

Revit Architecture 2010

User's Guide

Autodesk®

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Welcome to Autodesk Revit Architecture 2010

1

This section includes licensing information and other information pertinent to this release of Autodesk Revit®Architecture.

Network Deployment Installation

This procedure describes how to set up a Revit Architecture installation for deployment from a network location. Revit users can then access the network location to run the Revit Architecture installation program to install the software on their client systems or workstations.

NOTE Creating a network deployment does not install Revit Architecture locally. If you want to install Revit Architecture on the computer used to create the network deployment, run the resulting client installation using the shortcut.

Before starting this procedure, see [Licensing](#) on page 5 for information about software licensing and instructions on how to set up one or more network license servers, if you plan to use them.

To set up network deployment

- 1 Start the Revit Architecture installation program.

If you are installing from a Revit Architecture DVD, the installation program starts automatically when you insert the DVD. (If you need to start it manually, navigate to the root directory of the DVD, and double-click Setup.exe.) If you have downloaded the installation program from the Internet, double-click the file to start it.

- 2 In the Installation Wizard, click Create Deployments.

- 3 In the Begin Deployment dialog, do the following:

- a For Specify the Administrative Image location, indicate where the administrative image for the deployment will reside. Click Browse to navigate to the desired network location.
- b For Specify the new deployment name, enter a name for the shortcut to the client installation program.
- c Ensure that the correct type of operating system is selected (32-bit or 64-bit) for the deployment.

NOTE You select the type of operating system on which you intend to deploy the client. For example, if you are creating the deployment on a 64-bit operating system, but you will deploy the client to a 32-bit operating system, select 32-bit deployment.

- d Click Next.
- 4 In the Select the Products to Include on the Deployment dialog, select Autodesk Revit Architecture 2010, and click Next.
- 5 In the Accept the License Agreement dialog, do the following:
 - a For Country or Region, select the appropriate value from the list.
 - b Read the agreement. Click Print to print a copy, if desired.
 - c Select I Accept, and click Next.
- 6 In the Product and User Information dialog, do the following:
 - Enter the serial number and product key. You can find them on the label of the product DVD or from an electronic fulfilment message.
 - Enter the first name, last name, and organization of the user creating the deployment.
- 7 In the General Deployment Settings dialog, do the following:
 - If you want to create log files for the deployment creation, select Create Network Log, and specify the directory where the log should be created.
 - If you want to create log files for client installations, select Create Client Log.
 - If you want client installations to run in silent mode, select Silent mode. When silent mode is active and a user initiates the deployment, the installation proceeds without any explicit user input. Users will not be able to change any of your installation settings.
 - If you want to allow users to participate in the Customer Involvement Program, select Customer Involvement.
- 8 Click Next.
- 9 In the Review–Configure–Create Deployments dialog, review the settings in the Current Settings list. If desired, click Print to print a copy of the deployment settings.

Change settings for the deployment

If you want to change the settings for the network deployment, perform the following steps. If the deployment settings are correct, skip to the steps for Create the Network Deployment.

- 10 Click Configure.
- 11 In the Application Preferences dialog, do the following:
 - a Select appropriate values for Language, Default Units, and Default Usage.
 - b If you do not want the installation to create a desktop shortcut for Revit Architecture, clear Create desktop shortcut.
 - c For Set the installation folder, specify the location where Revit Architecture is to be installed on client systems. You can click Browse to navigate to the target folder.
 - d Click Next.

12 In the Content Selection dialog, do the following:

- a** Expand the content areas in the list, and select items to install, or clear items that should not be installed. (For most installations, accept the default settings.)
- b** If you do not want Revit content to be installed on client systems, select Skip content installation.
- c** For Set the Content Folder, specify the location where Revit Architecture content is to be installed on client systems. You can click Browse to navigate to the target folder.
- d** Click Next.

13 In the Select the License Type dialog, do one of the following:

- To use stand-alone licenses on client systems, click Stand-alone License, and click Next. (For more information, see [Standalone Licensing](#) on page 5.)
- To use a network license, do the following:
 - a** Click Network License.
 - b** Specify the type of network license to use (Single License Server, Distributed License Server, or Redundant License Server), and provide the server information requested. For more information, see [Distributed License Server Model](#) on page 13 and [Redundant License Server Model](#) on page 14.
 - c** Click Next.
 - d** In the Serial Number dialog, enter the Revit Architecture network license serial number, and click Next.

14 In the Define File Locations dialog, specify the search paths, file names, and locations for project templates, user files, family templates, and libraries.

15 In the Include Service Packs dialog, do one of the following:

- Click Include Service Packs from local drive or local network, and then click Add to add one or more service packs, or click Remove, as applicable.
- Do not include Service Pack.

Select one of the following for each service pack added:

- **Append the service packs onto the deployment.** This option is used for most deployments. It applies the current deployment only. Multiple service packs can be appended to a deployment. The service pack file is included in the deployment, and the service pack is applied after the product is deployed.
- **Merge the service packs into the administrative image MSI file.** This option is for general deployment only. Once merged, a service pack cannot be removed from the administrative image. Multiple service packs may be included in a single administrative image.

16 In the Configure InfoCenter Communication Center dialog, select the desired options.

NOTE This step is optional. You can configure the Communication Center using the CAD Manager Control Utility at a later time.

- a** Specify whether to enable Live Updates.
Checks whether product updates are available when a Web connection is established. Select one of the following:
 - Receive Live Updates from Autodesk.

Allows users to receive product updates and support announcements from Autodesk servers.

- **Receive Live Updates from local server.**

Allows you to maintain a patch list on a local server. A patch list is an XML file that specifies a list of patches available for installation. If you select this option, the Local Patch List Location is available. Use the Browse button to locate the path to a server location where you want the patch list. More information, see the help for the CAD Manager Control Utility.

- b Specify whether to enable Information channels.**

Information channels notify users with different types of information such as product support information.

- c Specify whether to enable CAD Manager channel.**

Controls the display of CAD Manager channels in InfoCenter. You can specify the following:

- **Feed Location.** Defines the location of the CAD Manager channel RSS feed. RSS feeds are in XML format.

- **Display Name.** Specifies the display name of the CAD Manager channel.

- d Specify whether to enable users to add RSS feeds.**

17 Click Next.

18 In the Configure Access to Online Resources dialog, select the desired options, and click Next.

NOTE This step is optional. You can configure the Access to Online Resources using the CAD Manager Control Utility at a later time.

- a Specify whether to allow users access to the following online tools:**

- **Enable DesignCenter (DC) Online.** The DesignCenter provides access to pre-drawn content such as symbol libraries, manufacturers' content, and online catalogs.

- **Allow access to the Subscription Center.** The Subscription Center provides announcements and subscription program news, as well as links to e-Learning Lessons, if you are an Autodesk subscription member.

- b Select the following Customer Error Reporting (CER) settings as desired.**

- **Allow users to receive notification of resolution,** so they are aware of resolutions to issues and can download applicable updates from Autodesk.

- **Include computer name in error reports.** The computer name is included in notifications to the user and in reports available to subscription administrators.

- c Specify whether to allow users to customize their InfoCenter search settings.**

19 In the Configuration Complete dialog, click Configuration Complete.

The Review–Configure–Create Deployments dialog displays again. Review the settings to make sure they are correct.

Create the network deployment

20 In the Review–Configure–Create Deployments dialog, click Create Deployment.

The installation program creates the network deployment, as specified. This process may take several minutes.

21 Click Finish.

To install Revit Architecture on a client system, double-click the shortcut in the network location. This is the shortcut name and location you specified on the Begin Deployment dialog.

If you need to modify the deployment settings:

- 1 Double-click the Tools folder (located in the directory you specified for creating the deployment).
- 2 Double-click Create and modify deployment.exe to open the Begin Deployment dialog.
- 3 Click Modify an existing deployment on the Begin Deployment dialog.


Licensing

There are 3 options for licensing with Revit Architecture:

- **Standalone.** A standalone license is associated with one machine. In addition, you can transfer a license from one computer to another with a standalone license. For more information, see [License Transferring](#) on page 16.
- **Network.** A network license is not associated with one computer. It can be installed on a network server and multiple computers on that network to run Revit Architecture. In addition, you can borrow a license from the license server and use it outside the network environment for a specified time. For more information, see [License Borrowing](#) on page 16.
- **Demo.** A demo license allows you to use Revit Architecture as a viewer. You can open projects, export them, and print them. However, if you make changes to the project, you cannot export or print it.

Standalone Licensing

Follow this procedure to obtain a standalone license for Revit Architecture. If you have not already run Revit Architecture in trial mode, the Product and License Information dialog displays when you first start Revit

Architecture. If you have already run Revit Architecture in trial mode, click  ➤ Licensing ➤ Product and License Information.

To enter a standalone license

- 1 In the Product and License Information dialog, select Standalone-Locked.
- 2 Click Register.
- 3 In the Product Activation dialog, select Activate the product, and click Next.
- 4 In the Register Today dialog, enter your serial number.
- 5 Select Get an activation code or Enter an activation code. If you select Enter an activation code, select Paste the activation code or Type the activation code, and enter the code using the selected method.
- 6 Click Next.
- 7 Indicate whether Revit Architecture is registered to a company or an individual.
- 8 Select your country.
- 9 Specify whether the product is an upgrade, and click Next.
- 10 Enter your information, answer the questions, and click Next.
- 11 Verify your information, and click Next.
- 12 When finished, click Finish.

Network License Server Setup

If you already have an Autodesk License server set up, skip to [Obtain a Network License File](#) on page 7.

IMPORTANT Revit Architecture supports redundant or distributed server configurations.

Install the Network License Manager Tools

If an existing version of the license manager is already installed on this computer, you must remove it by using Add/Remove Programs on the Control Panel before reinstalling. Revit Architecture requires Network License Manager version 11.5.0 and is not compatible with previous versions of the Network License Manager. If you have a version other than 11.5.0, you will have to reinstall it after completing this procedure.

IMPORTANT If you are running the network license manager on Windows XP and have upgraded to Service Pack 2, a new software firewall is enabled. When using its default settings, this firewall disables the Autodesk License Server installed on the same computer. For more information, contact Revit Architecture Client Support.

To install the Network License Manager

- 1 On the Revit Architecture DVD, start the Revit Architecture installation program.
- 2 Click Install Tools and Utilities.
- 3 On the Select the Products to Install page, select Autodesk Network License Manager, and click Next.
- 4 Review the License Agreement dialog. You must accept this agreement to proceed with the installation. Click I Accept the License Agreement, and click Next.

NOTE If you do not agree to the terms of the license, click Cancel to cancel the installation.

- 5 On the Review–Configure–Install page, review your product selection and the current settings. If you do not want to make any changes, click Install; otherwise, click Configure.

If you click Configure, on the Select Installation Type page, select either Typical or Custom. Accept the default installation folder C:\Program Files\Autodesk Network License Manager\, or click Browse to specify a different path. If you enter a path that does not exist, a new folder is created using the specified name and location. Click Next.

If you want a copy of the configuration settings, click Copy to Clipboard, and paste the settings into a text file.

WARNING Do not install the Network License Manager on a remote drive. When you install the Network License Manager files, you must provide a path to a local drive. Specify the drive letter. The Universal Naming Convention (UNC) is not supported.

- 6 On the Configuration Complete page, click Configuration Complete to return to the confirmation page.
- 7 On the Review–Configure–Install page, click Install.
- 8 When the Installation Complete page displays, click Finish.

For more information about the Network License Manager, see the associated documentation in the Network License Manager installation directory.

TIP Revit Architecture recommends that you create a folder under the Network License Manager directory called Logs for storing any log files that are generated from license server reporting.

Obtain Host Name ID Using LMTools

1 Do one of the following:

- In Windows XP, click Start menu ► Programs ► Autodesk ► Autodesk Network License Manager ► LMTOOLS.
- In Windows Vista, click Start menu ► All Programs ► Autodesk ► Autodesk Network License Manager ► LMTOOLS.

The LMTOOLS utility opens.

2 Click the System Settings tab.

3 Click Save HOSTID Info to a File.

4 Save the file. You provide this file to Autodesk to obtain a license file.

RELATED If you do not have LMTOOLS installed on your machine, obtain the host name by opening a Command Prompt window and entering ipconfig/all. This provides both host name and host ID information for your machine.

Obtain a Network License File

A license file identifies important license information, including license type and behavior, and the number of seats available for use. You must obtain a license file from Autodesk for each license server.

With the Network License Activation Utility, you can obtain licenses over the Internet. In addition, this utility registers your product, provides automated support through e-mail if you cannot obtain a license over the Internet, and saves and migrates license files.

To install your Network License Activation Utility

1 In the Autodesk Installation wizard, click Install Tools and Utilities.

NOTE Each installation of the Network License Activation Utility is product specific. If you have more than one Autodesk product, and you want to install the Network License Activation Utility on all of them, you must install it once for each product.

2 On the Select the Products to Install page, select Autodesk Network License Activation Utility, and click Next.

3 Review the License Agreement dialog. You must accept this agreement to proceed with the installation. Click I Accept the License Agreement, and click Next.

NOTE If you do not agree to the terms of the license, click Cancel to cancel the installation.

4 On the Review–Configure–Install page, review your product selection and the current settings. If you do not want to make any changes, click Install; otherwise, click Configure.

If you click Configure, on the Select Installation Type page, select either Typical or Custom. Accept the default installation path C:\Program Files\Autodesk Network License Manager\Network License Activation Utility\enu\, or click Browse to specify a different path. If you enter a path that does not exist, a new folder is created using the specified name and location. Click Next.

If you want a copy of the configuration settings, click Copy to Clipboard, and paste the settings into a text file.

5 On the Configuration Complete page, click Configuration Complete to return to the confirmation page.

6 On the Review–Configure–Install page, click Install.

7 When the Installation Complete page displays, click Finish.

To use the Network License Activation Utility (online request)

1 Do one of the following:


- In Windows XP, click Start menu ► Programs ► Autodesk ► Autodesk Network License Manager ► Revit Architecture Network License Activation Utility.
- In Windows Vista, click Start menu ► All Programs ► Autodesk ► Autodesk Network License Manager ► Revit Architecture Network License Activation Utility.

2 On the Obtain a Network License page, make sure Direct Connect (over the Internet) is selected, enter your product key, and click Next.

3 On the Server Information page, enter the following data:

- The product serial number.

NOTE If you are modifying an existing license file or obtaining a new license for an existing product, your previously entered information might be displayed. Make sure that the serial number displayed is the one you want to license. If not, enter the correct product serial number.

- **License server model.** For information about each license server model, click  (Help).
- **Server host name.** If you do not know the host name, enter the following at the command prompt to locate the name of each server you plan to use: `<prompt> lmutil lmhostid -hostname`

NOTE In a distributed server model, you are limited to a maximum of 20 servers. After the 20-server limit has been reached, the Add button disappears.

- **Host ID.** This value must be specified for each server host name you entered in the previous step. Enter the host ID manually, or click Lookup to have the utility locate the host ID for the server.

NOTE If your server has more than one network adapter, select the one that corresponds to a physical network adapter. To determine which adapters are physical, enter **ipconfig /all** at a Windows command prompt and view the Description field above each physical address. If there is more than one physical network adapter, you can use any one of them, as long as it was listed when you ran **ipconfig /all**. Logical devices such as VPN adapters, PPP adapters, and modems may be listed but are not usable for licensing.

- **Seats.** If you selected Distributed Server as the license server model, enter the number of seats for each license server in the Seats field, and click Next.

4 In the Confirm Server Information dialog, review the server information that you entered, and click Next.

5 On the Log In page, enter your user ID and password, then click Log In.

If you do not have a user account, click the Create a User ID Now link, and follow the instructions to create a user account.

6 On the Choose Account page, select an account, and click Next.

7 On the Licenses Received page, in the Save License File for <computer name> field, enter the location where you want to save the license file, or click Browse to navigate to the location.

NOTE It is recommended that you save your license file to C:\Program Files\Autodesk Network License Manager\License.

Other content on this page differs depending on which server model you selected.

8 Click Next.

9 On the License Activation Successful page, click Print to save a printed copy of the license information, or click Done to complete the transaction and exit the Network License Activation Utility.

After you receive your license file and save it locally, to configure your license server, see [Configure the Network License Server](#) on page 10.

To use the Network License Activation Utility (offline request)

1 Do one of the following:


- In Windows XP, click Start menu ► Programs ► Autodesk ► Autodesk Network License Manager ► Revit Architecture Network License Activation Utility.
- In Windows Vista, click Start menu ► All Programs ► Autodesk ► Autodesk Network License Manager ► Revit Architecture Network License Activation Utility.

2 On the Obtain a Network license page, click Email, fax, phone, or send request by postal mail, enter your product key, and click Next.

3 On the Server Information page, enter the following data:

- **The product serial number.**

NOTE If you are modifying an existing license file or obtaining a new license for an existing product, your previously entered information might be displayed. Make sure that the serial number that is displayed is the one you want to license. If it is not, enter the correct product serial number.

- **The License server model.** For information about each license server model, click  (Help).

- **The Server host name.** If you do not know the host name, enter the following at the command prompt to locate the name of each server you plan to use:

```
<prompt> lmutil lmhostid  
-hostname
```

NOTE In a distributed server model, you are limited to a maximum of 20 servers. After the 20-server limit has been reached, the Add button disappears.

- **The Host ID.** For each server host name you entered in the previous step. Enter the host ID manually, or click Lookup to locate the host ID for the server.

NOTE If your server has more than one network adapter, select the one that corresponds to a physical network adapter. To determine which adapters are physical, enter **ipconfig /all** at the Windows command prompt and view the Description field above each physical address. If there is more than one physical network adapter, you can use any one of them, as long as it was listed when you ran ipconfig /all. Logical devices such as VPN adapters, PPP adapters, and modems may be listed but are not usable for licensing.

- **Seats.** If you selected Distributed Server as the license server model, the Seats field is displayed. In the Seats field, enter the number of seats for each license server.

4 Click Next.

5 In the Confirm Server Information dialog, review the server information that you entered, and click Next.

6 On the Product Registration page, specify the following:

- Whether the product will be registered to a company or individual.

- The country or region where the product will be used.
- If the product is an upgrade. If it is, you will need the previous serial number.

Click Next.

- 7 Enter your personalization data on the Customer Information page, and choose how you want to receive your activation code: Email, Fax, or Postal mail. Click Next.
- 8 Review your personalization data on the Confirm Information page and choose the method you want to use to submit your request. Your request can be sent by email, fax, or phone. Your activation code will be sent by the method you specified on the Customer Information page.
- 9 If you want to print a copy of your registration information, select the Select Open Activation Request Form option. When you are finished, click Close.

After you receive your license file and save it locally, to configure your license server, see [Configure the Network License Server](#) on page 10.

NOTE It is recommended that you save your license to the file location where you installed the Network License Manager.

If you cannot register the product using the Network License Activation Utility, go to the Autodesk Services and Support web page at <http://www.autodesk.com/servicesandsupport>.

Set Up the Network License File

After you receive a license file from Autodesk, you set up the file to configure the license server.

NOTE If you already have a license server running for another Autodesk product, such as AutoCAD 2010 or AutoCAD Architecture, you need to combine your Revit Architecture license file with the existing license file. Skip this procedure and the procedure on Configuring the License Server, and go to [Combining Network License Files](#) on page 12.

To set up the network license file

- 1 Copy the contents of the license file (supplied by Autodesk in an e-mail) to an ASCII text editor, such as Notepad.

WARNING Do not copy the contents into a word processor. A word processor can add hidden formatting that a text editor cannot read.

- 2 Save the file to the \Program Files\Autodesk Network License Manager\License folder. You can use any name for the license file, but you must save the file with an LIC extension.

NOTE If you use Notepad as your text editor, for Save As Type, select All Files so that a TXT extension is not added automatically.

Configure the Network License Server

Use the LMTOOLS utility to configure the license server so that you can manage the Revit Architecture product license you received when you ran the Network License Activation Utility.

You should be logged in with Administrator rights when using the LMTOOLS utility.

1 Do one of the following:

- In Windows XP, click Start menu ► Programs ► Autodesk ► Autodesk Network License Manager ► LMTOOLS.
- In Windows Vista, click Start menu ► All Programs ► Autodesk ► Autodesk Network License Manager ► LMTOOLS.

2 Click the Service/License File tab.

3 Select Configuration using Services.

4 Click the Config Services tab.

5 For Service Name, do one of the following:

- If a service name is selected, verify that it is the one you want to use to manage licenses.
- If no service name exists, enter the service name to use to manage the licenses. **Autodesk_nlm** is recommended for the service name.

NOTE If you have more than one software vendor using FLEXnet for license management, the Service Name list contains more than one option. Make sure only one Autodesk service is listed.

6 In the Path to lmgrd.exe File field, enter the path to the Network License Manager daemon (lmgrd.exe), or click Browse to locate the file.

By default, this daemon is installed in the \Program Files\Autodesk Network License Manager folder.

7 In the Path to the License File box, enter the path to the license file, or click Browse to locate the file.

For more information, see [Set Up the Network License File](#) on page 10.

8 In the Path to the debug log file box, enter the path to the debug log, or click Browse to locate the file.

Best practice is to save the debug log in C:\Program Files\Autodesk Network License Manager. The log file must have a LOG extension. For new log files, you must enter the LOG extension manually.

9 To run lmgrd.exe as a service, select Use Services.

10 To automatically start lmgrd.exe when the system starts, select Start Server at Power Up.

11 Click Save Service to save the new configuration under the service name that you selected in Step 5. If you want to save the settings to the service, click Yes when prompted.

Start the license server

12 Click the Start/Stop/Reread tab.

13 Click Start Server to start the license server.

IMPORTANT If you need to stop a server, it is not recommended to click Stop Server on this tab. Other processes might be running on this server. Best practice is to schedule a reboot instead.

14 To ensure that the license manager has started correctly, wait 30 seconds after starting the license service. Then, on the Server Status tab of LMTOOLS, select Display Everything, and click Perform Status Enquiry.

15 Scroll to the bottom of the results, and look for a line similar to the following that displays the feature code and number of licenses:

Users of 48400REVITS_2_OF: (Total of 10 licenses issued; Total of 0 licenses in use)

If you do not see a similar line displayed in this part of the dialog, review the installation steps.

Combining Network License Files

If you already have a license server running for another Autodesk product (such as AutoCAD 2010 or AutoCAD Architecture), you need to combine your Revit Architecture license file with your existing license file.

Before attempting this procedure, see [Obtain a Network License File](#) on page 7.

To add licenses to the license server, you can either combine the license files into one file, or put all of the license files into one folder and then point the license server to that folder, not to a specific file.

To combine license files for Autodesk products into one license file, edit the existing license file, adding lines from the new license file to the existing license file. To edit the existing license file, copy all of the lines from the Revit Architecture license file, starting at the line beginning with "INCREMENT", into the existing license file.

When adding licenses of the same Autodesk product to your license file, you must obtain a new license file for the total number of licenses for that feature code, not just the new ones. For example, do not combine 2 different Revit Architecture license files into one file. Obtain a new license file that contains the required total number of Revit Architecture seats.

If the server computer has more than one network adapter installed, all Autodesk products should be bound to the same adapter.

Example

Existing License File

```
SERVER PCS770 0012340f10c2
USE_SERVER
VENDOR adskflex port=2080
INCREMENT 41100ACD_2002_0F adskflex 1.000 permanent 5 \
  VENDOR_STRING=commercial:permanent SUPERSEDE DUP_GROUP=H \
  ISSUED=27-mar-2009 ck=213 SN=3XX-XXXXXXX
SIGN=123456ABCDEF
```

New License File

```
SERVER PCS770 a1b2c3d4e5f6
USE_SERVER
VENDOR adskflex port=2080
INCREMENT 48400REVITS_2_0F adskflex 1.000 permanent 10\
VENDOR_STRING=commercial:permanent BORROW=720 SUPERSEDE \
  DUP_GROUP=UH ISSUED=10-Mar-2009 SN=339-12345678
SIGN="1037 \
7E66 6695 2D57 47D9 C59D FAAB DC45 CC51 1414 A8AB 29F4
2773 \
CE33 59EC 0397 B326 29FE 16EC 5C95 8213 BE5C A88F 25F5 3FC1 \
8CB4 C0CD 65D4 C7E5 40BB" SIGN2="1261 B3BF 7D54 0CF4 C84D
9EFD \
B041 D91A A56D 015B 9A30 20B7 BF73 0766 3674 019F 5D8B 36EE \
5B75 86B2 D219 6C86 9900 B297 DD3C C34B 5303 DB46 2533 2222
```

Combined License File

```

SERVER PCS770 a1b2c3d4e5f6
USE_SERVER
VENDOR adskflex port=2080
INCREMENT 41100ACD_2002_0F adskflex 1.000 permanent 5 \
    VENDOR_STRING=nfr:permanent SUPERSEDE DUP_GROUP=H \
    ISSUED=27-mar-2009 ck=213 SN=3XX-XXXXXXX SIGN=123456ABCDEF
INCREMENT 48400REVITS_2_0F adskflex 1.000 permanent 10\
VENDOR_STRING=commercial:permanent BORROW=720 SUPERSEDE \
    DUP_GROUP=UH ISSUED=10-Mar-2009 SN=339-12345678
SIGN="1037 \
7E66 6695 2D57 47D9 C59D FAAB DC45 CC51 1414 A8AB 29F4
2773 \
CE33 59EC 0397 B326 29FE 16EC 5C95 8213 BE5C A88F 25F5 3FC1 \
8CB4 C0CD 65D4 C7E5 40BB" SIGN2="1261 B3BF 7D54 0CF4 C84D
9EFD \
B041 D91A A56D 015B 9A30 20B7 BF73 0766 3674 019F 5D8B 36EE \
5B75 86B2 D219 6C86 9900 B297 DD3C C34B 5303 DB46 2533 2222

```

Rereading the Network License File

To initiate the license server, open LMTOOLS, and on the Start/Stop/Reread tab, click ReRead License File.

Distributed License Server Model

In the distributed license server model, licenses are distributed across more than one server. A unique license file is required for each server. To create a distributed license server, you must run the Network License Manager on each server that is part of the distributed server pool.

Advantages

- Servers can be distributed across a wide area network (WAN). They do not need to exist on the same subnet.
- If one server in the distributed server pool fails, the licenses on the remaining servers are still available.
- The distributed license server model is supported on Windows XP® Professional and on the workstation and server editions of Windows® 2000 and Windows® 2003.
- If you need to replace a server in the distributed server pool, you do not need to rebuild the entire pool.
- Server replacement is easier than using a redundant server pool, where you must reactivate the entire pool.

Disadvantage

- If a server in the distributed server pool fails, the licenses on that server are unavailable.

Sample Distributed License File

The following is sample code from a distributed license file.

```

SERVER Server2 2a34567f90d3
USE_SERVER
VENDOR adskflex port=2080
INCREMENT 46300ACD_2005_0F adskflex 1.000 permanent 3 \
VENDOR_STRING=commercial:permanent BORROW=720 SUPERSEDE \
DUP_GROUP=UH ISSUED=22-mar-2009 SN=339-12345678 SIGN="1707 \
9EAC CBCB 2405 692E 4A89 FC45 C009 E360 944A 14BA E99C 9B24 \
5A1B 4A44 083A BE5F 3827 AA26 30CC 2AC2 D6B3 A61B AB5E 492E \
3EBD 0B48 4E75 193A DA82" SIGN2="004A FC90 AB47 3F6B 59BC 0E6D \
6681 6971 A76A BA52 98E2 5671 26B3 0E78 791B 109F 0591 7DC3 \
F09F 4D8D 4FB7 E341 4A03 CD68 1D77 27F8 8555 9CF7 DEDD 9380"

```

Redundant License Server Model

In the redundant license server model, you use 3 servers to authenticate a single license file. One server acts as the master, while the other 2 servers provide backup if the master server fails. With this configuration, licenses continue to be monitored and issued as long as at least 2 servers are functional. The license file on all 3 servers is the same. You must install the Network License Manager on each server.

In the redundant license server model, all servers must reside on the same subnet and have consistent network communications. (Slow, erratic, or dial-up connections are not supported.)

Advantage

- If one of the 3 servers fails, all licenses that are managed in the server pool are still available.

Disadvantages

- The redundant license server model is supported only on Windows 2000 Server Edition.
- If more than one server fails, no licenses are available.
- All 3 servers must reside on the same subnet and have reliable network communications. The redundant server pool does not provide network fault tolerance.
- If one of the 3 servers is replaced, you need to obtain a new license file from Autodesk. Also, on the client machines, the Licpath.lic file should be modified to include the new server name.
- If your Autodesk product supports license borrowing, and licenses are borrowed from a redundant license server pool, you must restart the license server after you stop the Network License Manager.

Sample Redundant License File

The following is sample code from a redundant license file.

```

SERVER Server1 1a34567c90d2 27005
SERVER Server2 2a34567f90d3 27005
SERVER Server3 3a34567b90d4 27005
USE_SERVER
VENDOR adskflex port=2080
INCREMENT 46300ACD_2005_0F adskflex 1.000 permanent 3 \
VENDOR_STRING=commercial:permanent BORROW=720 SUPERSEDE \
DUP_GROUP=UH ISSUED=22-mar-2009 SN=339-12345678 SIGN="1707 \
9EAC CBCB 2405 692E 4A89 FC45 C009 E360 944A 14BA E99C 9B24 \
5A1B 4A44 083A BE5F 3827 AA26 30CC 2AC2 D6B3 A61B AB5E 492E \
3EBD 0B48 4E75 193A DA82" SIGN2="004A FC90 AB47 3F6B 59BC 0E6D \
6681 6971 A76A BA52 98E2 5671 26B3 0E78 791B 109F 0591 7DC3 \
F09F 4D8D 4FB7 E341 4A03 CD68 1D77 27F8 8555 9CF7 DEDD 9380"


```

Network License Client Setup

After you have set up a license server, follow this procedure in Revit Architecture to license a client machine.

NOTE Client Setup is usually completed during product installation or network deployment.

To license a client machine

- 1 Click  ► Licensing ► Product and License Information.
- 2 Select Network.
- 3 Enter the network server name.
- 4 Click Apply.
- 5 Click Close.

Licensing from Previous Versions of Revit Architecture

Each new release of Revit Architecture requires the current version of the standalone or network license. Standalone or network licenses from previous versions do not work with the latest release of Revit Architecture. If you do not have a current license, Revit Architecture runs in demo mode. See [Licensing](#) on page 5.

Network License Cascading

For products purchased separately or as part of a Revit Architecture Series package, a network license server can be set up with combinations of license seat counts. The cascading mechanism employed by Autodesk first uses the single product license (non Series), and then cascades as needed to the Series licenses.

License Server Reporting

For more information about license server reporting and license server configuration, see the associated documentation on the SAMreport-Lite utility that you can install with Revit Architecture.

Licensing Extension

If you have network licensing, and a license outage occurs, you can extend your licensing long enough to save your work.

Outage Examples

- You were using Revit Architecture, left your computer for over 2 hours but forgot to save, and all the floating licenses, including yours, are now assigned to other users.
- The machine that hosts the license server went down.

Saving Your Work in an Outage

If an outage occurs, you can save your work by using the Use Extension feature. You use an extension each time you issue a command. For example, you click a tool on the ribbon, the dialog is displayed, and you click Use Extension. This cycle repeats up to 10 times.

When you connect to the license server at the beginning of a Revit Architecture session, you get a set of 10 extensions.

If you use up all 10 extensions before saving, you must enter demo mode; however, you cannot save your work in demo mode.

License Transferring


If you are running Revit Architecture with a standalone license, you can transfer that license using the Transfer License Utility. This transfers a product license from one computer to another and ensures that the product works only on the computer that has the license. To access Transfer License Utility, do one of the following:

- On Windows XP, click Start menu ► Programs ► Autodesk ► Autodesk Revit Architecture 2010 ► Transfer License Utility.
- On Windows Vista, click Start menu ► All Programs ► Autodesk ► Autodesk Revit Architecture 2010 ► Transfer License Utility.


For more information about the Transfer License Utility, see its online help.

License Borrowing

If you are running a network-licensed version of Revit Architecture, you can borrow a license from a license server so that you can use the software for a specified time when your computer is not connected to the network. The license is returned to the license server automatically at the end of the day on the return date that you specified when you borrowed the license. You can also return a license early.

NOTE If you have a standalone version of the software, you cannot borrow a license. To view your product license type, click  ► Licensing ► Product and License Information.

To borrow a license

- 1 Click  ► Licensing ► Borrow License.
- 2 Click a return date on the calendar in the dialog.
Be sure the date is within the valid range as shown in the dialog.
- 3 Click Borrow License.


NOTE There is a limit to the number of licenses available for borrowing. If you try to borrow a license and are notified that no licenses are available, all network licenses might already be borrowed by other users. If you are unable to borrow a license, contact your network administrator.

License Returning

When the license-borrowing period expires, the borrowed license is returned to the license server automatically. When you reconnect your computer to the network, you may start Revit Architecture normally. Successful startup of the software indicates that you have acquired the usual (online) network license. At that point, you can borrow a license again.

NOTE To view the expiration date for the borrowed license, click Help menu ► About ► Product Information. In the Product Information dialog, under License expiration date, view the license return date.

To return a license early



- Click  ➤ Licensing ➤ Return License Early.

Using Help

This section provides information about navigating the online help.

To access online help

Do one of the following:

- In the InfoCenter box, click  (Help).
- For context-sensitive help:
 - In a dialog, click  or Help.
 - Move the cursor over a tool on the ribbon. When its tooltip displays, press F1.

NOTE If you turn off tooltips, context-sensitive help (F1) for ribbon tools is also turned off. If you want context-sensitive help to be available, set Tooltip assistance to Minimal. See [Tooltips](#) on page 92.

Help Viewer Tabs

- **Contents.** The Contents tab resembles a Table of Contents in a printed book. Instead of chapter and page numbers, there are books and pages with headings. Click a closed book, and it opens to display sub-books or topic pages. When you click an open book, it closes. When you click pages, you select topics to view in the right-hand pane of the HTML Help viewer. Note: Opening a book or page requires only a single click.
- **Index.** The Index tab displays keywords for quick information searches in Revit Architecture. To open the topic associated with a keyword, double-click the keyword, or select it and click Display. If the keyword is used with more than one topic, a Topics Found dialog box is displayed so you can select a specific topic to view.
- **Search.** Use the Search tab to search for words in the Help system and locate associated topics. After typing the words you want to find, click List Topics.
The Search tab also includes advanced search capability. You can search for topics using wildcard (*,?) and boolean characters (AND, OR, NEAR, NOT). To use Boolean searches, click the right arrow button next to the search-string field.
- **Favorites.** Use the Favorites tab to bookmark topics that you visit frequently.

New Information Markers

On the Contents tab, red markers identify new chapters  and topics .

Autodesk Training Programs and Products

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Autodesk Official Training Courseware

Autodesk publishes many courseware titles each year for users at all levels to improve their productivity with Autodesk software. The preferred training materials of Autodesk partners, these books are also well-suited for self-paced, standalone learning. All courseware simulates real-world projects with hands-on, job-related exercises. Autodesk Official Training Courseware (AOTC) is developed by Autodesk. Autodesk Authorized Training Courseware (AATC) is developed by Autodesk partners, including titles in a growing number of languages. Autodesk Official Certification Courseware (AOCC) teaches the knowledge and skills assessed on the Certification examinations. Visit <http://www.autodesk.com/aotc> to browse the Autodesk Courseware catalog.

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Autodesk e-Learning for Autodesk Subscription customers features interactive lessons organized into product catalogs. Each lesson is 20–40 minutes in length and features hands-on exercises, with an option to use a simulation or the software application. You can also use an online evaluation tool that identifies gaps in skills, determines which lessons will be most helpful, and gauges learning progress.

If you are a member of Autodesk Subscription, you can access e-Learning and other subscription services from your Autodesk product. For more information about Autodesk subscription resources, visit <http://www.autodesk.com/subscription>.

Memory Usage

To minimize possible instability in Revit Architecture when it uses operating system memory, you can:

- Restart Revit Architecture regularly.
If you receive a message that the current session's memory usage is approaching the operating system limit, save your work as soon as possible and restart Revit Architecture. If you are using a workshared environment, save your local file, restart Revit Architecture, and then synchronize with central.
- Enable the 3 GB feature on your Windows® operating system to improve performance on 32-bit machines. See [Enabling the 3 GB Feature on 32-Bit Machines](#) on page 19.
- Run 64-bit Revit Architecture on a Windows 64-bit operating system.
- Reduce the number of loaded DWG and RVT links. See [Managing Links](#) on page 1286.
- Reduce the number of loaded RVT and RFA files. See [Deleting Unused Families and Family Types](#) on page 421.
- Limit the number of views open. If you have multiple views open, you can quickly close all hidden views by selecting View tab ► Windows panel ► Close Hidden.

- Limit the number of worksets that you open when using a workshared file. In the Open dialog, from the Open drop-down list, select Specify, which lets you select the worksets to close before opening the local file.

NOTE In some cases, antivirus software solutions can lock files or slow data transfer, giving the appearance of memory limitations. See [File Operations \(Open, Save, Synchronize\) Are Blocked or Slow](#) on page 1409 for more information.

3 GB Feature Considerations

Before deciding to use the 3 GB feature, review the following considerations:

- This feature is supported only on Windows XP SP2 and Windows Vista running on 32-bit machines.
- When the 3 GB feature is enabled, your operating system has less memory space. It is not completely clear what implications this may have on Windows, so be cautious with regard to the total application load placed on Windows while running in this mode. If you do not require the larger address space, it is recommended that you do not enable this option.
- At least one graphics card driver version (ATI Fire GL 8800, driver version 6.12.10.3035) is known not to work with 3 GB. If you experience a crash, restart your computer without the /3GB option and check whether upgrading to the latest graphics card driver resolves the issue.

Enabling the 3 GB Feature on 32-Bit Machines

Revit Architecture is a 32-bit application, which is limited to 4 GB of virtual address space. Typically, on a 32-bit machine, Microsoft® Windows® reserves 2 GB of the 4 GB virtual address space of any process for the operating system and leaves the remaining 2 GB for the application process (including the space for the code pages, the stack, and all dynamically allocated memory). The 3 GB feature divides the virtual address space differently on 32-bit machines, providing 3 GB for the application and 1 GB for the operating system.

On 64-bit machines, the 3 GB switch does not apply because Windows does not reserve virtual address space for the operating system, allowing Revit Architecture to use up to the available 4 GB.

Before enabling the 3 GB feature, see [3 GB Feature Considerations](#) on page 19.

To enable the 3 GB feature on Windows XP

1 Open the boot.ini file.

This file is typically located in C:\, and it is a protected operating system file. To see it, in a Windows Explorer window, click Tools menu ► Folder Options. On the View tab, clear Hide protected operating system files, and click OK.

2 In the operating systems section, copy the original line containing the boot path, then modify the copied line to add the option (/3GB) and the display string that identifies the boot option. Examples of the line to copy and the modified version of the line are shown below. The modified portions of the copied line are in bold.

- multi(0)disk(0)rdisk(0)partition(2)\WINDOWS="Microsoft Windows XP Professional" /fastdetect
- multi(0)disk(0)rdisk(0)partition(2)\WINDOWS="Microsoft Windows XP Professional **3GB**" /**3GB** /fastdetect

When you start your computer with the modified boot.ini file, you see the following options to select from:

- Microsoft Windows XP Professional
- Microsoft Windows XP Professional 3GB

To enable the 3 GB feature on Windows Vista

- 1 Click Start menu ► All Programs ► Accessories, and run the command prompt.
- 2 Enter **BCDEDIT /SetIncreaseUserVa 3072**, and exit the command prompt.

NOTE If you are not able to set this value, when you run the command prompt, right-click, and click Run as Administrator.

- 3 Reboot the computer.

The switch is now set. It is not necessary to make a selection when you reboot the computer; it is automatically enabled.

After you enable the 3 GB feature, you should verify that you have sufficient virtual memory allocated for your purposes. See [Verifying Virtual Memory Allocation](#) on page 20.

Verifying Virtual Memory Allocation

To verify virtual memory allocation on Windows XP

- 1 Click Start menu ► Settings ► Control Panel.
- 2 In the Control Panel, double-click System.
- 3 In the System Properties dialog, click the Advanced tab.
- 4 In the Performance field, click Settings.
- 5 In the Performance Options dialog, click the Advanced tab.
- 6 In the Virtual Memory field, click Change.

To verify virtual memory allocation on Windows Vista

- 1 Click Start menu ► All Programs ► Accessories, and run the command prompt.
- 2 To change the virtual memory allocation back to 2 GB, enter:
BCDEDIT /SetIncreaseUserVa 2048

NOTE If you are not able to set this value, when you run the command prompt, right-click and select Run as Administrator.

To verify the virtual memory allocation, enter **BCDEDIT**.

In the boot entry option list, the value displays with the IncreaseUserVa option.

Your system should have at least 3 GB set aside for the paging file size to take full advantage of the available address space. Every concurrently running application is sharing the available paging file size, so setting it to something more than 3 GB (such as 4 GB) is recommended.

Architectural Workflows

2

Use the following topics to learn how Revit Architecture supports typical architectural workflows and tasks.

Start a New Project

At the beginning of a new project, use the following workflows to get started.

Before You Begin

Consider whether the following options will be useful. If so, learn about these options, and determine how and when to implement them during the project cycle.

Use a project template.

Project templates provide initial settings to streamline project setup and implement standards.

Link multiple projects.

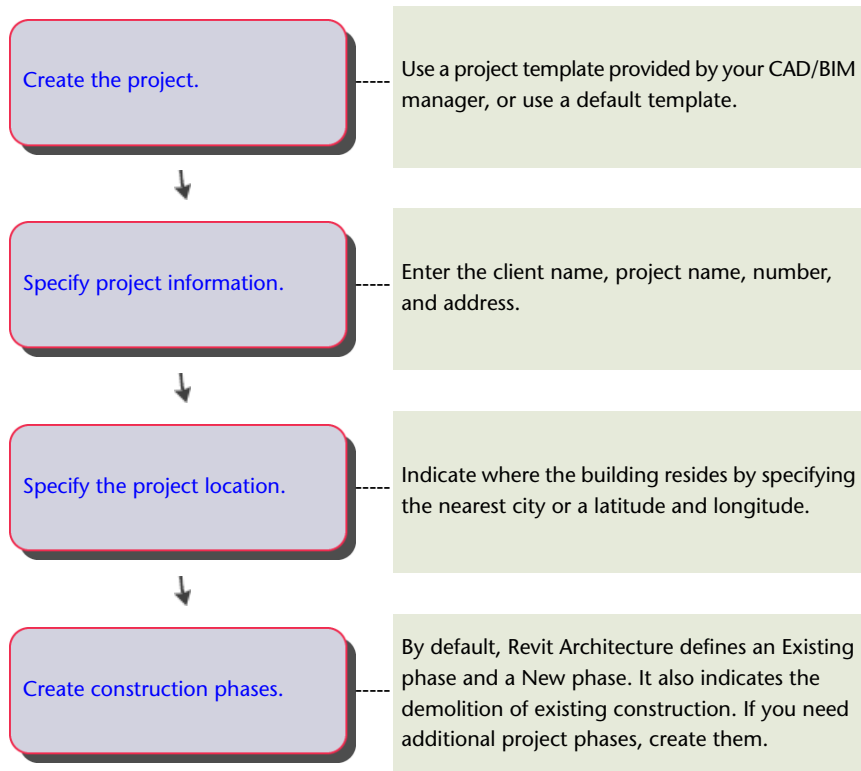
Link models together, for example, to specify the relative locations of individual buildings on a campus, or to coordinate efforts across disciplines (architectural, structural, and engineering).

Work in a team.

After the initial design phase, you can set up worksharing so that multiple team members can work on the project at the same time.

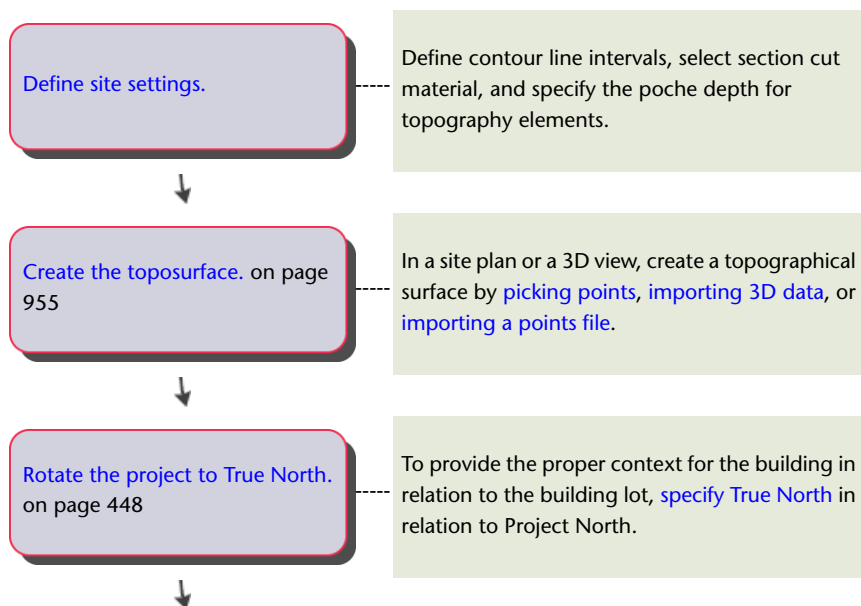
Set Up the Project

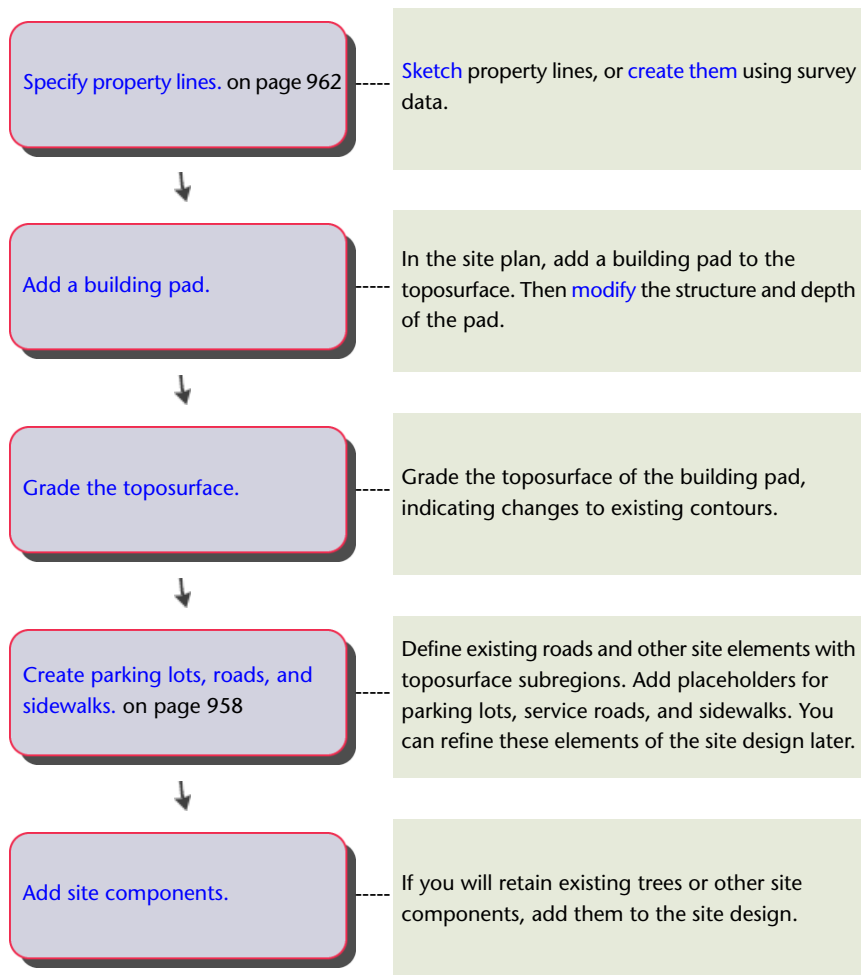
To design a building model, first create a project in Revit Architecture, and then enter project-specific information.



Create the Site Plan

The site plan provides context for the building model.





Build the Model

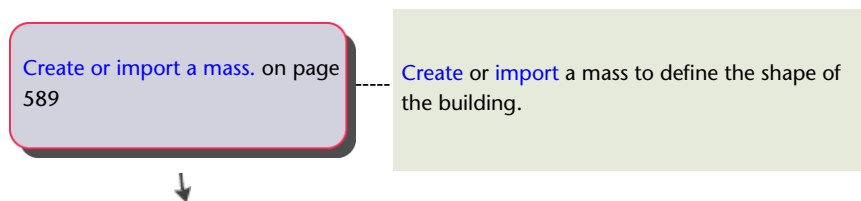
Start with the general building components (walls, floors, roofs). Then slowly refine the design, adding more detailed components (stairs, rooms, furniture) as you proceed.

Design the Preliminary Layout

Establish the larger context of the building model by starting with a massing study or an existing design, and defining levels and grids.

Perform a Massing Study

(Optional) To explore design ideas for the initial shape of a building, you can use masses.



Create floors, walls, and roofs from mass faces. on page 615

Convert faces of the mass into [walls](#) on page 615, [floors](#), [curtain systems](#), and [roofs](#).

Add Levels and Grids

Levels and grids are finite planes that help to define project context.

Add levels.

Create a level for each known story or other reference needed for the building design.



Add grids.

Place column grid lines to help plan the building layout.

Use DWG and Image Files

When creating the preliminary layout, you can use existing DWG files or raster image files as underlays on which to sketch your design.

Import a DWG file.

To base the new building model on an existing AutoCAD drawing, import the DWG file.

Import a raster image.

To base the new model on a raster image, import the image.

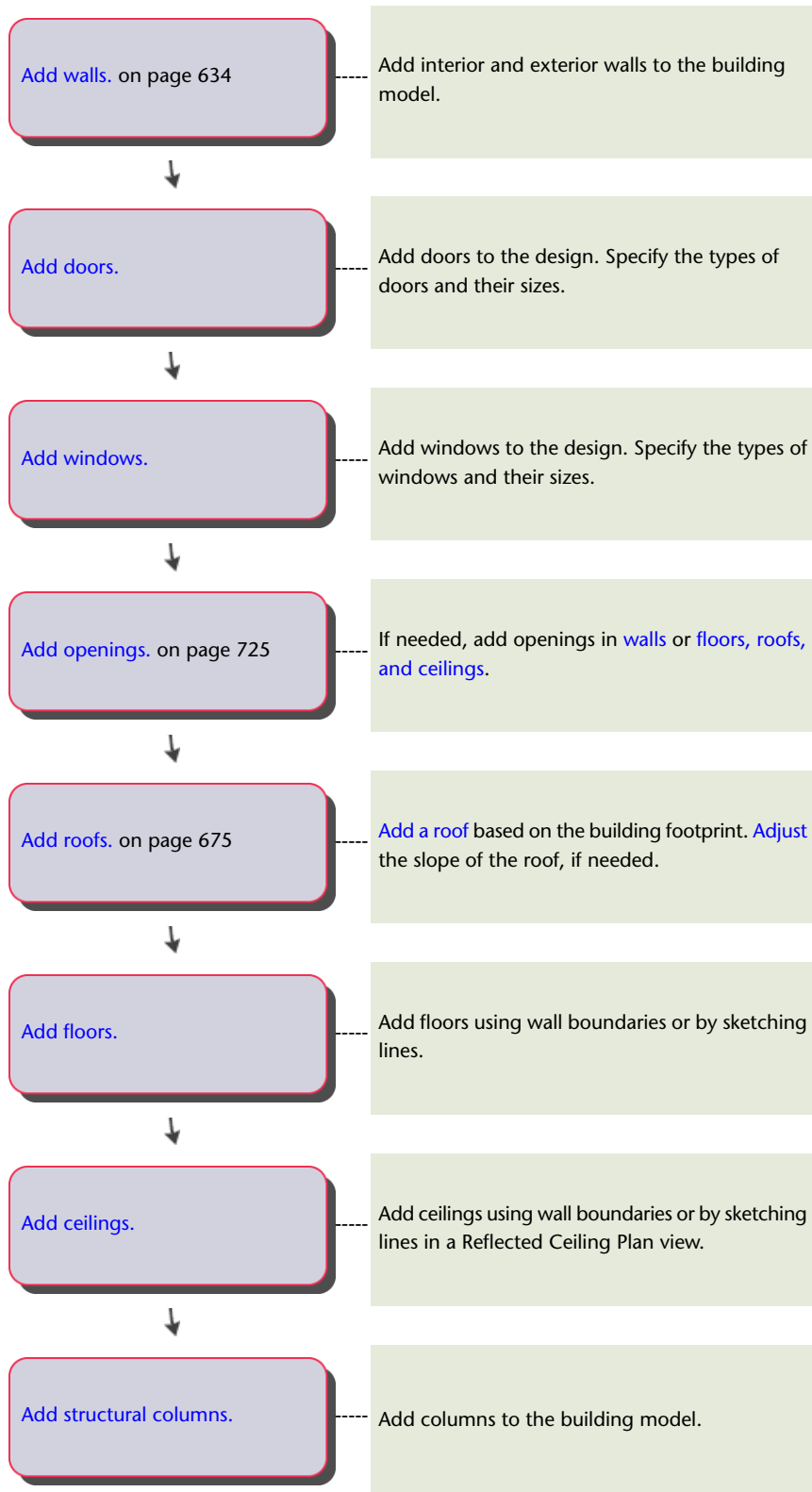


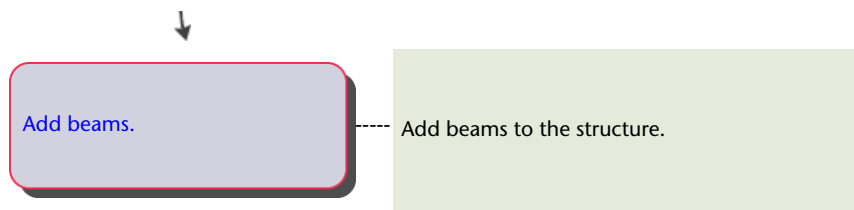
Resize the raster image.

If the image imports at the wrong size, resize it as needed.

Add Basic Building Elements

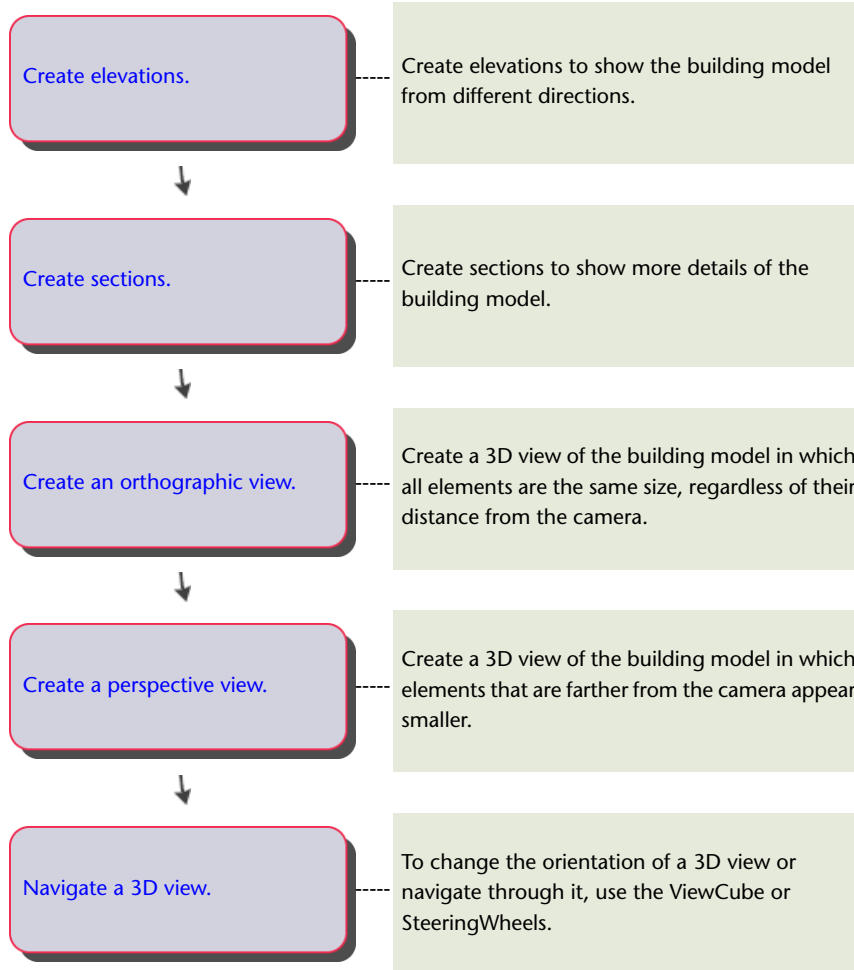
Place generic elements in the building model to plan the layout. You can assign specific element types later when you refine the design.





View the Model

You can create different views of the building model, such as sections, elevations, and 3D views. When you change the building model in one view, Revit Architecture propagates those changes throughout the project.

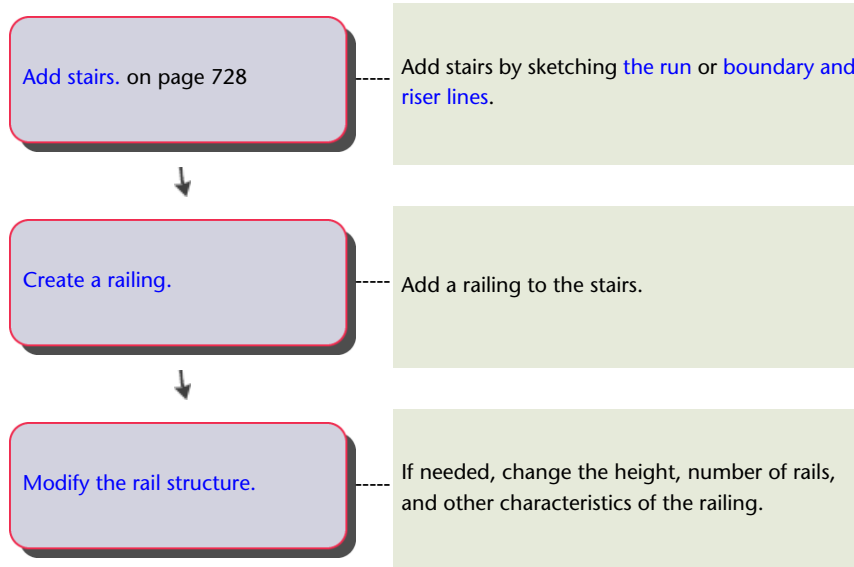


Add More Elements to the Model

After creating the preliminary layout, add more details to the building model to further develop the design.

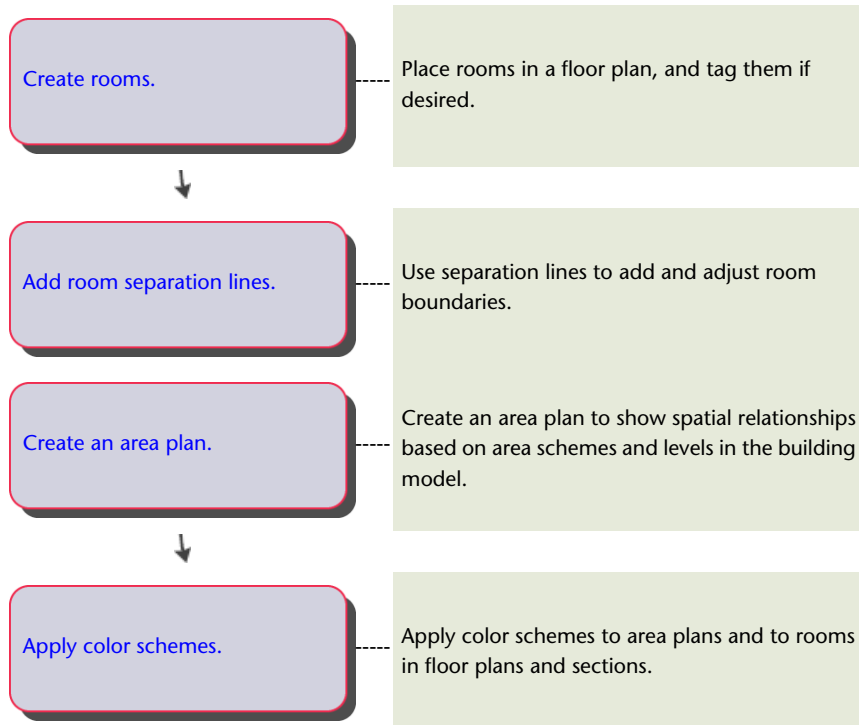
Stairs and Railings

Create simple or complex stairs and railings in the building model.



Rooms and Areas

Use rooms, areas, and color schemes to plan occupancy and usage of a building, and to perform basic analysis of the design.



Components

You can add components such as furniture, casework, and plumbing fixtures to the building model. Many components are standard items that can be delivered on site. Some components must be built in place to meet project-specific requirements.

Place a component.

Load a family into the project, and place instances of that family in the building model.

Create an in-place element. on page 435

Create a custom component designed for a particular context in the building model.

Refine the Model

After planning the basic design, refine the building model by specifying component types, adding details, and creating parametric relationships to constrain the model.

Refine/Replace Components

With the basic design established, you can now refine the building model to specify different element types, build curtain walls, and create other details.

Refine types of building elements.

To refine the types of walls, doors, and other components used in the building model, select the elements to change, and specify the appropriate types.

Modify the structure of basic elements.

If needed, modify the structure of walls, floors, roofs, and ceilings.

Create and refine curtain walls. on page 766

Create curtain walls. Modify the grid layout. Adjust mullions. Change panel types.

Add sweeps and reveals.

Add wall reveals, and add sweeps for walls, roofs, and floors.

Manage the Relationships of Elements

To ensure that the building model maintains relationships among elements, apply constraints. For example, you can specify that a door maintains a certain distance from a wall, that all windows remain equally spaced on a wall, or that 2 collinear walls should stay aligned with each other.

Apply constraints based on dimensions.

Place a dimension, and lock it in place to apply a constraint.

Apply constraints based on alignment.

Align elements (such as a wall with a reference line), and lock the alignment to create a constraint.

Collaborate with Others

Revit Architecture provides several ways to share project work or information with other team members. The point at which you perform these tasks will vary by project and by organization.

Add Team Members to the Project

If you plan to divide the design work among multiple team members, use the Revit worksharing feature after creating the basic design.

Break Up the Model

When you enable worksharing, you can break up the building model into worksets. In addition to the default worksets, you can create more worksets based on functional areas, such as interior, exterior, and site.

Learn best practices.

Review best practices for dividing a building model into worksets.

Share the project.

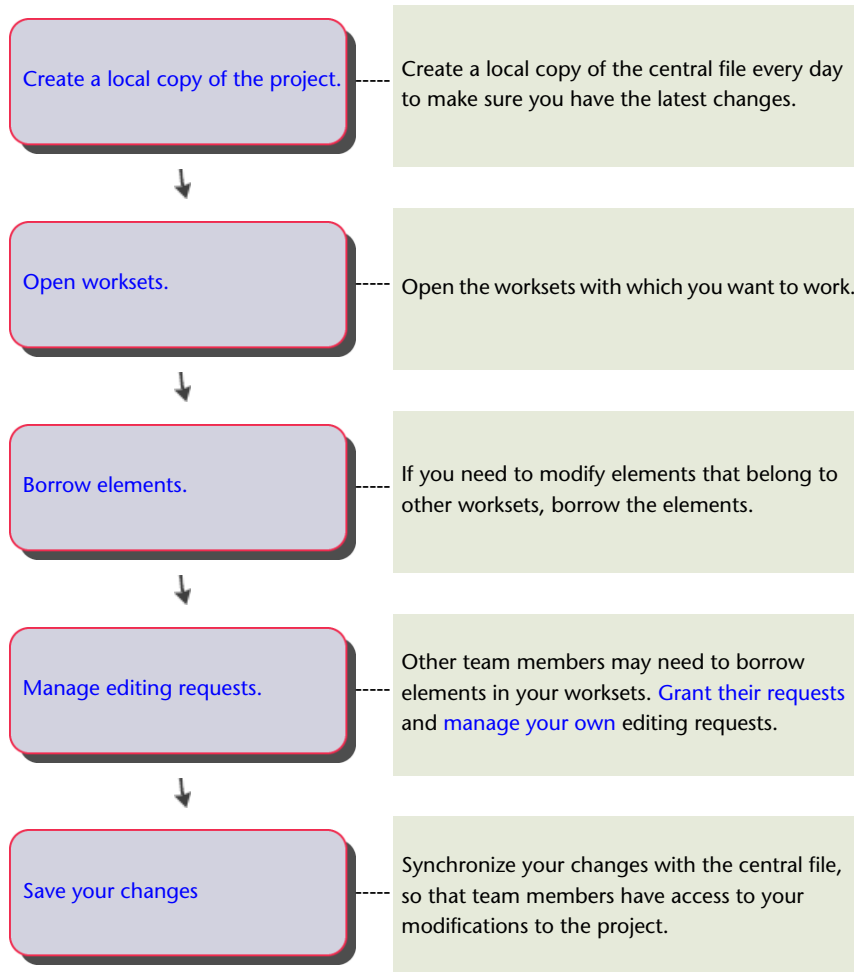
Enable worksharing so that multiple team members can work on the model.

Divide the project into shareable parts.

Divide the building model into worksets, and add elements to each workset.

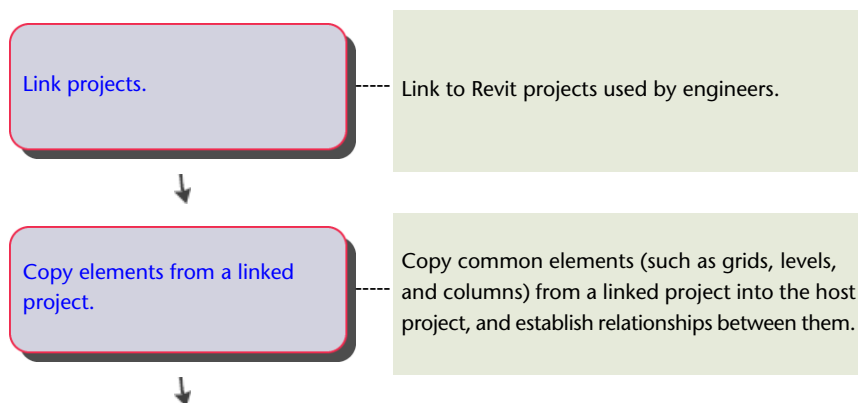
Work on Part of the Project

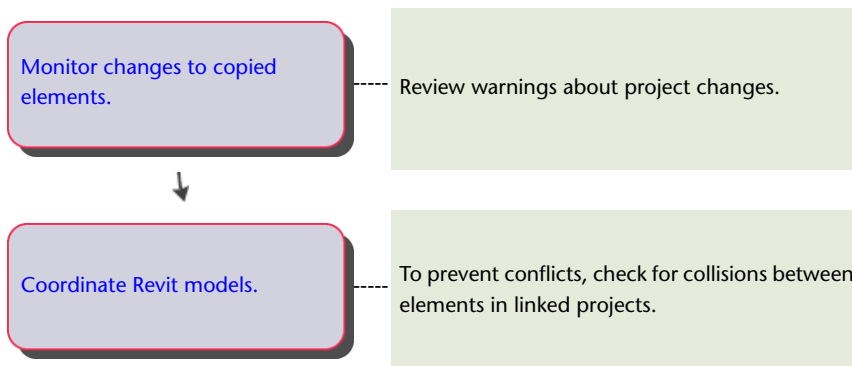
The following is the typical sequence of tasks for each team member working on the project.



Share the Model with Other Disciplines

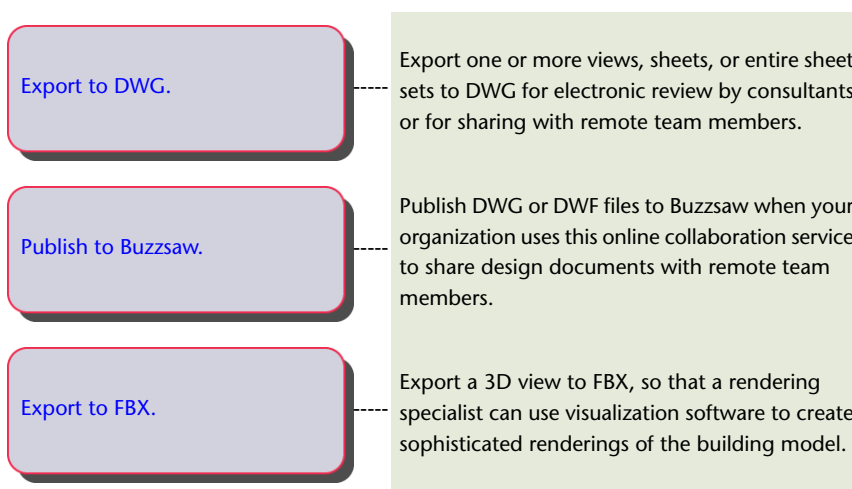
You can set up a project so that relevant information about the Revit model can be shared with engineers in multiple disciplines.





Issue the Design to Consultants

If you need consultants to review or work on parts of a design, use the following options to share the project electronically.



Document the Model

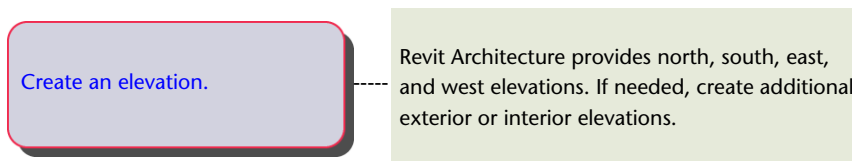
Prepare the construction documents that builders and engineers use.

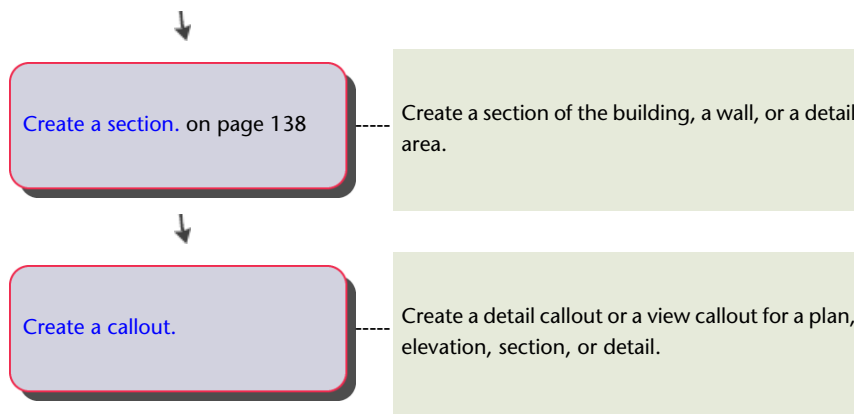
Create Drawings of the Model

To share design information with builders and engineers, you can produce detailed drawings from the building model, or create a drafted drawing to show specific details.

Create View References

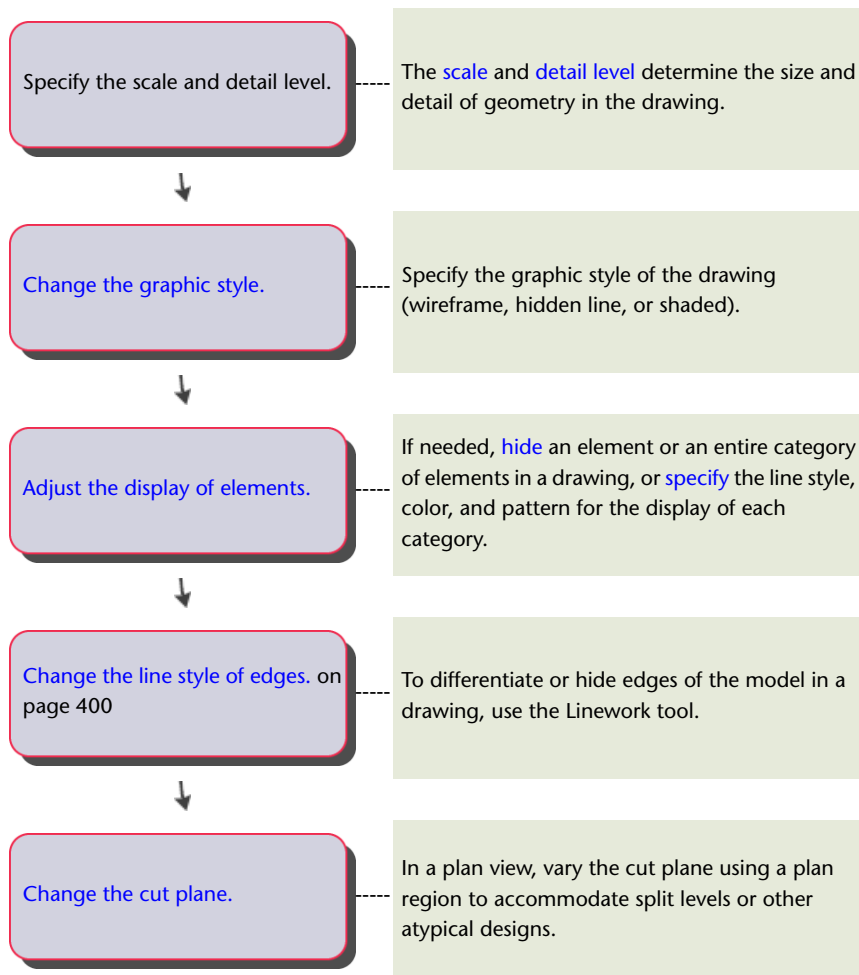
Create elevations, sections, and callouts to provide design details about the building model.





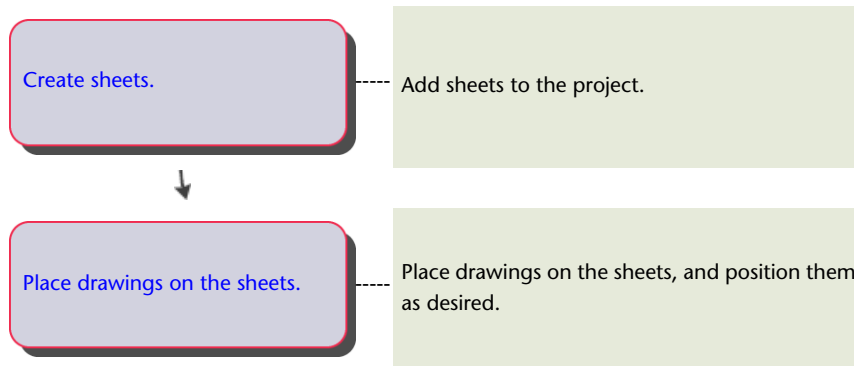
Adjust the Graphics in a Drawing

Change the appearance of a drawing to help communicate design details.



Plan the Sheet Layout

Determine which sheets you need and which drawings they will contain. In a later step, you will [refine the sheets](#) to add title blocks, title marks, and a sheet index.

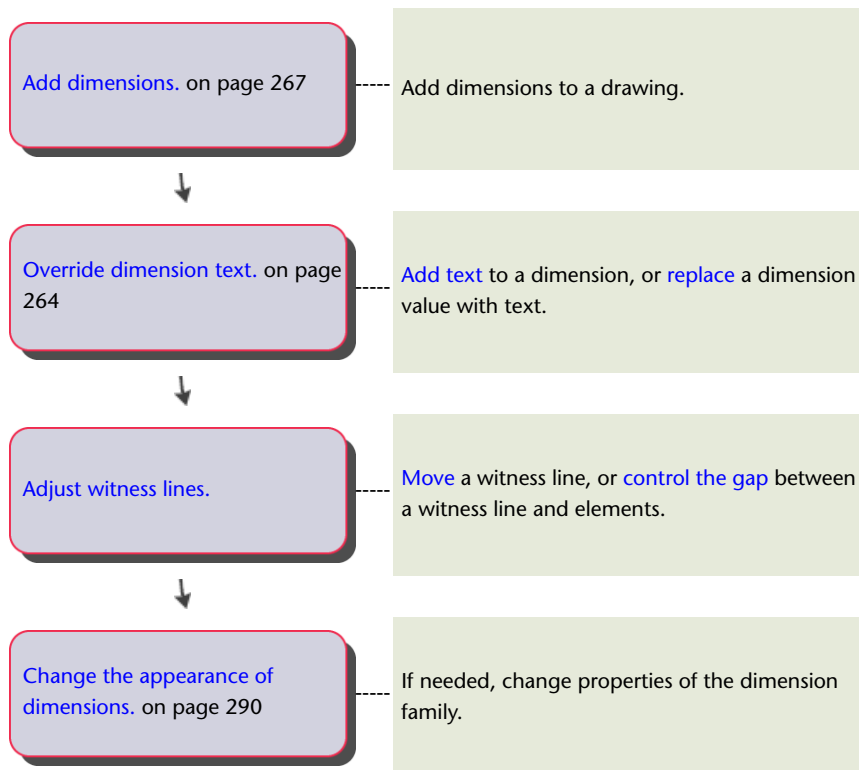


Annotate the Drawings

Add dimensions, text, and tags to provide detailed information.

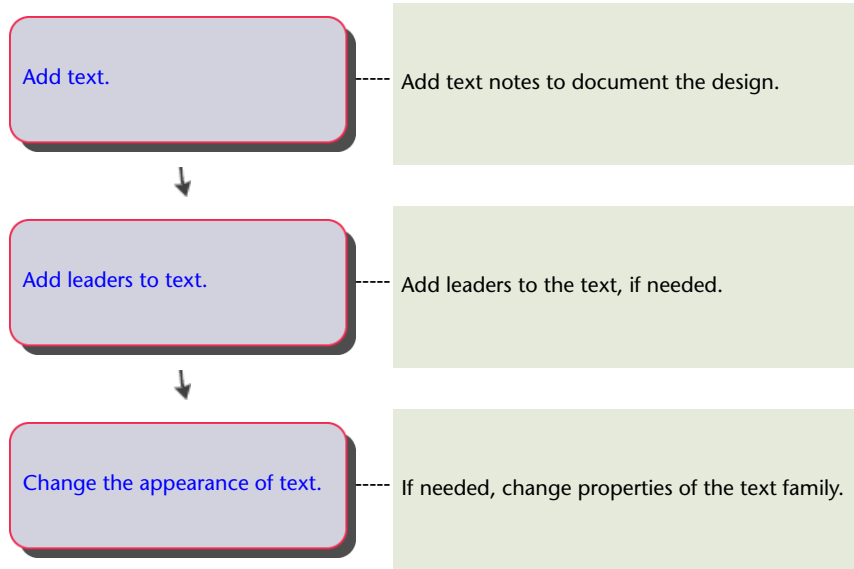
Add Dimensions

After adding dimensions, you can change their appearance, add dimension text, and adjust witness lines.



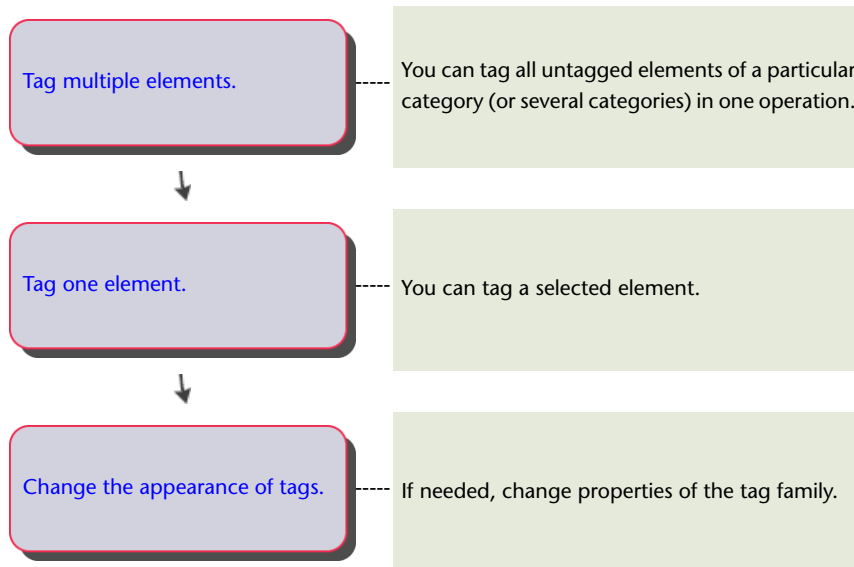
Add Text and Leaders

Add text notes to drawings, with or without leaders. Change the text style, if needed.



Add Tags

Add tags to identify elements in views. Change the appearance of tags to suit your needs and conventions.



Create Schedules

Create schedules to determine quantities and estimate costs.

Door Schedule

Create a door schedule to determine quantities and estimate costs.

Create a door schedule.

Create a schedule that itemizes each door in the building model.



Filter the door schedule by level.

By filtering the schedule, you can list the doors for each level of the building.

Window Schedule

Create a window schedule to determine quantities and estimate costs.

Create a window schedule.

Create a schedule that summarizes windows by type.

Room Finish Schedule

Create a schedule of room finishes to estimate costs and quantities of required materials.

Create a room finish schedule.

Create a schedule that specifies the type of flooring, wall covering, ceiling, and trim for each room.



Add custom parameters to rooms.

If desired, create fields to store additional information about rooms, such as the style of décor, finish, or trim for each room. This information can display in the room schedule, and you can use it for sorting and filtering.



Modify the appearance of the schedule.

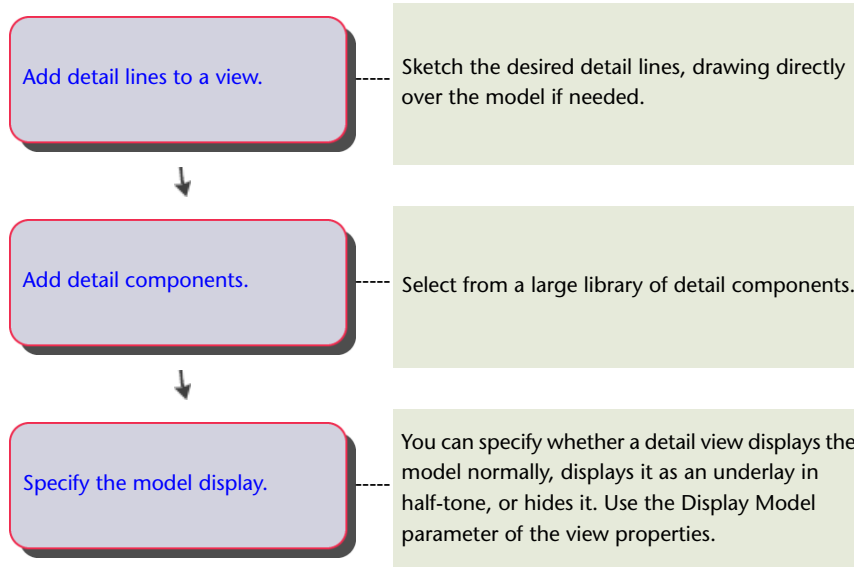
If needed, [change](#) the layout, formatting, or sort order of the schedule. [Modify](#) the schedule to hide a column, delete a row, or edit cells.

Add Details

Add detail lines and components from a detail library. Add keynotes to identify equipment and materials required.

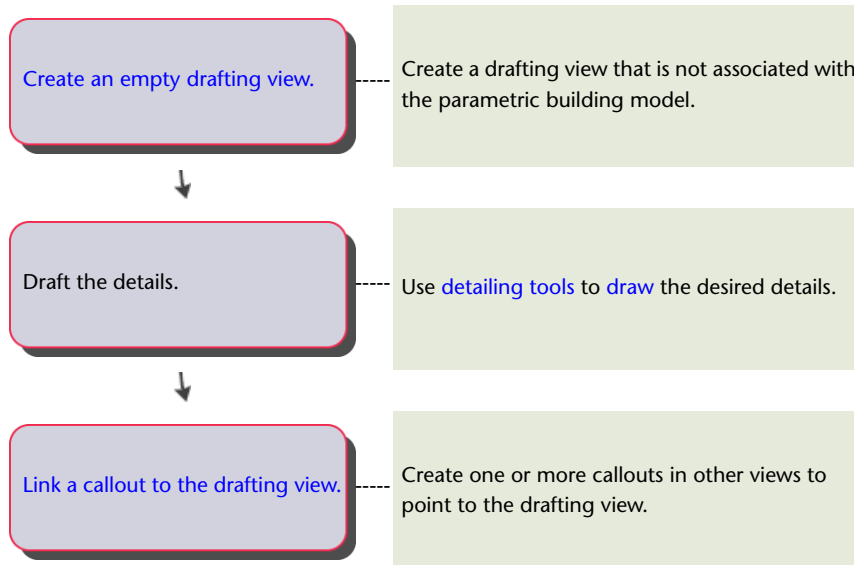
Add Detail Lines and Components

You can sketch detail lines, or insert detail components from a library.



Create Drafted Details

In Revit Architecture, most views of the building model show elements from the model. If you want to draft details that are not based on the building information model, use a drafting view.



Use a Detail Library

If your organization has an existing detail library, you can re-use these details in Revit drafting views.

Import a DWG file.

Import details stored as DWG files into drafting views in the Revit project.

Transfer drafting views from a standard project.

If your organization has created a Revit project that stores standard drafting views, you can insert one or more of these views into the current project.

Add Keynotes

Use keynotes to provide information about building details.

Add keynotes.

Tag elements or materials with standard CSI keynotes or custom keynotes.

Refine Sheets

After you have created sheets and placed drawings on them, you refine the appearance of the sheets.

Customize the title block.

Create or modify a title block to include information about your organization.



Modify title marks.

To change the content and appearance of title marks on sheets, modify view title types.



Create a sheet index.

Create a sheet index (drawing list) to include on the title sheet.

Publish Construction Documents

Print construction documents, or publish them for electronic sharing.

Print Views and Sheets

When you need hard copies, you can print check plots, individual sheets, or entire sheet sets.

[Print a sheet.](#)

Print one or more sheets in a construction document set.

[Print an area \(check plot\).](#)

When printing the current view, under Print Range, select Current Window or Visible Portion of Current Window.

Generate DWF or PDF Files

When you are ready to archive the construction documents, you can generate DWF or PDF files.

[Export to DWF.](#) on page 1355

Export a sheet set to DWF to preserve project information with the drawings.

[Print to PDF.](#) on page 1084

Print to PDF to store the designs in electronic files.

Track Revisions

Enter revision information, mark changes with revision clouds, and specify the revisions to display on each sheet.

[Enter revision information.](#)

Enter information about the revision in the Sheet Issues/Revisions dialog.



[Add revision clouds.](#)

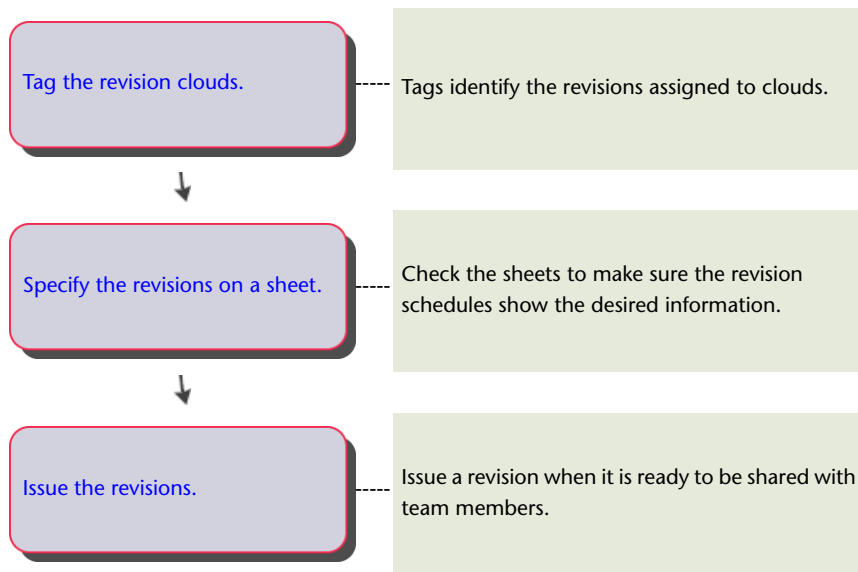
After you update the project to implement the change, draw revision clouds to indicate the areas that changed.



[Assign a revision to each cloud.](#)

By default, the most recent revision is assigned to a new cloud. However, you can change the revision that applies to a cloud.





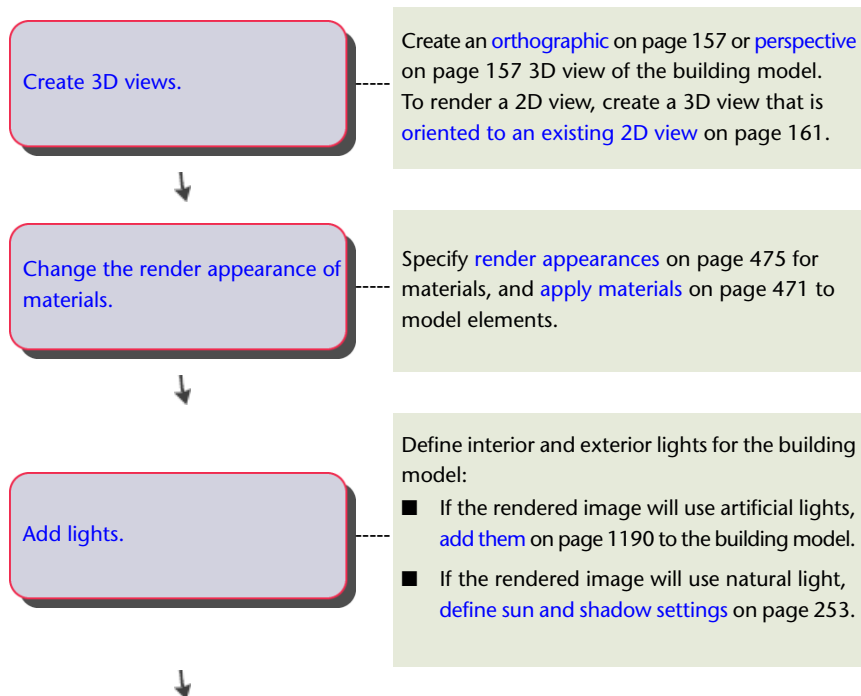
Present the Project

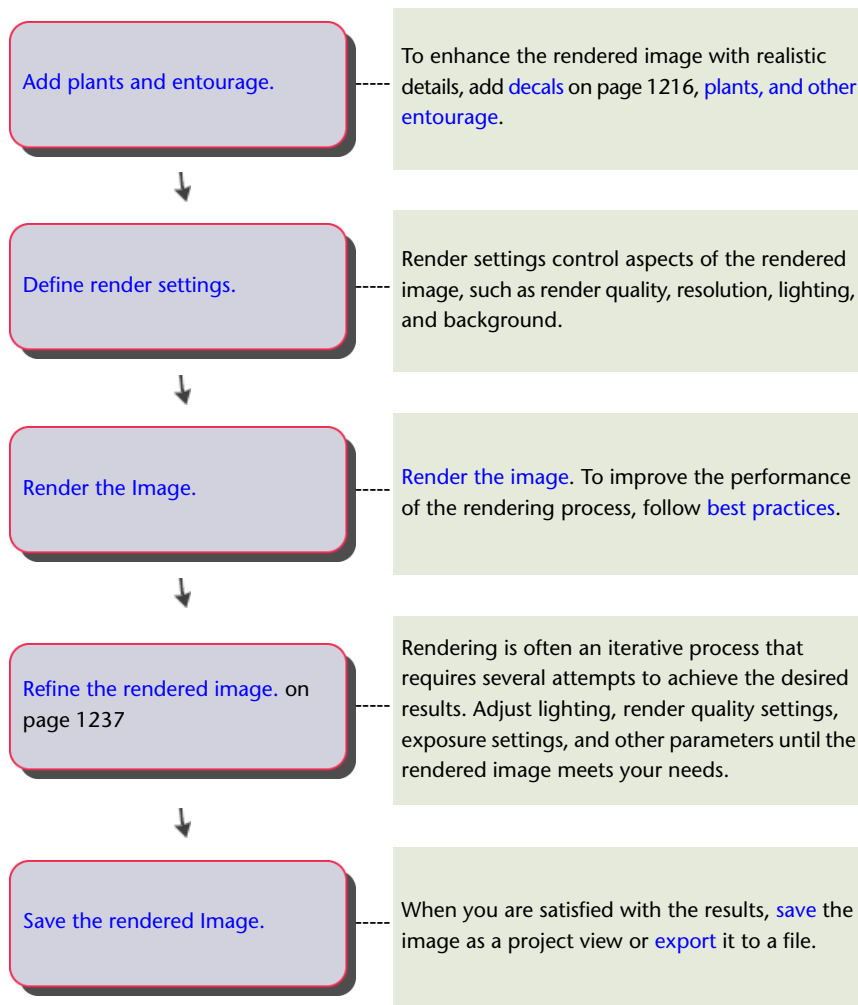
Prepare the design for presentation to clients or other stakeholders.

Create Renderings

Generate a photorealistic image of a building model, and present the design to clients or share it with team members

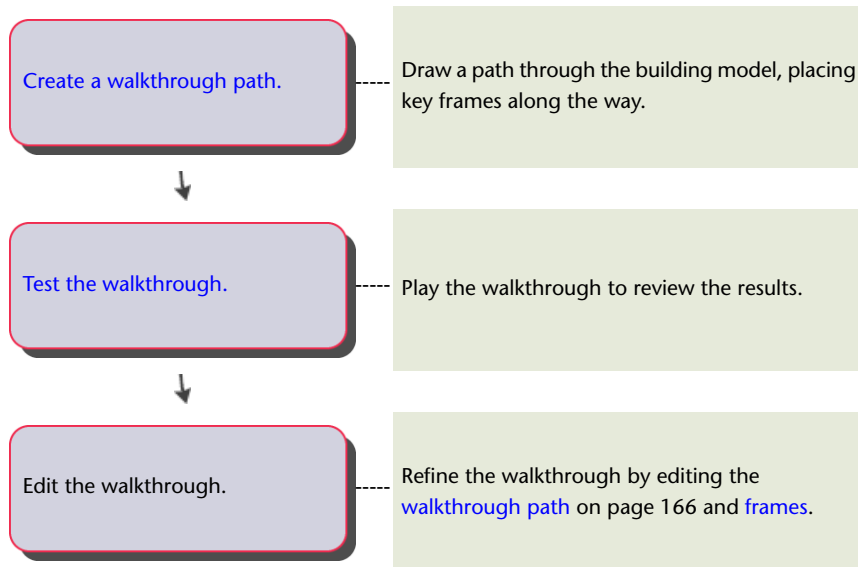
NOTE You can perform the first 4 steps in any order.





Create a Walkthrough

Create a virtual tour of the building model to share the design with others.





Export the walkthrough on page
168

Export the walkthrough to an animation file or a series of still image files.

What's New?

3

This topic describes new and enhanced features for Revit Architecture.

New in Revit 2010

The following topics describe the new and enhanced features for Autodesk Revit Architecture 2010.

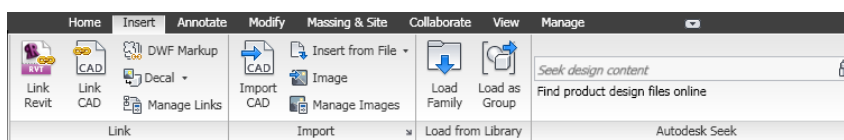
User Interface Enhancements

Autodesk Revit Architecture 2010 includes major changes to the user interface, as described in the following topics.

User Interface

In Autodesk Revit Architecture 2010, the user interface has been completely redesigned to be more intuitive. The 2009 toolbar, menu bar, and Design Bar have been replaced with a single point of access for all tools: the ribbon. The ribbon is organized into task-based tabs and panels that align with typical workflows and reduce the learning curve. When you select an element in the drawing area, the ribbon displays a contextual tab of tools that apply to that element.



NOTE Revit Architecture 2010 does not provide a way to switch between the 2009 menu-based interface and the 2010 ribbon-based interface.



See [Parts of the Revit Interface](#) on page 86

Learning Tools

Autodesk Revit Architecture 2010 provides the following learning tools to aid the transition from Revit Architecture 2009 to Autodesk Revit Architecture 2010.

- *User Interface Overview*: Intended for all Revit users, the User Interface Overview is an interactive display that describes parts of the user interface as you move the cursor over them. To access the User Interface Overview, click the above link, or click  (Help) drop-down ► User Interface Overview. The English edition of the User Interface Overview provides a link to a printable PDF version of the overview.
- *User Interface Tour*: Intended for all Revit users, this tool provides an animated tour of the new Revit interface. To access the User Interface Tour, click the link located on the User Interface Overview page.
- *Where Is My Command?*: Intended for existing Revit Architecture 2009 users, Where Is My Command? is a help file that lists all commands by previous 2009 menu location and displays their current location on the 2010 ribbon. To access Where Is My Command?, click the above link, or click  (Help) drop-down ► Where Is My Command?.

Tooltips

Tooltips display when you move the cursor over a tool in the ribbon. They provide a description of the tool, and help you learn how to use the new interface.

You can adjust the level of information provided in tooltips, and turn them off when you no longer need them. For instructions, see [Tooltips](#) on page 92.


InfoCenter

The InfoCenter toolbar is a collection of tools that help you find information about Revit Architecture. InfoCenter consists of the Search, Communication Center, Subscription Center, and Favorites tools. Revit Architecture Help is also located on the InfoCenter toolbar.

See [InfoCenter](#) on page 100.

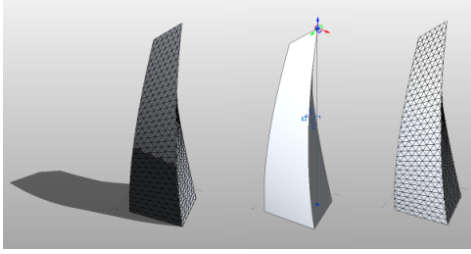
Improved Spell Checker

The spell checker included with Revit Architecture has been replaced with an improved product. You can specify a language for the main dictionary, and you can create custom dictionaries.

To set spelling options, click  ► Options, and click the Spelling tab.

See [Spelling Options](#) on page 520.

Conceptual Design Environment



Autodesk Revit Architecture 2010 introduces a new conceptual design environment. Use the conceptual design environment to explore early design concepts before creating a more detailed BIM model in the Revit project environment.

The conceptual design environment is a type of Family Editor that provides sophisticated modeling tools and techniques for designers to create new massing families. These design concepts contain intelligent model data, eliminating the need to re-create a design from the beginning whenever a change is required. This capability makes it easy to iterate through a series of designs during the conceptual design phase.

The masses that you create in the conceptual design environment can be integrated into the Revit project environment and carried through to the final construction phase.

You can use the conceptual design environment to create a conceptual massing family (which can be loaded into projects), or to create an in-place mass in a Revit project. (See [Forms](#) on page 551.)

The conceptual design environment provides the following features:

- flexible geometric form-making and manipulation tools
- an enhanced drawing environment that allows drawing directly on surfaces and reference planes
- tools to divide surfaces, apply patterns, and create flexible parametric components
- an integrated workflow with the Revit project environment

For complete details, see [Conceptual Design Environment](#) on page 527.

Form Creation

Create accurate solid or void forms using the Create Form tool. Directly manipulate the forms by selecting a line, vertex, edge, or surface and dragging it to create the desired shape. You no longer need to enter sketch modes in order to change the shape of a form. (See [Forms](#) on page 551.)

Parameters and constraints are defined directly in the 3D view. They can be interactively tested so that you can immediately determine whether a design is ready for the Revit project environment.

You can create 3D curves using the traditional spline tool, or using the new Spline Through Points tool, which uses control points that you can drag in any direction.

Graphical Controls

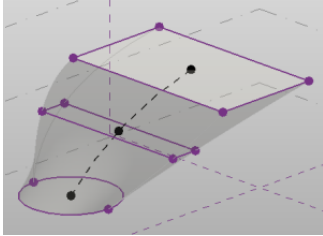
New 3D graphical controls allow you to directly manipulate a form by selecting one of its elements (surface, edge, line, or vertex) and dragging the control until the form has changed to the desired shape. Press the Spacebar to change between local and global coordinates.

See [Manipulating Forms](#) on page 566.

Inspect Form Geometry

View the geometry of a form using X-Ray. This display mode helps you better understand how a form is constructed and allows you to easily select and manipulate geometry elements.

See [X-Ray Mode](#) on page 547.



Add Edge or Profile

Modify forms using Add Edge and Add Profile. These tools provide simple and accurate ways to modify your form.

See [Adding Elements to a Form](#) on page 562.

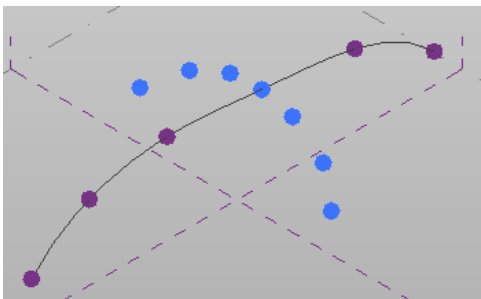
Drawing Forms

When you start drawing in the 3D view, Autodesk Revit Architecture 2010 determines the work plane for you. Because you are already in the 3D view, you do not need to rely on multiple views to see what you are developing. You can draw on reference planes, levels, or the faces of other forms. You can also use 3D snapping to enhance the ability to snap to levels, grids, and other form elements.

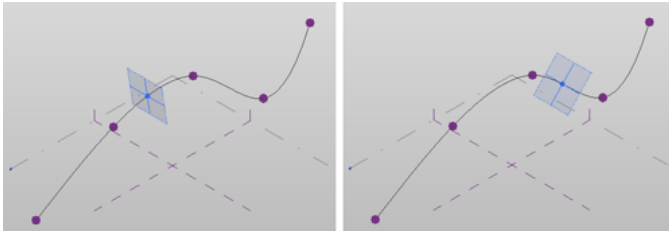
See [Drawing in the Conceptual Design Environment](#) on page 533.

Reference Points

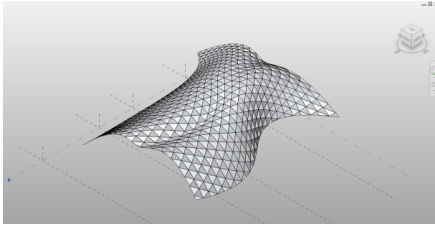
Reference points can host lines, curves, and splines in the conceptual design environment. You can plot points to create splines and lines using the Spline through Points tool, and then use them to parametrically modify the geometry of the line.



Reference points can be placed along splines, edges, or surfaces to supply additional planes of references that are anchored to its host. See [Reference Points](#) on page 540.



Divide and Pattern Surfaces

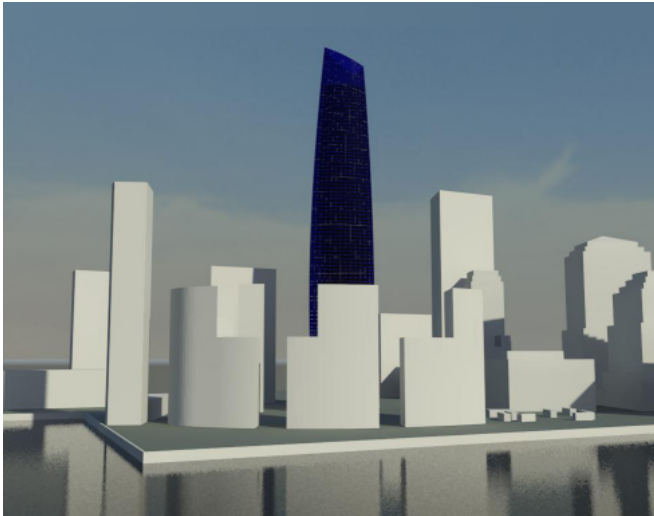


The conceptual design environment allows the ability to divide and pattern complex surfaces and then add building detail that can later be fabricated. Divide Surface allows you to separate surfaces by levels, reference planes, or model lines, and add patterns to them. Then you create and apply parametric components that automatically conform to the divided surface of the complex form.

You can schematically study curtain system designs or structural framing layouts, or begin to apply curtain panels to your form with Divide Surface. These designs have a persistent relationship to the BIM model at all stages of the project.

See [Rationalizing Surfaces](#) on page 569.

Integrating the Concept



Designs created in the conceptual design environment can be integrated into the Revit project environment, where you can perform analyses and scheduling using the Building Maker tools.

You can calculate and schedule floor perimeters, areas and volumes, and exterior surface areas to analyze a mass.

See [Massing Studies](#) on page 589 and [Analyzing a Conceptual Design](#) on page 594.

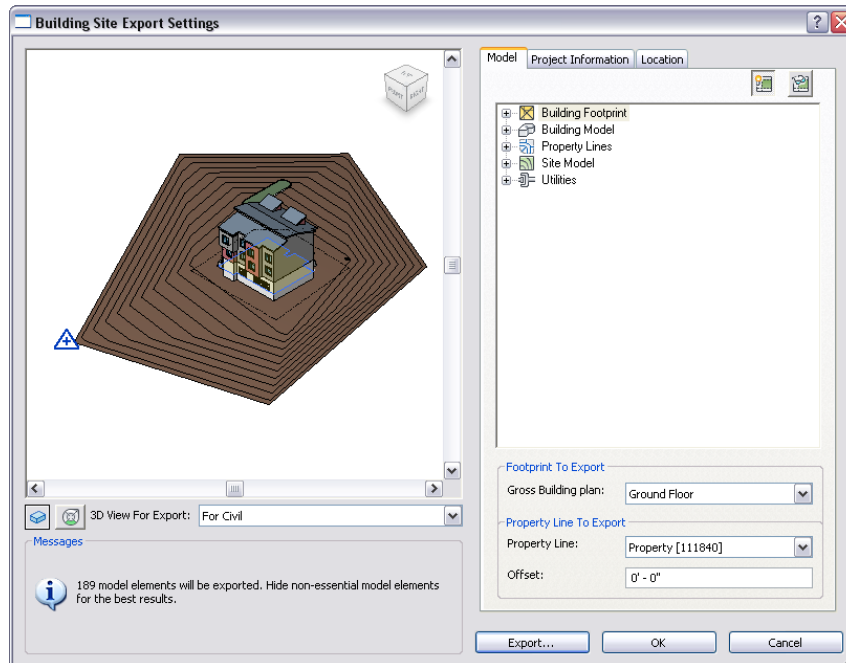
Interoperability

This topic describes the new and enhanced features for interoperability among Autodesk products using Autodesk Exchange files (ADSK), as well as sharing content online using Autodesk® Seek.

Exporting Building Sites

Architects can design buildings using Revit Architecture, then export the digital design geometry (including the BIM data) to civil engineers who are designing the building site using AutoCAD® Civil 3D® or applications that accept Autodesk Exchange (ADSK) files.

See [Exporting Building Sites](#) on page 1376.



Project Base Points and Survey Points

In Autodesk Revit Architecture 2010, a project base point and a survey point are now available in Revit projects to support the export of building sites to civil engineering applications.

The coordinates of the survey point are exported from the building site to the ADSK file. They correctly orient the building geometry in the coordinate system of the civil engineering application.

By default, the project base point and the survey point are hidden in views. To turn on their visibility:

- 1 Open the view in which you want to see the project base point and the survey point.
- 2 Click View tab ► Graphics panel ► Visibility/Graphics.
- 3 On the Model Categories tab under Visibility, expand the Site category.
- 4 Under Site, select Project Base Point and Survey Point.
- 5 Click OK.

See [Project Base Points and Survey Points](#) on page 1302.

Importing Building Components

Architects using Revit Architecture and MEP engineers using Revit MEP® can import building components from Autodesk® Inventor® or other mechanical applications that create Autodesk Exchange (ADS) files.

See [Importing Building Components](#) on page 1398.

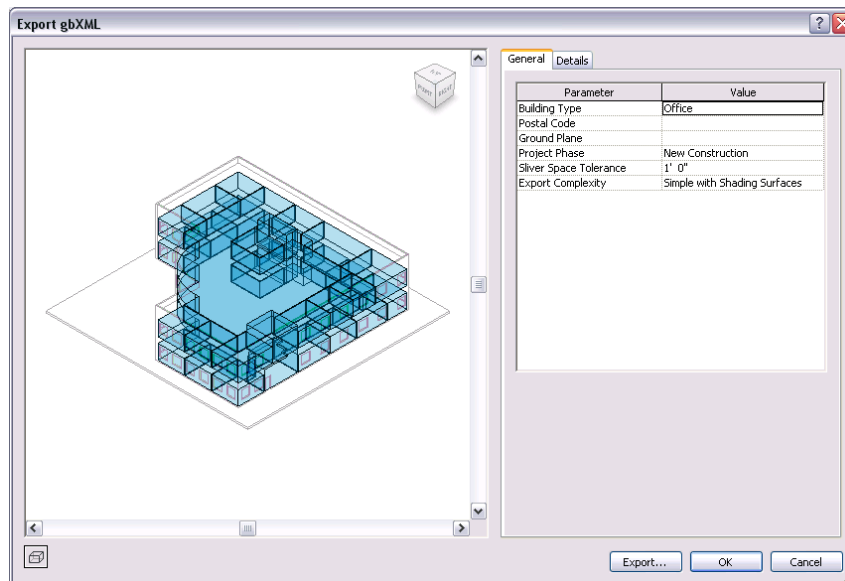
Publishing Content to the Autodesk® Seek Website

In Autodesk Revit Architecture 2010, you can publish Revit families, products, or design information directly to the Autodesk Seek website, so it can be shared with others who are searching for manufacturer-specific or generic building products online.

See [Publishing to Autodesk® Seek](#) on page 1382.

Export to gbXML

In Autodesk Revit Architecture 2010, you can examine an analytical model of a project before exporting the model to a gbXML file. The new [Export gbXML dialog](#) lets you ensure that surface types and openings are correctly identified and verify that the entire volume for the building is being exported.



Worksharing

Autodesk Revit Architecture 2010 includes the following improvements for worksharing (See [Working in a Team](#) on page 1249.)

Create New Local

A workshared project file can be opened as a local file from the Open dialog. A copy of the central file is made and renamed as a local file. If a local file already exists, Revit will prompt you to overwrite the existing file or rename the new file.

See [Creating a Local Copy of a Central File from the Open Dialog](#) on page 1258.

Set Default Worksets to Open

For a workshared project, you can specify which worksets will open by default when the project is next opened. For example, for a project with a small team, you may want all worksets to open by default. For a large team, you may want users to specify the worksets to open each time.

To set default worksets, use the Open workset default option. When you save a new central file, this setting will be applied to all users. If the change is made when saving a local file, it will be valid the next time the local file is opened.

See [Save Options](#) on page 115.

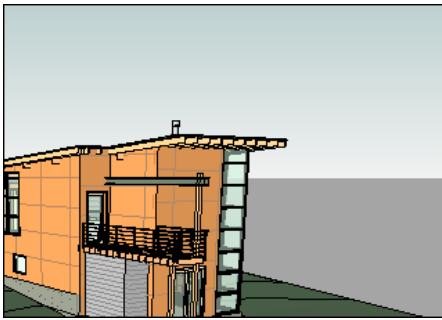
Visibility and Graphics Enhancements

Autodesk Revit Architecture 2010 includes the following improvements for visibility and graphics.

Gradient Backgrounds for 3D Views

You can define gradient backgrounds for 3D views, including orthographic views and perspective views. You can specify colors for the sky, horizon, and ground. You can also specify where the horizon occurs by indicating the ground plane level.

See [Specifying the Background for a 3D View](#) on page 158.



Halftone/Underlay Settings

In Autodesk Revit Architecture 2010, you can control the line weight and pattern used for underlays, and the brightness of halftone elements. When printing views or sheets, you can specify that halftones print as thin lines to retain print fidelity.

See [Halftone/Underlay](#) on page 497.

Visibility Filters for Sections, Callouts, and Elevations

When you use filters to control the visibility and graphic display of elements, you can include elevations, sections, and callouts in the categories to use for filtering.

See [Controlling Visibility and Graphic Display of Elements Using Filters](#) on page 204.

Anti-Aliasing

You can enable anti-aliasing for 3D views, so that curved lines appear smoother.

See [Graphics Options](#) on page 517.

Hardware Acceleration for Graphics

You can enable hardware acceleration for graphics display to improve performance when Revit Architecture refreshes the screen, changes to another window, or displays annotations.

See [Graphics Options](#) on page 517.

Highlight Color

You can specify a highlight color, in addition to a selection color and an alert color.

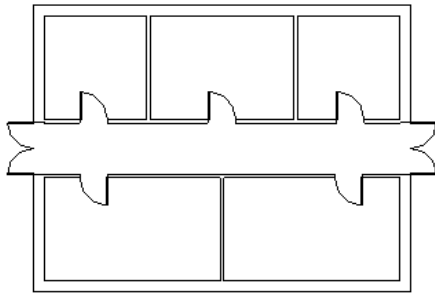
See [Graphics Options](#) on page 517.

Hide by Filter

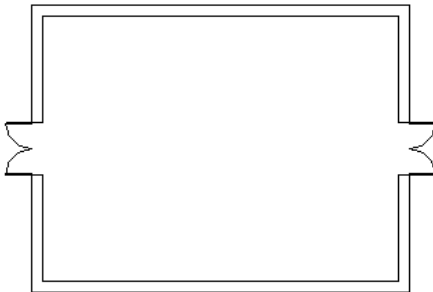
In addition to hiding selected elements in a view, or elements based on categories, you can hide elements in a view using filters.

For example, suppose you want to be able to hide interior walls, doors, floors, stairs, and ramps in a view. To do this, you can set the Function parameter for those family types to Interior, and then apply the predefined Interior filter to the view. As a result, the view hides all elements whose Function parameter is set to Interior. This feature can be helpful when preparing a view for export.

Floor plan showing interior and exterior walls and doors



Floor plan with Interior filter applied to hide interior walls and doors



See [Hiding Elements](#) on page 208 and [Controlling Visibility and Graphic Display of Elements Using Filters](#) on page 204.

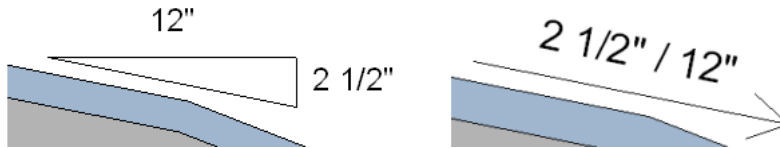
Details and Annotations

Autodesk Revit Architecture 2010 offers the following new feature for detailing and annotating.

Spot Slope

Spot slope is a new type of spot dimension, similar to spot elevation. A spot slope displays the slope at a specific point on a face or an edge of a model element. You can place spot slopes in plan views, elevation views, and section views. The following illustration shows the 2 spot slope types.

See [Spot Slopes](#) on page 282.



Macros Development with Revit VSTA

Revit VSTA 2010 has been enhanced in the following ways.

Before using Revit VSTA 2010, see [Upgrading from Revit VSTA 2009](#) on page 1422.

Improved Workflow

The Macro Manager has been redesigned to streamline the workflow for creating macros in the Revit VSTA IDE and implementing them at the document and application level. The new Macro Manager increases the visibility and organization of your API macro development while you work.

See [Basic Workflow for Revit VSTA Macro Development](#) on page 1425.

Macro Security

New macro security features have been implemented to protect your workstation from running unknown malicious code. Macros can be disabled at the application and document levels, or can be set to prompt the you to allow them when they are detected.

See [Macro Security](#) on page 1434.

Documentation

In Autodesk Revit Architecture 2010, the documentation has been improved as follows.

Architectural Workflows


A new chapter in the documentation provides a high-level introduction to Revit Architecture by mapping typical architectural tasks to software features and functionality. This information is useful for new users of Revit Architecture.

See [Architectural Workflows](#) on page 21.

New in Revit 2009

The following topics describe the new and enhanced features for Revit Architecture 2009.

IMPORTANT Command names, locations, and instructions in these topics reflect the user interface for Revit Architecture 2009. In Autodesk Revit Architecture 2010, many of the names and their locations have changed.

To find 2009 commands in the 2010 release, click  (Help) drop-down ► Where Is My Command? or see [Learning Tools](#) on page 44.

Rendering Enhancements

In Revit Architecture 2009, the AccuRender® rendering engine has been replaced with the mental ray® rendering engine. With this change, Revit Architecture provides an overall higher quality of rendering.

Improved lighting effects and more accurate render appearances for materials result in more photorealistic rendered images.

For details on specific improvements related to rendering enhancements in Revit Architecture, see the following topics.

Image generated using the AccuRender rendering engine



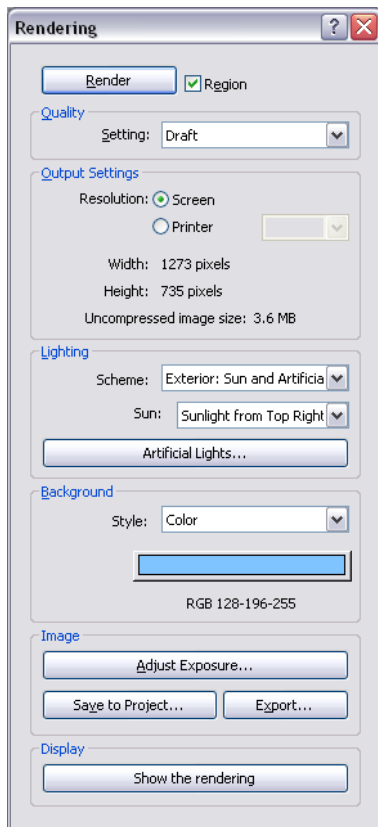
Image generated using the mental ray® rendering engine



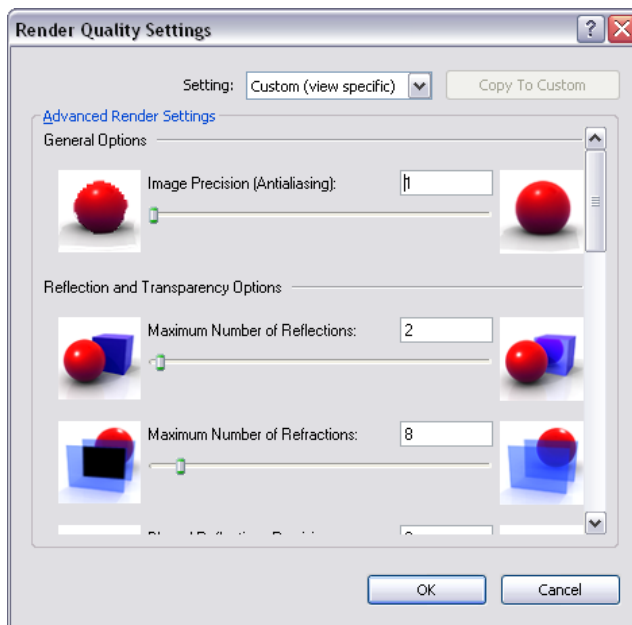
Rendering Workflow Enhancements

The user interface for rendering images has been completely redesigned. Fewer dialogs, a simplified workflow, improved defaults, and clear terminology make it easier for users to generate realistic images with a minimum of effort, even if they have limited rendering experience.

Improved user interface for rendering



For more experienced users, Revit Architecture offers control over advanced settings to refine a rendered image and achieve the desired result.



Related topics

- [Rendering Workflow](#) on page 1163

- [Rendering an Image](#) on page 1220
- [Render Quality Settings](#) on page 1225
- [Rendering Best Practices](#) on page 1233

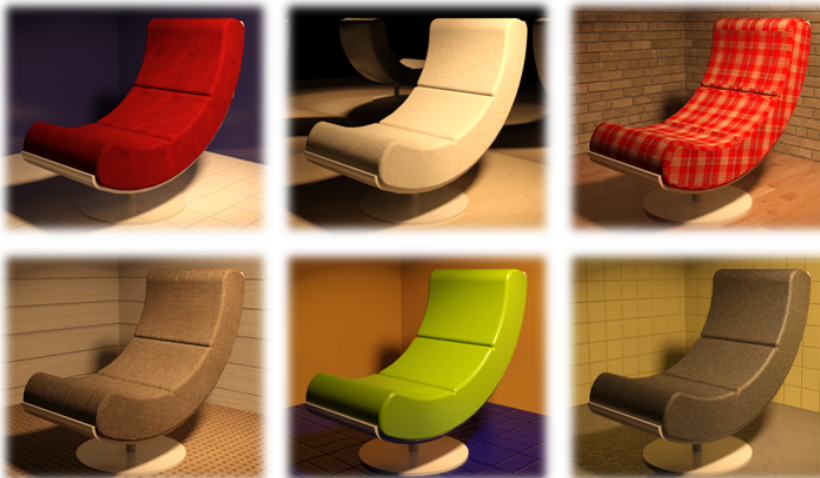
Render Appearance Enhancements for Materials

In Revit 2008 and previous releases, the software provided default materials, many of which used AccuRender definitions for render appearances. When you rendered a 3D view of a building model, these AccuRender definitions were used to provide a realistic representation of the model elements.

In Revit Architecture 2009, new render appearances provide more accurate results in rendered images. A dynamic user interface presents different properties for each type of render appearance, allowing more control over textures and visual effects. When working with materials, you can enter search text to locate the desired material or render appearance quickly, based on its name, description, keywords, or other information.

Material definitions are stored as part of the project file. Render appearances are stored in a local, read-only library. If you change settings for render appearances, many changes are stored as part of the project. If you specify image files for render appearances (for example, for custom colors or textures), you can store the image files in a directory, and point Revit Architecture to that directory. (See [Additional Render Appearance Paths](#) on page 518.) To share custom render appearances with team members, you use File menu ► Transfer Project Standards. Also send the directory containing the image files.

See [Materials](#) on page 468, [Render Appearance Library](#) on page 491, and [Transferring Project Standards](#) on page 446.



Lighting Enhancements

Lighting fixtures are now photometric and can be described by IES files. (Many manufacturers provide IES files for their lighting fixtures, which you can download from their Web sites.) When you render an image, Revit Architecture uses information in the IES file to determine the intensity of light at various points in space. If you do not use an IES file to describe the light source, you can specify real-world lighting variables based on manufacturer information. These improvements provide more accurate, realistic lighting in the rendered image. See [Lights](#) on page 1164.

During the rendering process, daylighting is performed automatically. For advanced lighting quality in interior views, you can enable daylight portals, if needed. See [Daylight Portals](#) on page 1227.



Plant and Entourage Enhancements

Revit Architecture 2009 provides an improved library of RPC (Rich Photorealistic Content) files from ArchVision®.

The library has been expanded to include the following:

- Over 100 trees and plants
- More ArchVision realpeople™, as well as updates to realpeople that were shipped with previous releases
- Additional office furnishings and fixtures

The new RPC content offers more photorealistic render appearances. It is stored in a local, read-only library. If your organization has purchased additional RPC content, you can use it in building models to enhance rendered images.

The user interface for RPC content is simplified to improve the workflow. See [Plants and Entourage](#) on page 1203.



Decal Enhancements

Revit Architecture 2009 provides a more accurate rendering of decals. The user interface has been enhanced to provide more control over the appearance of decals in rendered images.

See [Decals](#) on page 1215.

Enhancements for Export to 3ds Max

When you export a 3D view to Autodesk® 3ds Max® to use its higher-level rendering capabilities, Revit Architecture 2009 passes rendering settings to 3ds Max. The information includes render appearances (material assignments), lights, and related settings defined in the project. By preserving this information during the export process, Revit Architecture maintains a high degree of fidelity and reduces the amount of work you must perform in 3ds Max.

See [Exporting to 3ds Max](#) on page 1373.

Migrating to Revit Architecture 2009

After you upgrade from a previous release to Revit Architecture 2009, Revit families and projects may need to be migrated to make them compatible with the new rendering functionality.

Some migrations are performed automatically when you upgrade the Revit software. Other migrations are performed automatically when you open a Revit family or project. Some migrations must be performed manually.

To migrate...	Do this...	For more information, see...
Render appearances for materials		
default render appearances for materials	Open the project in Revit Architecture 2009, and save it.	Migrating Render Appearances for Materials on page 58, Changing the Render Appearance of a Material on page 475

To migrate...	Do this...	For more information, see...
modified render appearances for materials	Open the project in Revit Architecture 2009. Click Settings menu ► Materials. For each material that used a custom AccuRender definition, assign a new render appearance. Save changes to the project.	Migrating Render Appearances for Materials on page 58, Changing the Render Appearance of a Material on page 475
Lighting		
a lighting fixture family	Open the family in Revit Architecture 2009, and save it.	Migrating Lighting Fixtures on page 60, Lights on page 1164
lighting fixture families in a project	Open each lighting fixture family in Revit Architecture 2009, and save it. Then reload each family into the project, overwriting the existing family. Save changes to the project.	Migrating Lighting Fixtures on page 60, Lights on page 1164
daylighting	No action required. The mental ray rendering engine performs daylighting automatically. For advanced lighting quality in interior views, you can enable daylight portals, if needed.	Daylight Portals on page 1227
To migrate...	Do this...	For more information, see...
Entourage		
default RPC content provided with Revit 2008	No action required. When you render an image in the project, Revit 2009 updates its render appearance automatically.	Migrating Entourage on page 60, Plants and Entourage on page 1203
additional RPC content that you licensed or downloaded	Configure the ArchVision Content Manager (ACM) to work with Revit Architecture.	Migrating Entourage on page 60, Using the ArchVision Content Manager on page 1212
AccuRender procedural plants	Do either of the following: <ul style="list-style-type: none"> ■ Open the project, and manually replace each 2008 plant family with a 2009 plant family. ■ Open the 2008 plant family in the Family Editor. Select Settings menu ► Family Category and Parameters. For Rendering Appearance Source, select Third Party, and click OK. In the Family Type, for Render Appearance, specify an RPC file for the plant. Save the plant family. 	Migrating Plants on page 61, Plants and Entourage on page 1203
decals	No action required. Decals are automatically upgraded to work with Revit Architecture 2009.	Migrating Decals on page 61, Decals on page 1215

Migrating Render Appearances for Materials

In Revit Architecture 2009, some materials migrate automatically to use the new render appearances. For other materials, new render appearances will need to be assigned manually.

NOTE Glow, smoothness, and shininess are no longer supported for Revit materials. However, render appearances for materials may have similar properties. When you upgrade a project to Revit Architecture 2009, all materials from earlier Revit releases are converted to have no glow, no smoothness, and no shininess.

For more information, see [Materials](#) on page 468.

Render Appearances that Migrate Automatically

In Revit Architecture 2009, new render appearances have been assigned to all materials that are used in Revit families or templates and that previously used AccuRender definitions. When you upgrade a project that uses these materials, the materials are updated to use the new render appearances.

For these materials, each 2008 render appearance is mapped to a new 2009 render appearance, based on a match of the AccuRender definition name. If you modified an AccuRender definition without changing its name, the modified AccuRender appearance is updated to use the 2009 render appearance.

NOTE Revit Architecture 2009 does not change the names of any existing materials in a project.

Render Appearances that Require Manual Updates

Revit Architecture 2009 assigns a default render appearance to the following:

- Materials that are not used in Revit families or templates
- Materials that use custom AccuRender definitions in Revit 2008 or prior releases

In rendered images, this default render appearance displays as gray, and the material's Comments field displays the following text:

Rendering appearance not upgraded

You must update these materials to assign new render appearances to them. See [Updating a 2008 Render Appearance](#) on page 59.

If a Revit 2008 project makes extensive use of AccuRender definitions, you can edit a text file to map the AccuRender definitions to new render appearances. For instructions, go to the Autodesk Support Knowledge Base and search for the technical solution TS1081106.

Updating a 2008 Render Appearance

Use the following procedure to assign a new render appearance to a 2008 material whose render appearance was not upgraded automatically.

To update a render appearance for a material

- 1 In Revit Architecture 2009, open a project.
- 2 Click Settings menu ► Materials.
- 3 In the left pane of the Materials dialog, under Materials, enter **not upgraded** in the search field.
The materials list displays the names of all materials whose Comments field contains the specified text.
- 4 Select a material from the list.
- 5 On the Render Appearance tab, click Replace.
- 6 In the Render Appearance Library, select the desired render appearance for the material, and click OK.

See [Searching for a Render Appearance](#) on page 491.

7 If desired, modify properties for the render appearance.

See [Render Appearance Properties](#) on page 478.

8 Click Apply.

9 Repeat Steps 4 through 8 for other materials whose render appearances were not upgraded.

10 In the Materials dialog, click OK.

11 Save changes to the project.

Migrating Lighting Fixtures

In Revit Architecture 2009, all 2008 lighting fixture families (including spot lights and linear lights) display and render as spherical light sources with intensity control.

To migrate a lighting fixture family, open the lighting fixture family in the Family Editor. Revit Architecture adds a new light source definition to the family, using default settings. Make desired changes to the light source definition and its parameters. (See [Defining the Geometry of a Light Source](#) on page 1180 and [Defining Parameters for Lighting Fixtures and Light Sources](#) on page 1182.) Save changes to the family.

To migrate a lighting fixture family in a project, first migrate the lighting fixture family as described above. Then save the family and reload it into the project, overwriting the existing family. (Override parameters in the project if desired.) Save changes to the project.

After migration, the light sources for the lighting fixtures render photometrically, and they have more photometric properties. For more information, see [Lights](#) on page 1164.

Migrating Light Groups

In a Revit 2008 project, you may have created light groups to control light settings (on/off or dimming) in rendered images.

When you migrate a Revit 2008 project to Revit Architecture 2009, the light groups are maintained. However their settings (on/off or dimming) are not preserved. As a result, you must redefine the settings for each 3D view that uses a light group. See [Light Groups](#) on page 1197.

Migrating RPC Content

Revit 2008 provided several RPC files from ArchVision® as entourage (such as plants, cars, and people) for rendered images. Revit Architecture 2009 provides updated files for the same RPC content, as well as additional RPC files for new entourage.

For more information, see [Plants and Entourage](#) on page 1203.

Migrating Entourage

When you render an image in a migrated project, Revit Architecture 2009 uses new render appearances for existing RPC content (provided with Revit 2008) automatically. You do not need to perform any manual steps to migrate the default Revit 2008 RPC content.

If a Revit 2008 project contains RPC content that you licensed or downloaded (not provided with Revit 2008), configure Revit Architecture 2009 to use the ArchVision Content Manager. See [Using the ArchVision Content Manager](#) on page 1212.

Migrating Plants

Many Revit 2008 plant families were defined using AccuRender procedures. In Revit Architecture 2009, render appearances for plant families are defined using RPC files. There is no one-to-one strategy for mapping Revit 2008 plants to Revit 2009 plants.

When you open a Revit 2008 project in Revit Architecture 2009, existing AccuRender plant families will have their Rendering Appearance Source parameter set to Family Geometry. When you render an image, the plants do not display.

If you plan to render images containing plants, you must do either of the following:

- Manually replace each 2008 AccuRender plant family with a 2009 RPC plant family. See [Placing Plants and Entourage in a Project View](#) on page 1213.
- Open the 2008 plant family in the Family Editor. Select Settings menu ► Family Category and Parameters. For Rendering Appearance Source, select Third Party, and click OK. In the Family Type, for Render Appearance, specify an RPC file for the plant. Save the plant family. See [Specifying a Render Appearance for an RPC Family](#) on page 1207.

Migrating Decals

When you open a Revit 2008 project using Revit Architecture 2009, any decals in the project are automatically upgraded for Revit Architecture 2009. If you specified any special attributes for the decal using Revit 2008, those attributes are not retained. Instead, Revit Architecture 2009 provides a more accurate rendering of decals.

For more information, see [Decals](#) on page 1215.

Migrating Rendered Images in a Project

Revit Architecture 2009 does not automatically re-render images in a migrated project. To update a rendered image using the new rendering functionality, you must re-render the image.

Before rendering an image, verify that the following conditions are met:

- Materials use the desired render appearances. See [Migrating Render Appearances for Materials](#) on page 58.
- Existing lighting fixture families have been migrated. [Migrating Lighting Fixtures](#) on page 60
- Existing light groups have the desired settings (on/off or dimming) in the view. See [Migrating Light Groups](#) on page 60.
- Any exterior lighting scheme uses the desired sun position. See [Controlling Lighting in a Rendered Image](#) on page 1228.
- Plants are updated to use new RPC render appearances. See [Migrating Plants](#) on page 61.

For instructions about rendering an image, see [Rendering an Image](#) on page 1220 and [Rendering Best Practices](#) on page 1233.

Performance of the Rendering Engine

In Revit Architecture 2009, the mental ray rendering engine is designed to produce more photorealistic rendered images than in Revit 2008. It provides renderings of comparable quality to AccuRender in a similar amount of time.

However, in Revit Architecture 2009, you have more control over the quality settings for rendered images. For example, you can generate a quick draft quality image to check material settings, or use a higher quality setting to generate a presentation-quality image. Higher quality rendered images require more time to generate than lower quality images. Other characteristics of the building model can also increase rendering time. Regardless of the quality setting you choose, however, the resulting rendering will be more accurate and more detailed than the corresponding AccuRender image.

See [Specifying the Render Quality](#) on page 1224 and [Rendering Best Practices](#) on page 1233.

What's Changed for Rendering?

The following table lists rendering features and functions in Revit 2008, and describes how these have changed in Revit Architecture 2009.

Revit 2008 Feature	In Revit 2009...	For more information
AccuRender radiosity and raytracing	Revit Architecture 2009 now performs similar functions automatically when it renders an image. You no longer need to perform these functions as separate steps.	Rendering an Image on page 1220
AccuRender environment settings, sun and sky settings	When you define render settings, you specify whether the sky is cloudy or hazy (or both), or a solid color. For the sun position, you can select from predefined settings, or define a sun position based on date/time/location or azimuth/altitude.	Controlling Lighting in a Rendered Image on page 1228, Specifying the Background for a Rendered Image on page 1229
Daylighting	For rendered images, daylighting is performed automatically. For advanced lighting quality in interior views, you can enable daylight portals, if needed.	Daylight Portals on page 1227
Render scenes	You define render settings for each 3D view. To apply defined render settings to other views, create a view template. Then apply it to the desired views.	Defining Render Settings on page 1221, View Templates for Render Settings on page 1232
AccuRender backface culling, view culling	Revit Architecture 2009 now performs these functions automatically when it renders an image. You no longer need to specify these settings.	
External material libraries	Material definitions are stored as part of the project file. Render appearances are stored in a local, read-only library. If you change attributes for render appearances, many changes are stored as part of the project. If you specify image files for render appearances, store the image files in a directory, and point Revit Architecture to that directory. To share custom render appearances with team members, use File menu ► Transfer Project Standards, and send them the directory containing the image files.	Materials on page 468, Render Appearance Library on page 491, Transferring Project Standards on page 446, Rendering Options on page 518
Revit 2008 Feature	In Revit 2009...	For more information
AccuRender procedural trees	ArchVision RPC trees	Plants and Entourage on page 1203

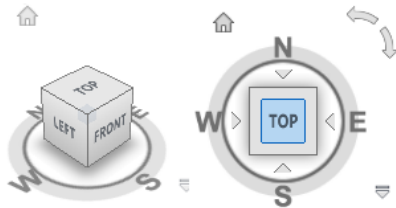
Revit 2008 Feature	In Revit 2009...	For more information
Seasonal settings	For many plants, you can now select a render appearance that shows a standard version of the plant or a fall version of the plant. You specify this in the plant family. The plant season is no longer a render setting.	Specifying a Render Appearance for an RPC Family on page 1207

Navigating 2D and 3D Views

ViewCube and SteeringWheels are navigation tools that allow you to navigate 2D and 3D views in Revit Architecture. These tools replace the Dynamic View commands that were available in 2D and 3D views in previous releases of Revit Architecture.

ViewCube

The ViewCube is a 3D navigation tool that indicates the current orientation of a model and lets you adjust the viewpoint.



The ViewCube displays by default when you open a 3D view. You can show or hide the ViewCube using Window menu ► ViewCube.

SteeringWheels

SteeringWheels are tracking menus that allow you to access different 2D and 3D navigation tools from a single point. SteeringWheels are divided into different sections known as wedges. Each wedge on a wheel represents a single navigation tool. You can pan, zoom, or manipulate the current view of a model in different ways.

There are several SteeringWheels; wheels are specific to the context that a model is being viewed in.

Full Navigation Wheel



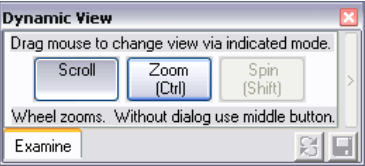

SteeringWheels can be accessed from the toolbar. Click  (in 2D views) or  (in 3D views) to access the SteeringWheels.

For more information on ViewCube and SteeringWheels, see [Navigating Views](#) on page 217.

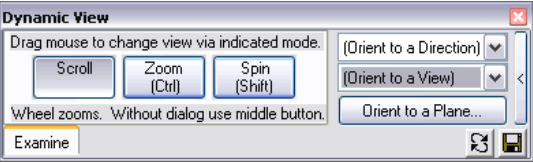
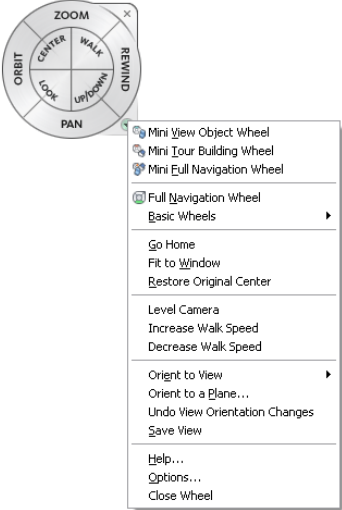
Dynamic View Tools in ViewCube and SteeringWheels



The following tables indicate where Dynamic View tools can be found in the ViewCube and SteeringWheels. For some tools, behavior has changed and is noted.

General Navigation Options

In Dynamic View	In ViewCube/SteeringWheels
	
Scroll	Pan In a 2D context, pan scrolls the view. If you are using pan with an active view on a sheet, pan scrolls the sheet view, not the active view on the sheet. NOTE In a 3D context, primarily when you are using 3D SteeringWheels, pan dollies the camera left and right.
Zoom	Full Navigation Wheel: Zoom Tour Building Wheel: Forward

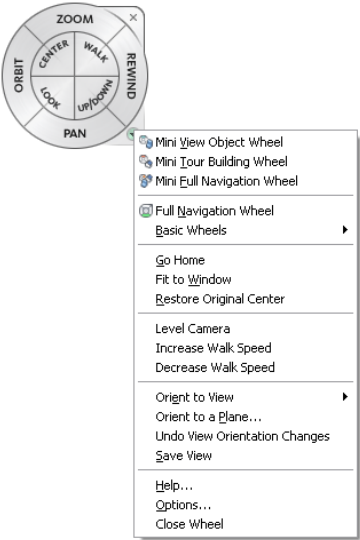
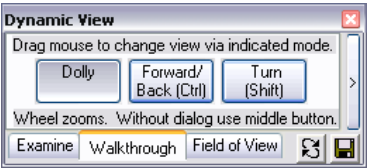
3D View Navigation Options

In Dynamic View	In ViewCube/SteeringWheels
	
Spin	SteeringWheels: Orbit ViewCube: Click and drag the ViewCube

In Dynamic View	In ViewCube/SteeringWheels
Undo view orientation changes ()	SteeringWheels: Rewind Rewind offers enhanced undo options for view orientation changes. See Rewind Tool on page 237.
Save View ()	Right-click SteeringWheels or ViewCube, and click Save View.
Orient to a Direction	Click faces, edges, or corners on the ViewCube, or right-click the ViewCube, and click Orient to a Direction.
Orient to a View	Right-click SteeringWheels or ViewCube, and click Orient to View.
Orient to a Plane	Right-click SteeringWheels, and click Orient to a Plane.

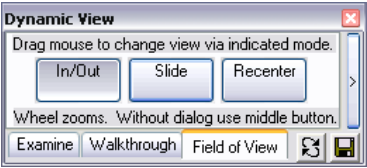
Perspective View Navigation Options

In Dynamic View	In SteeringWheels
Walkthrough Tab Options	

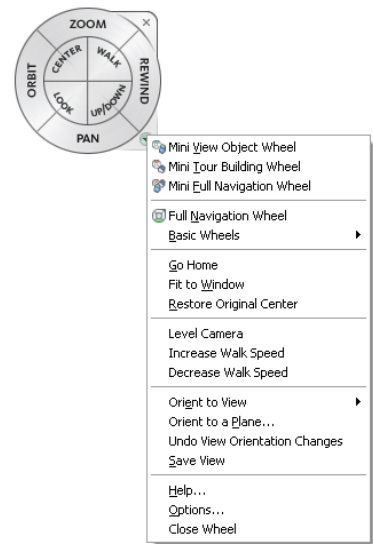


Dolly	Pan
Forward/Back	Full Navigation Wheel: Walk Tour Building Wheel: Forward
Turn	Look
Field of View Tab Options	

In Dynamic View



In SteeringWheels



In/Out

Right-click SteeringWheels, and click Increase/Decrease Focal Length.

Slide

Right-click SteeringWheels, and click Move Crop Boundary.



Recenter

Right-click SteeringWheels, and click Re-center Crop Boundary.

User Interface


This topic describes the new and enhanced features for the user interface in Revit Architecture 2009.

Recent Files

When you start Revit Architecture, it displays the new Recent Files window in the drawing area instead of opening a default template. This window shows the projects and families that you worked on recently in descending chronological order. To open one of these, click it. If you hold the cursor over the image, a tooltip displays the path, size, and date the project or family was modified. To open a file that is not listed in the Recent Files window, click  (Browse for additional project files) or, click  (Create new project).


The Recent Files window provides fast access to your recent projects and families. After you have worked in a Revit file, you can return to the Recent Files window by clicking Window menu ► Recent Files, or press **CTRL + TAB** if the window is still open. See [Opening Revit Files](#) on page 112.

Selection Count

When you select multiple elements, it can be difficult to determine whether you have selected the intended elements. The right side of the status bar now includes a selection count  to indicate how many items are currently selected.

If you click the selection count icon, the Filter dialog displays, indicating how many elements are selected in each category. In the Filter dialog, you can select and clear categories to select or deselect those elements. See [How Many Elements Are Selected?](#) on page 341 and [Selecting Elements Using a Filter](#) on page 341.

Warnings for Selected Elements

To review warnings related to elements you have selected in the drawing area, click  on the Options Bar. See [Warnings for Selected Elements](#) on page 1415.

Export Warnings to a File

Warnings that relate to elements selected in the drawing area can be exported to an HTML file by clicking



on the Revit Architecture 2009 dialog. See [Exporting Warnings to a File](#) on page 1416.

Ground Plane at Level Field

Ground Plane at Level, located in the Sun and Shadow Settings dialog, is used to cast shadows in shaded views when you are creating a solar study. This option no longer affects rendered images. See [Solar Studies](#) on page 1241

Project Settings

This topic describes the new and enhanced features for project settings in Revit Architecture 2009.

Suppressing Trailing Zeros and Spaces

You can format project units to suppress trailing zeros (for example, 123.400 displays as 123.4) and suppress spaces (for example, 1' - 2" displays as 1'-2"). See [Setting Project Units](#) on page 502.

Decimal Display and Digit Grouping

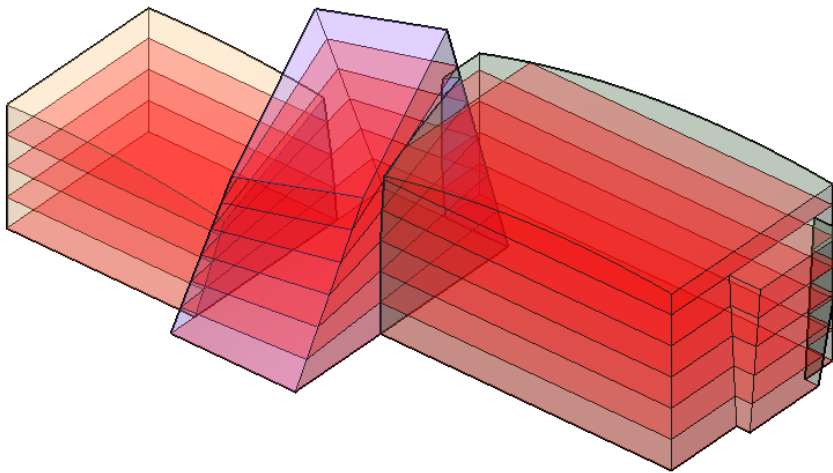
The decimal display option for project units has changed. When you select the decimal display type, you can also select how to group the digits in the unit value. See [Changing Decimal Display and Digit Grouping](#) on page 502.

Conceptual Design

This topic describes the new and enhanced features for conceptual design and massing studies in Revit Architecture 2009.

Analyzing Conceptual Designs

The ability to create mass floors from masses has been enhanced to enable analysis of conceptual designs. (In Revit 2008, mass floors were called floor area faces.) The software now calculates the area, exterior surface area, volume, and perimeter of each mass floor you create. This information is stored in the instance properties for mass floors. You can include these values in schedules and tags.



You can then use this information to determine the following:

- The best mix of uses (such as retail, residential, and office space) for the building
- Rough cost estimates for the exterior of the building, based on linear dimensions or surface area
- HVAC (heating/ventilation/air conditioning) requirements for different levels of the building

See [Analyzing a Conceptual Design](#) on page 594.

Mass Floor Schedule							
Mass: Type	Level	Usage	Floor Area	Floor Area %	Floor Perimeter	Exterior Surface Area	Floor Volume
Offices							
Square	3	Offices	352 m²	5%	75	227 m²	1,061.61 m³
Square	4	Offices	356 m²	5%	76	552 m²	965.60 m³
Wedge	4	Offices	288 m²	4%	73	219 m²	846.24 m³
Wedge	5	Offices	277 m²	4%	72	216 m²	818.27 m³
Wedge	6	Offices	269 m²	4%	71	479 m²	799.55 m³
Offices: 5			1541 m²	22%	367	1694 m²	4,491.27 m³
Parking							
Square	1	Parking	342 m²	5%	74	224 m²	1,033.59 m³
Wedge	1	Parking	339 m²	5%	78	235 m²	985.75 m³
Rectangle	1	Parking	638 m²	9%	116	348 m²	1,935.24 m³
Parking: 3			1319 m²	19%	268	807 m²	3,954.57 m³
Residential							
Rectangle	2	Residential	652 m²	9%	116	348 m²	1,974.15 m³
Rectangle	3	Residential	664 m²	9%	116	348 m²	2,011.07 m³
Rectangle	4	Residential	676 m²	9%	116	347 m²	2,046.36 m³
Rectangle	5	Residential	688 m²	10%	115	408 m²	2,058.08 m³
Rectangle	6	Residential	620 m²	9%	101	783 m²	1,176.26 m³
Residential: 5			3300 m²	46%	563	2234 m²	9,265.93 m³
Retail							
Square	2	Retail	347 m²	5%	75	226 m²	1,048.83 m³
Wedge	2	Retail	319 m²	4%	76	229 m²	929.98 m³
Wedge	3	Retail	302 m²	4%	74	224 m²	883.48 m³
Retail: 3			968 m²	14%	225	678 m²	2,862.29 m³
Grand total			7129 m²	100%	1,423	5413 m²	20,574.06 m³

Related topics

- [Swept Blend](#)

Project Views

This topic describes the new and enhanced features for project views in Revit Architecture 2009.

Formatting Currency in a Schedule View

You can format currency fields with the appropriate currency symbol in a schedule. See [Formatting Currency Fields in a Schedule](#) on page 185.

Cutting a Plan View by the Back Clip Plane

You can cut a plan view at the back clip plane. You activate this feature using the Depth Clipping parameter for the plan view. The back clip plane is defined by the View Depth parameter, which is part of the view's View Range properties.

NOTE Plan views include floor plan views, reflected ceiling plan views, detail plan views, and callout plan views.

See [Cutting a Plan View by the Back Clip Plane](#) on page 127.

Cutting an Elevation, Section, or Callout View by the Far Clip Plane

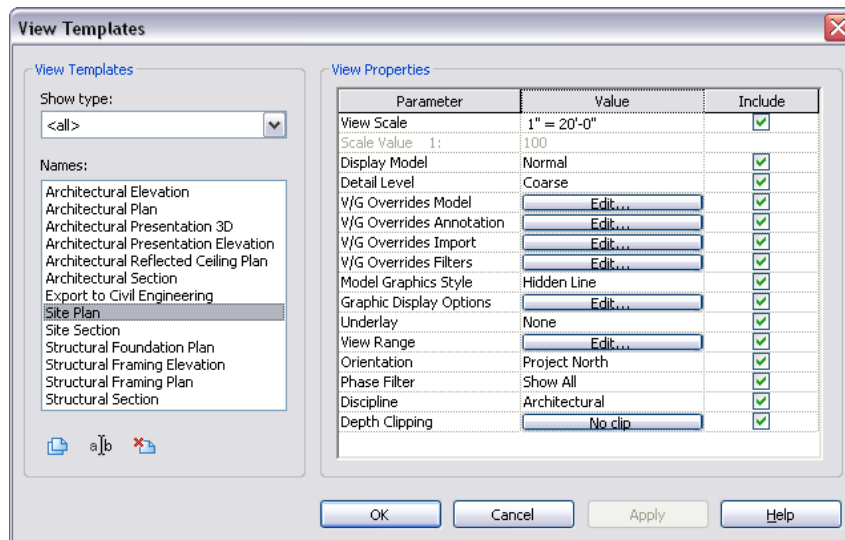
You can cut an elevation, section, or callout view at the far clip plane. See [Cutting an Elevation, Section, or Callout View by the Far Clip Plane](#) on page 133.

Custom View Scale

The view scale is the proportional system used to represent objects in a drawing. You can assign a different scale to each view in a project. In Revit Architecture 2009, you can now create custom view scales. See [View Scale](#) on page 243.

View Template Enhancement

Using the new Include option in the View Templates dialog, you can specify which view properties you want to be included in a view template.



Properties that you exclude from a template do not require a value and are not overridden when you apply a view template. See [View Templates](#) on page 507.

Applying a Color Scheme to a View

In plan views and section views, you can specify whether the color scheme displays in the background or the foreground of the view. This option is a property of the view. (See [Applying a Color Scheme](#) on page 1022.)

Mirroring a Project

Mirroring a project allows you to mirror (reflect the position and shape of) all elements in a project around an axis you select (North - South, East - West, Northeast - Southwest, or Northwest - Southeast). When you mirror a project, all model elements, views, and annotations are mirrored. Orientation of annotations is preserved when necessary; for example text does not mirror to retain readability. See [Mirroring a Project](#) on page 1301.

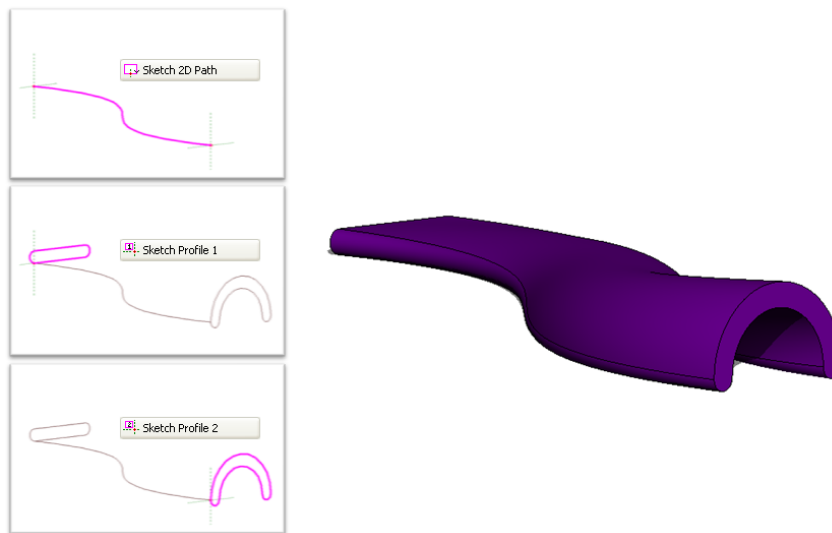
Rotate Project North

You can rotate project north for the entire project. See [Rotating Project North](#) on page 450.

Families

Swept Blend

Modeling complex geometry can be achieved using the Swept Blend tool. The tool allows massing or family geometry to be defined by 2 different profiles placed along a 2D path containing an arc or a spline.



See [Creating a Swept Blend](#) on page 331.

Families Guide

Documentation for family creation has been restructured, revised, and enhanced with more detailed conceptual information and tutorials.

See [The Families Guide](#) on page 418.

Project Phasing

This topic describes the new and enhanced features for project phasing in Revit Architecture 2009.

Graphic Overrides for Phase Statuses

For each phase status, you can now specify new graphic overrides from the Graphic Overrides tab of the Phasing dialog.

- **Cut lines and projection lines:**

You can specify a separate value, or no override, for line patterns, line weights, or line colors.

■ **Cut and surface patterns:**

You can specify a separate value, or no override, for fill patterns or colors, and specify whether a pattern is visible.

■ **Halftone:**

You can specify a halftone for any phase status.

See [Defining the Graphic Display for Phase Statuses](#) on page 1335.

Visibility and Graphics

This topic describes the new and enhanced features for visibility and graphics in Revit Architecture 2009.

Hiding an Element in a Join

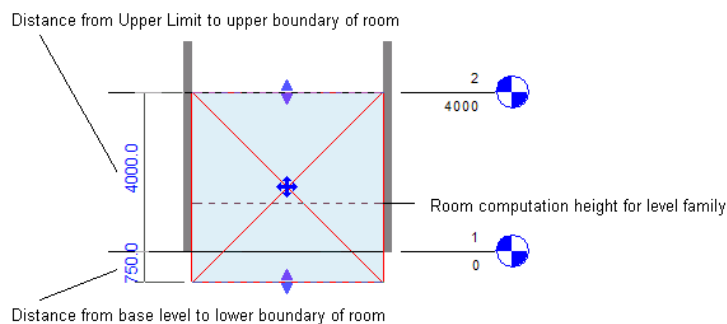
In Revit Architecture 2008, when you hid an element that was joined to another element in a view, the joined-to element that remained visible might look incomplete. For example, when you hid a wall that was joined to another wall in a view, the other wall displayed an edge with some gaps in geometry. In Revit Architecture 2009, such a wall displays an edge with clean geometry.

Rooms and Areas

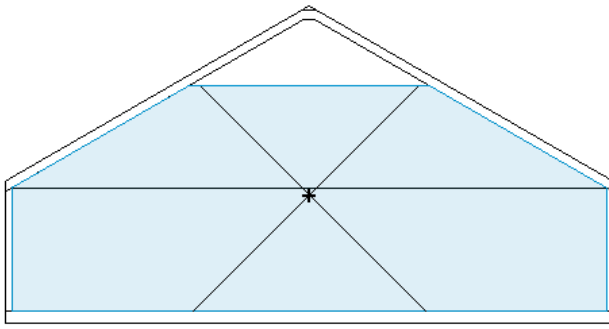
This topic describes new and enhanced features for rooms and areas in Revit Architecture 2009.

Rooms in Section Views

In Revit Architecture 2009, you can select rooms in section view. You can also use grips to adjust the upper and lower boundaries of rooms.



When volume computation is turned on, Revit Architecture shows the actual boundaries used to compute the volume of the room. These boundaries can include sloping elements, such as the walls, ceiling, and roof.



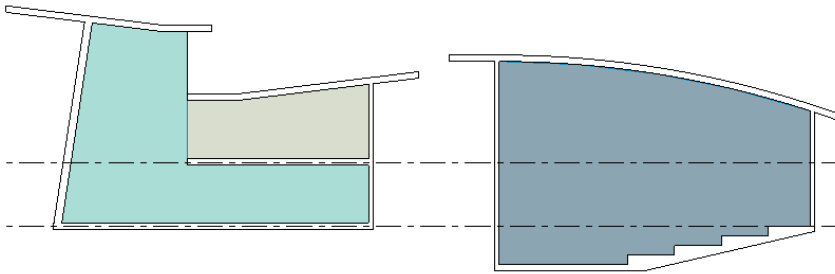
Related topics

- [Rooms in Section Views](#) on page 980
- [Changing the Room Height Graphically](#) on page 995

Room Volume Enhancements

When an existing project is opened in Revit Architecture 2009, it may show different numbers for room volumes. These differences are due to enhancements that provide more accurate room volume calculations. The software is now more flexible in the shapes of rooms for which it can compute volumes, and room volumes are now computed to the wall face.

See [Room Volume](#) on page 991.



Changes to Room Computation Height

The computation height is a defined height above the base level of a room. Revit Architecture measures the perimeter of the room at this height, and uses this information when computing the room area and volume.

In previous releases, the room computation height was a project-wide setting. In Revit Architecture 2009, the computation height is now a parameter of a level family. If needed, you can change this parameter. You can also create multiple level families that use different computation heights. For example, you may want to define one level family for stories and another level family for plenums. See [Computation Height](#) on page 989.

NOTE Changing the computation height can affect the performance of Revit Architecture.

Building Pads Are Room-Bounding

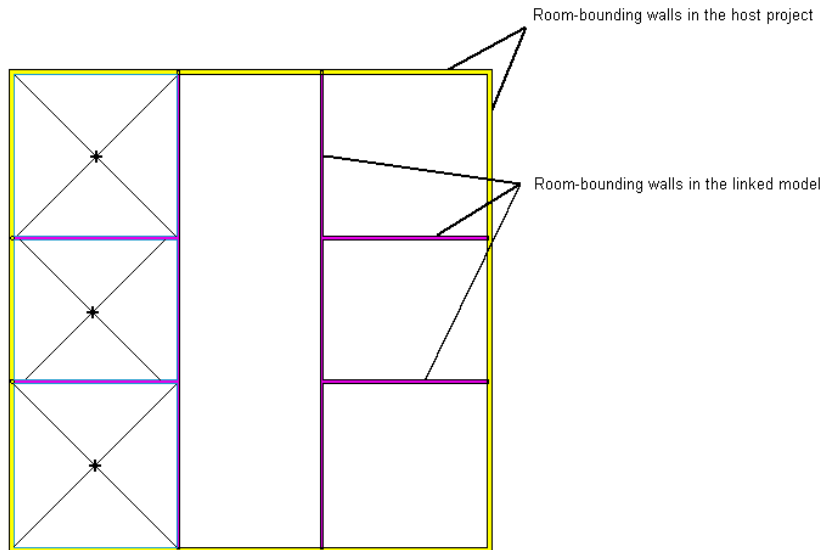
When calculating the area or volume of a room, Revit Architecture now considers a building pad to be a room-bounding element. If desired, you can turn off this element parameter. See [Room-Bounding Elements](#) on page 981.

Room Boundaries in Linked Models

In previous releases, when you linked Revit models together, Revit Architecture did not recognize room-bounding elements in the linked model. As a result, you were not able to place a room between walls (or other elements) in the host project and walls in the linked model.

In Revit Architecture 2009, you can now make the software recognize the room-bounding elements of a linked model. See [Room Boundaries in Linked Models](#) on page 984.

Placing rooms in a host project (building exterior) using walls in a linked model (building interior)



Tag Enhancements for Rooms and Areas

In Revit Architecture 2009, you can do the following:

- Use the Tag All Not Tagged tool to simultaneously tag all rooms or areas that have not yet been tagged.
- Change the orientation of a tag to be horizontal, vertical, or aligned with walls or boundary lines in the building model.
- Rotate the tag using the Rotate tool.

See [Room Tags](#) on page 985 and [Areas and Area Tags](#) on page 1011.

Unplace and Place Rooms and Areas

You can remove (unplace) a room or area from its current location in a building model. The Revit project retains information about the room or area. The room or area information still appears in schedules. You can then place the room or area in another location in the building. You delete a room or area by deleting its row from a schedule.

Related topics

- [Removing Rooms](#) on page 1000
- [Removing Areas](#) on page 1014

Color Fill in Section View

You can now apply color schemes to section views (in addition to plan views). In Revit Architecture, this feature applies to rooms and areas. In Revit MEP, this feature applies to rooms, areas, spaces, and zones. See [Color Schemes](#) on page 1019.



In plan views and section views, you can specify whether the color scheme displays in the background or the foreground of the view. This option is a property of the view. (See [Applying a Color Scheme](#) on page 1022.)



Modelling Enhancements

This topic describes the new and enhanced modelling features for architectural and structural components in Revit Architecture 2009.

Preventing a Join on a Mid-End Wall Face

Now, you can explicitly disallow a join to a mid-end wall using the join icons that appear above the end of the wall.

To explicitly disallow or allow a join on a mid-end wall

- 1 Select the wall.
- 2 Click  (Disallow Join) or  (Allow Join) above the mid-end wall face.

Slope a Building Pad

You can slope building pads using the Slope Arrow command on the Design Bar, if, for example, you want to add drainage for your building. See [Sloping a Building Pad](#) on page 967.

Beam Cutback

The new beam cutback tools apply beam join types and priority. You can use these tools to adjust visible cutback to beams in an end-join relationship.

You can create miter joins for elements of the same type. Using the miter lock tool allows you to keep a physical representation of the miter join in the Medium/Fine levels of detail while changing the symbolic cutback representation in Coarse detail.

See [Cutback](#) on page 865.

Slab Shape Edit

You can modify the split lines that Revit Architecture 2009 creates in the slab when it is warped. See [Shape Editing for Structural Floors, Roofs and Floors](#) on page 944.

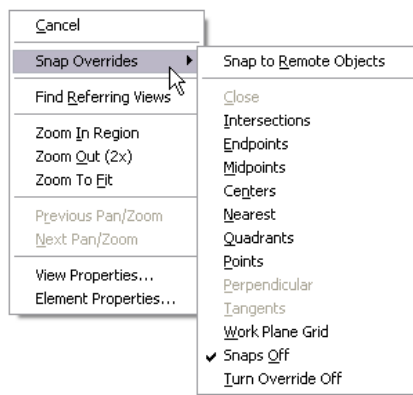
Slabs containing arc segments can be modified with the slab shape editing tools. The curved edge slabs can be set to have either concave or flat surfaces. See [Using the Curved Edge Condition Tool](#) on page 948.

Sketching and Snapping

This topic describes the new and enhanced features for sketching and snapping in Revit Architecture 2009.

Access to Temporary Snap Overrides

You can access temporary snap overrides from the right-click context menu when you place an element or component in the drawing area, or while moving, copying, rotating, or arraying existing elements.



See [Temporarily Overriding Snap Settings](#) on page 504.

Closing an Open Loop

You can use the Close snap to close valid open loops when sketching. If there is more than one option to close the loop, you can move the cursor or press *Tab* to see other snap options. See [Closing an Open Loop](#) on page 315.

Details and Annotations

This topic describes the new and enhanced features for details and annotations in Revit Architecture 2009.

Baseline and Ordinate Dimensions

You can create and place baseline and ordinate linear dimensions in your project. Baseline dimensions are multiple dimensions measured from the same baseline. Ordinate dimensions measure the perpendicular distance from an origin point (called the datum) to an element.

Baseline and ordinate dimensions are exported to CAD formats.

For more information, see [Baseline and Ordinate Dimensions](#) on page 269.

Formatting Permanent and Spot Dimensions

You can add bold, italic, underline, and width formatting to permanent and spot dimensions. Access these formats in the Type Properties dialog for the dimension.

Permanent Dimension Placement Enhancements

You can dimension to the following:

- Intersection points of lines, grids, reference planes, and location lines (for walls).
- The center of arcs, when placing a linear dimension. The center mark of the arc does not need to be visible to dimension to it.

Adding Text to Dimension Values

You can add supplemental text above, below, or to the left or right of a permanent dimension value. You can also replace permanent dimension values with text. See [Overriding Dimension Text](#) on page 273 and [Replacing Permanent Dimension Values with Text](#) on page 274.

Spot Elevation Enhancements

- You can display the top and bottom elevation of elements with a definite thickness. Top and bottom elevations are available for elements in plan views. See [Spot Elevations](#) on page 277.
- You can place spot elevations with a leader, a leader and a shoulder, or without a leader. See [Placing a Spot Elevation Dimension](#) on page 278.
- You can add supplementary text to spot elevations. See [Adding Supplementary Text to Spot Elevation Dimensions](#) on page 279.
- The Rotate with Component type property is now available for spot elevations. This allows spot elevations to maintain their location relative to the referenced element when the element is rotated. You can specify this type property in the Element Properties dialog for the spot elevation.

Spot Coordinate Enhancements

- You can display the elevation of the selected point with spot coordinates. See [Spot Coordinates](#) on page 280.
- You can add supplementary text to spot coordinates. See [Adding Supplementary Text to Spot Coordinate Dimensions](#) on page 281.
- The Rotate with Component type property is now available for spot coordinates. This allows spot coordinates to maintain their location relative to the referenced element when the element is rotated. You can specify this type property in the Element Properties dialog for the spot coordinate.

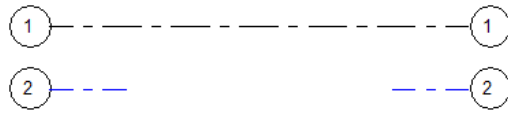
Grid Bubble Enhancements

- You can control whether grid bubbles display at either end of a grid line. You can do this graphically for individual grid lines in a view, or for all grid lines of a particular type by changing type properties.
- In the grid type properties, you can specify default locations of grid bubbles for horizontal grid lines in plan views and vertical grid lines in elevation views.

See [Showing and Hiding Grid Bubbles](#) on page 1095.

Creating Grid Gaps and Grid Segments

- When defining a grid type, you can specify that grid lines display a center segment or a gap. You can specify the default length of end segments. For a center segment, you can specify a different line color, weight, and style. See [Customizing Grid Lines](#) on page 1097.



- You can adjust the length of the gap or center segment in an individual grid line. For example, you may want to adjust the gap so the grid line does not display through the middle of a model element. See [Adjusting the Center Segment of a Grid Line](#) on page 1096.

Tag Label Enhancements

A new Edit Label dialog replaces the Select Parameter dialog in the Annotation Family Editor. You use this new dialog to create multi-parameter concatenated labels.

See [Tagging with Shared Parameters](#) on page 455.

Beam Tags and Spot Elevations

You can place structural framing tags and spot elevations anywhere above or below a beam using new tools that specify the location and offsets of the label. You can place tags individually or on all beams currently in view. See [Beam Annotations Tool](#) on page 853.

You can set tags and spot elevations to rotate in reference to a beam's location and rotation. This allows the placement of a tag that moves and repositions with the beam. See [Structural Framing Tag Families](#) on page 853.

Text Note Styles

You can now create or modify text note styles using Settings ► Annotations ► Text. See [Specifying Text Note Styles](#) on page 500.

Editing Elements

This topic describes the new and enhanced features for editing elements in Revit Architecture 2009.

Linework Enhancements

You can use the Linework tool to change the line style for selected edges of model elements in a view, including the following:

- Projection edges of model elements
- Cut edges of model elements
- Edges in imported CAD files
- Edges in linked Revit models

See [Changing the Line Style of Elements](#) on page 398.

Revisions and Sheets

This topic describes the new and enhanced features for revisions in Revit Architecture 2009.

Rotating a View on a Sheet

After placing a view (a drawing or a schedule) on a sheet, you can rotate it 90 degrees in either direction. See [Rotating a View on a Sheet](#) on page 1040.

Rotating a Revision Schedule

You can rotate a revision schedule 90 degrees clockwise or counterclockwise on a title block. See [Rotating a Revision Schedule](#) on page 1051.

Revisions			Revisions	Description
ID	Date	Description		
1	9.14	Wall Type Change	1	9.14 Wall Type Change
2	9.24	Accessible Modifications	2	9.24 Accessible Modifications
3	10.15	Owner Request	3	10.15 Owner Request
4	11.02	Add Vision Lites	4	11.02 Add Vision Lites

Defining the Height of a Revision Schedule

You can limit the size of a revision schedule on a title block. See [Defining the Height of the Revision Schedule](#) on page 1052.

Building Revision Schedules from the Top Down or Bottom Up

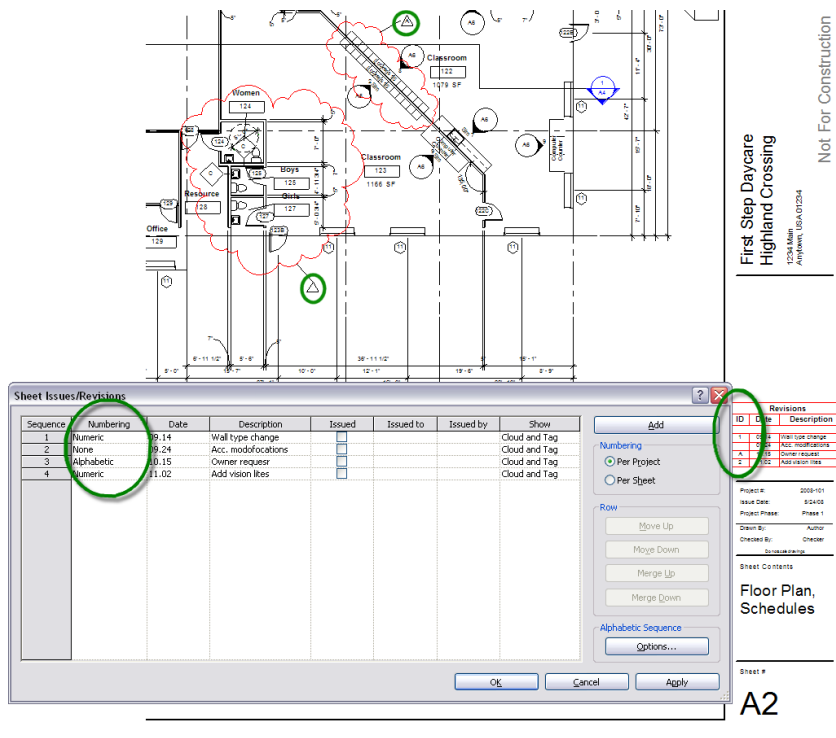
Revision schedules can display information in various ways. Some design firms use a top-down approach, with column headings and revision rows starting at the top of the schedule. Other design firms use a bottom-up approach, with column headings and revision rows starting at the bottom of the schedule. A new feature allows you to specify how Revit Architecture builds revision schedules. See [Building a Revision Schedule from the Top Down or Bottom Up](#) on page 1053.

Revisions			4	11.02	Add Vision Lites
ID	Date	Description	3	10.15	Owner Request
1	9.14	Wall Type Change	2	9.24	Accessible Modifications
2	9.24	Accessible Modifications	1	9.14	Wall Type Change
3	10.15	Owner Request			
4	11.02	Add Vision Lites	ID	Date	Description

Revisions		
ID	Date	Description

Numbering for Revisions

Previous versions of Revit Architecture used numeric numbering for revisions. In Revit Architecture 2009, you can specify numeric numbering, alphabetic numbering, or no numbering for each revision. For alphabetic numbering, you can specify the characters to use in the sequence.

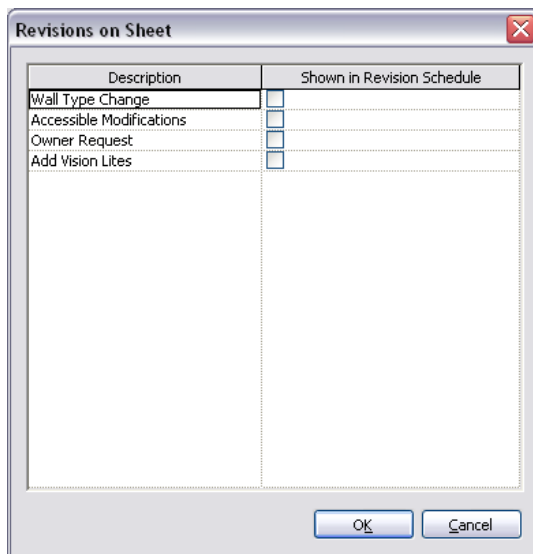


Related topics

- [Numbering for Revisions](#) on page 1073
- [Assigning a Numbering Scheme to a Revision](#) on page 1074
- [Defining an Alphabetic Sequence for Revisions](#) on page 1074

Revisions Listed in the Revision Schedule

On sheets, the revision schedule includes information about revisions that are identified by revision clouds and tags. In this release, you can specify that the revision schedule is to include revision information that is not represented by revision clouds and tags in the sheet's views. See [Specifying the Revisions to Include in a Revision Schedule](#) on page 1079.



Printing

This topic describes the new and enhanced features for printing in Revit Architecture 2009.

Batch Printing

You can use Batch Print for Revit 2009 to print many drawings at one time unattended. See [Batch Printing](#) on page 1086.

Linked Models

This topic describes the new and enhanced features for linked models in Revit Architecture 2009.

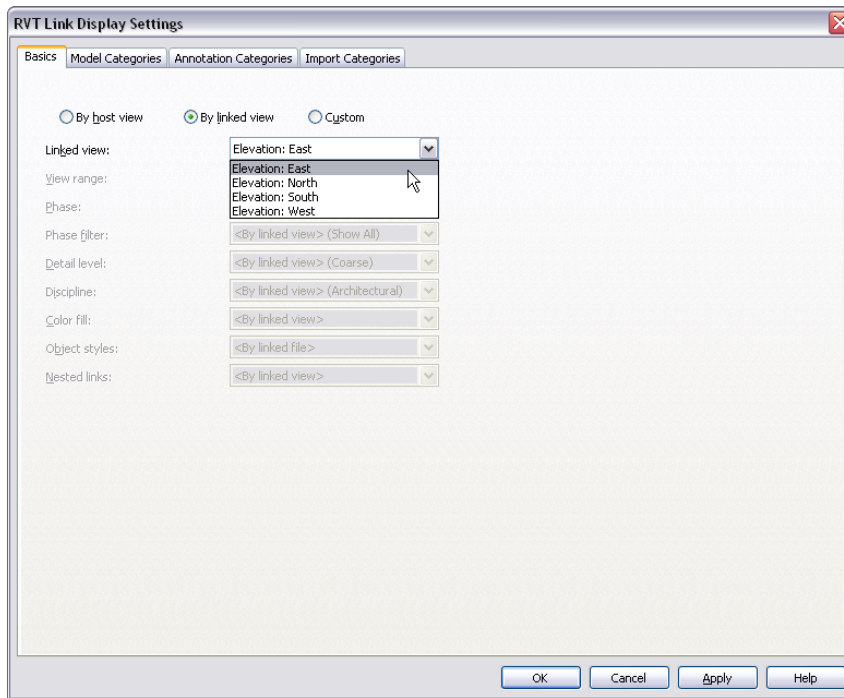
Phase Mapping

You can set up a correspondence between phases in the host Revit model and phases in the linked Revit model. To do this you set up the phase map in the properties of the linked file, and then apply the phase map in the host model. See [Phase Mapping Linked Revit Models](#) on page 1280.

Visibility and Graphic View Settings

You can control visibility and graphic view settings (such as filters, workset visibility, and display of annotations) for section, elevation, and 3D views in linked models.

When you select By Linked View or Custom on the RVT Link Display Settings tab of the Visibility/Graphics dialog, you can select any elevation, section, or 3D views that are available in the linked model.



See [Visibility for Linked Revit Models](#) on page 1282.

Related topic:

[Editing Elements](#) on page 77

Interoperability

This topic describes the new and enhanced features for interoperability in Revit Architecture 2009.

IFC Export Options

The default file format for IFC export is now IFC 2x3 (previously it was IFC 2x2).

You also have the following export options for all IFC file formats:

- **Current view only:** This option allows you to export elements that are visible in the current view. Visible elements include those that are hidden by hidden line or shaded mode, any underlays in the view, and elements that are cropped from view by the crop region. Elements temporarily hidden using temporary hide/isolate will not be exported. Categories marked as Not Exported in the IFC Export Classes dialog will not be exported.
- **Split wall and columns by level:** This option allows you to divide multi-level walls and columns by level.

See [Exporting a Project to IFC](#) on page 1369.

DWFX

The meaning of the term DWF has expanded to include DWFX. DWFX is based on the XML Paper Specification (XPS) from Microsoft, making it easier to share design data with reviewers who do not have Design Review installed. DWF and DWFX files contain the same data (2D and 3D); the only difference is the file format.

DWFX files can be opened and printed using the free Microsoft XPS Viewer, which comes pre-installed on computers using the Microsoft Windows Vista™ operating system. (For the Windows XP operating system, the Microsoft XPS Viewer can be downloaded directly from Microsoft.) Unlike DWF files, DWFX files include

additional information to display design data in the Microsoft XPS Viewer. As such, DWFX files are larger than corresponding DWF files.

See [Exporting to Design Web Format](#) on page 1355.

Related topics

- [Enhancements for Export to 3ds Max](#) on page 57

Worksharing

This topic describes the new and enhanced features for worksharing in Revit Architecture 2009.

Worksharing Monitor

The Worksharing Monitor is a utility that allows you to find out information about a workshared project:

- Who is currently working on this project?
- Is my local copy of the project up to date?
- When will my Save to Central operation finish?
- Has my request to borrow elements been granted?
- Are any issues interfering with my work on a Revit Architecture project?

The Worksharing Monitor is available to Revit Architecture subscription customers. See [Worksharing Monitor](#) on page 1274.

API

Revit Architecture provides an Application Programming Interface (API) that allows you to extend the functionality of the product. Starting with Revit Architecture 2009, you can use the API to define macros that can be saved with the application or project. For example, you might define a macro to add a grid to your project, to rotate a selected object, or to collect information about the square footage of all the rooms in your structure. Other general examples include:

- Locating and extracting Revit content to external files
- Changing geometry or parameters
- Creating elements
- Importing/exporting external file formats

Macro support is provided by the Revit VSTA plug-in, which you can install in conjunction with your existing Revit installation. For details and example code, see [Creating Macros with Revit VSTA](#) on page 1421.

Documentation

The documentation for Revit Architecture 2009 has been restructured and revised to improve usability. In addition, images have been added to illustrate and clarify important concepts. Look for further improvements to the documentation in future releases.

Families Guide

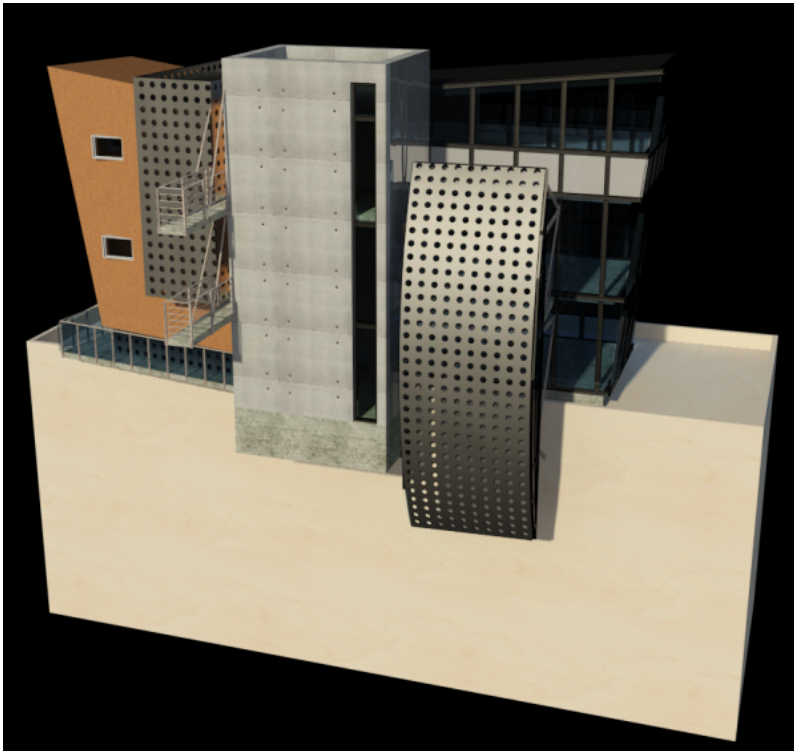
Documentation for family creation has been restructured, revised, and enhanced with more detailed conceptual information and tutorials.

See [The Families Guide](#) on page 418.

Revit Essentials

4

The following topics provide information on what you need to start a project in Revit Architecture.



Using the Revit Interface

Revit Architecture is a powerful CAD product for the Microsoft® Windows operating system. Its interface resembles those of other products for Windows, featuring a ribbon that contains the tools used to complete tasks.

In the Revit interface, many of the components (such as walls, windows, and doors) are available at the click of a button. You can drop these components into the drawing and immediately determine whether they meet your design requirements.

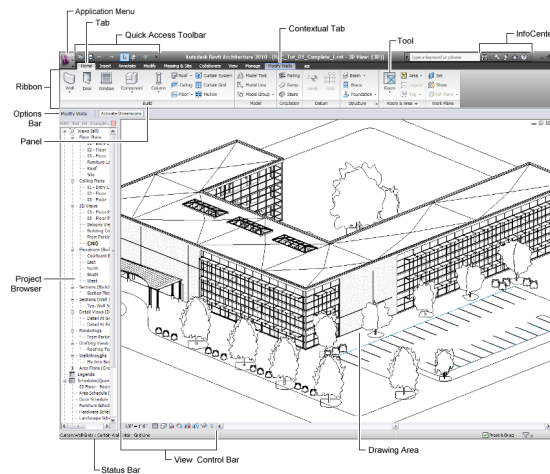
Related topics

- [Learning Tools](#) on page 44

Parts of the Revit Interface

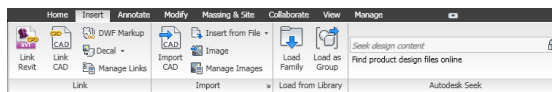
The Revit Architecture interface is designed to simplify your workflow. With a few clicks, you can change the interface to better support the way that you work. For example, you can set the ribbon to one of 3 display settings. You can also display several project views at one time, or layer the views to see only the one on top.

IMPORTANT If this topic displays when you are trying to access context-sensitive help, you need to turn on tooltips or wait for the tooltip to display before pressing F1. See [Tooltips](#) on page 92.



Ribbon Overview

The ribbon displays automatically when you create or open a file. It provides all the tools necessary to create a project. The ribbon can be customized by changing its view state and by rearranging the panels that contain the tools.



The ribbon has 3 types of buttons:

- button: invokes a tool
- drop-down button: contains a drop-down arrow that displays additional, related tools
- split button: invokes a frequently used tool, or displays a menu that contains additional, related tools


TIP When you see a button that shows a line dividing it into 2 areas, you can click the top (or left) side to access the tool you typically use most often. Click the other side for a list of related tools.

To move panels

- Click a panel label and drag the panel to a desired place on the ribbon.

- Click a panel label and drag the panel off the ribbon to the drawing area or the desktop. To return the panel to the ribbon, mouse over the panel to display a control in the upper-right corner, and click Return Panels to Ribbon.

To change the ribbon view state

- Click  (Show Full Ribbon) to the right of the ribbon tabs.

The ribbon view state cycles through the following options:

- **Show Full Ribbon:** Shows entire ribbon.
- **Minimize to Panel Tiles:** Shows tab and panel labels.
- **Minimize to Tabs:** Shows tab labels.

Ribbon Tabs and Panels

The ribbon is comprised of tabs and panels.


The following table describes the ribbon tabs and the types of tasks they contain.

Ribbon Tab	Includes tasks for...
Home	many of the tools you need to create the building model.
Create (family files only)	many of the tools you need to create a family.
Insert	tools to add and manage secondary items such as raster images, and CAD files.
Annotate	tools used for adding 2D information to a design.
Modify	tools used for editing existing elements, data and systems. When working on the Modify tab, select the tool first, then select what you want to modify.
Massing & Site	tools for modeling and modifying conceptual mass families and site elements
Collaborate	tools for collaboration with internal and external project team members.
View	tools used for managing and modifying the current view, and for switching views.
Manage	project and system parameters, and settings.
Add-Ins	third-party tools used with Autodesk Revit Architecture 2010. The Add-Ins tab is enabled only when a third-party tool is installed.

Expanded Panels

A drop-down arrow at the bottom of a panel indicates that you can expand the panel to display additional tools and controls. By default, an expanded panel closes automatically when you click another panel. To keep a panel expanded, click the push pin icon in the bottom-left corner of the expanded panel.

Dialog Launcher

Some panels allow you to open a dialog to define settings or complete a task. A dialog-launcher arrow  on the bottom of a panel opens a dialog.

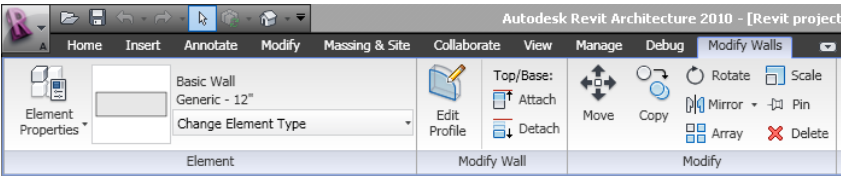
Contextual Ribbon Tabs

When you use certain tools or select elements, a contextual ribbon tab displays that contains a set of tools that relate only to the context of that tool or element.

For example, when you click the Wall tool, the Place Wall contextual tab displays, showing 3 panels:

- **Select:** contains the Modify tool.
- **Element:** contains Element Properties and the Type Selector.
- **Draw:** contains the drawing tools necessary for the wall sketch.

A contextual ribbon tab closes when you exit the tool.




To reset the ribbon and Quick Access toolbar

- delete the UIState.dat file located in the Autodesk Revit Architecture 2010 folder under one of the following folders:
 - For Windows XP:
%USERPROFILE%\Local Settings\Application Data\Autodesk\Revit
 - For Windows Vista:
%LOCALAPPDATA%\Autodesk\Revit

Application Frame Overview

The application frame contains tools and provides feedback to help you manage your Revit projects.

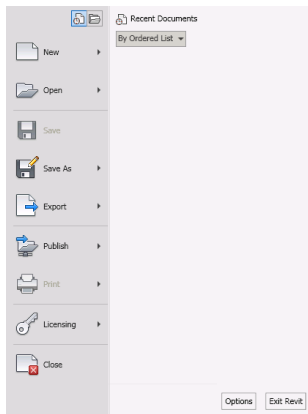
The application frame consists of the following areas:

Application Window Tool	Description
Application button 	Opens (single-click) or closes (double-click) the application menu.
Application menu	Provides access to common tools. (See Access Common Tools on page 89.)

Application Window Tool	Description
Quick Access toolbar	Displays frequently used tools. (See Using the Quick Access Toolbar on page 91.)
InfoCenter	Provides requested information. (See InfoCenter on page 100.)
Status bar	Displays information related to the current state of a Revit operation. (See Status Bar on page 99.)

The Application Menu

The application menu provides access to many common file actions. It also allows you to manage your files using more advanced tools, such as Export and Publish.



NOTE Revit Architecture settings can be updated in Options on the application menu. See [Setting Options](#) on page 516.






Access Common Tools

Access common tools to start or publish a file in the application menu.

Click  to quickly access the following actions:

- Create a file
- Open an existing file
- Save a file
- Print a file
- Publish a file

- Close the application

Click the left side of...	to open the...
 (New)	New dialog
 (Open)	Open dialog
 (Print)	Print dialog
 (Publish)	DWF Publish Settings dialog
 (Licensing)	Product and License Information dialog

Recent Documents

Files display in the Recent Documents list with the most recently used file at the top by default.

Pinned Files

You can keep a file listed regardless of files that you save later using the push pin button to the right. The file is displayed at the bottom of the list until you turn off the push pin button.

Sort and Group Options

Use the drop-down list at the top of the Recent Documents list to sort or group files by

- File name
- File size
- File type
- Date the files were last modified

Currently Open Documents

Files display in the Open Documents list with the most recently opened file at the top. To make a file current, click the file in the list.

Quick Access Toolbar

View Undo and Redo History

The Quick Access toolbar displays options to undo and redo changes to your file. To undo or redo a less recent change, click the drop-down button to the right of the Undo and Redo buttons.









Add Commands and Controls

Add unlimited tools to the Quick Access toolbar. Tools that extend past the maximum length of the toolbar are displayed in a flyout button.

To add a ribbon button to the Quick Access toolbar, right-click the button on the ribbon and click Add to Quick Access toolbar. Buttons are added to the right of the default commands on the Quick Access toolbar.

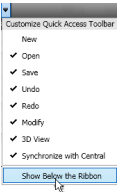
Using the Quick Access Toolbar

The Quick Access toolbar contains the following items by default:

Quick Access Toolbar Item	Description
 (Open)	Opens a project, family, annotation, building component, or IFC file.
 (Save)	Saves a current project, family, annotation, or template file.
 (Undo)	Cancels the last action by default. Displays list of all actions taken during the session.
 (Redo)	Reinstates the last cancelled action. Also displays a list of all reinstated actions performed during the session.
 (Modify)	Completes an action, or prepares the software to select an element to modify.
 (3D View)	Opens or creates views including Default 3D, Camera, and Walkthrough.
 (Synchronize and Modify Settings)	Synchronizes a local file with one on the central server.
 (Customize Quick Access Toolbar)	Customizes the items displayed on the Quick Access toolbar. To enable or disable an item, click next to it on the Customize Quick Access Toolbar drop-down. NOTE The New button displays on the Customize Quick Access Toolbar drop-down, but is not enabled by default.

To undo or redo a series of actions, click the drop-down list to the right of the Undo or Redo buttons. This list displays the action history in a list. Starting with the most recent action, you can select any number of previous actions to include in the Undo or Redo operation.

The Quick Access toolbar can display below the ribbon. To change the setting, on the Quick Access toolbar, click Customize Quick Access Toolbar drop-down ► Show Below the Ribbon.



While in an edit mode (such as Place Wall) or the Family Editor, items that are added to the Quick Access toolbar from the Create, Modify, Group, Clipboard, or View Graphics panel persist on the toolbar for that

mode. However, when you switch to another editing mode, these items do not display and need to be re-added to the Quick Access toolbar. See [Using the Quick Access Toolbar](#) on page 91.

NOTE Some tools on contextual tabs cannot be added to the Quick Access toolbar.

Tooltips

When you hold the cursor over a tool on the ribbon, by default Revit Architecture displays a tooltip. The tooltip provides a brief description of the tool. If you leave the cursor over the ribbon tool for another moment, additional information displays, if available. While the tooltip is visible, you can press F1 for context-sensitive help that provides more information about that tool.

NOTE If you press F1 before the tooltip displays, the default help topic opens instead of the appropriate context-sensitive help topic. Wait for the tooltip to display before pressing F1.

These tooltips are useful when you are first learning how to use the software. You can adjust the amount of information displayed in tooltips or how quickly the information displays. You can also turn off the tooltips when you no longer need them.

To adjust or turn off tooltips

1 Click  ► Options.

2 On the General tab, under Notifications, for Tooltip assistance, select one of the following values:

Value	Description
Minimal	Displays only the brief description provided by tooltips, suppressing the display of additional information.
Normal	Displays a brief description when you move the cursor over a tool, followed by more information if you leave the cursor in place for another moment. This is the default.
High	Displays the brief description and more information about the tool (if available) at the same time, without a delay.
None	Turns off tooltips so they no longer display.

NOTE When you turn off tooltips, context-sensitive help (F1) is also turned off. If you want context-sensitive help to be available, set Tooltip assistance to Minimal.

3 Click OK.

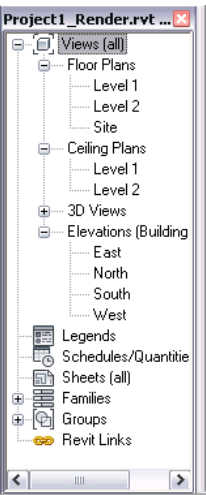
Keytips

Press the Alt key to display shortcut keys for common tools in the application window.

When you select a keytip, more keytips are displayed for that tool.

Project Browser

The Project Browser shows a logical hierarchy for all views, schedules, sheets, families, groups, linked Revit models, and other parts of the current project. As you expand and collapse each branch, lower-level items display.



To change the size and location of the Project Browser

- To show the Project Browser, click View tab ► User Interface panel, and select the Project Browser check box.
- To hide the Project Browser, click View tab ► User Interface panel, and clear Project Browser, or click the Close button (the red X) at the top of the browser.
- To resize the Project Browser, drag one of its borders.
- To move the Project Browser, drag the browser’s title bar within the Revit window. As you move the cursor, an outline indicates where the browser will move to, and what its shape will be. Release the mouse button to place the browser in the desired location. You can also drag the Project Browser outside the Revit window to the desktop.
- To float the Project Browser in the drawing area, double-click its title bar. You can then move the browser to the desired location, and drag its borders to resize it.

You can customize the organization of project views in the Project Browser. See [Customizing Project View Organization in the Project Browser](#) on page 255.

Changes to the size and location of the Project Browser are saved and restored when the application is restarted.

Using the Project Browser

The Project Browser is a powerful way to navigate and manage complex projects.

Views, Schedules, Sheets

If you want to...	then...
open a view	double-click the name of the view, or right-click the name and click Open from the shortcut menu. The active view name displays in bold.

If you want to...	then...
add a view to a sheet	drag the view name onto the sheet name or onto the sheet in the drawing area. You can also right-click the sheet name, and click Add View on the shortcut menu. In the Views dialog, select the view to add, and click Add View to Sheet. After you perform one of these actions, the sheet is active in the drawing area, and the added view displays as a viewport. As you move the cursor, the viewport moves with it. When the viewport is in the desired location on the sheet, click to place it. See Adding Views to a Sheet on page 1033.
remove a view from a sheet	under the sheet name, right-click the view name, and click Remove From Sheet.
create a new sheet	right-click the Sheets branch, and click New Sheet. See Adding a Sheet on page 1032.
copy a view	right-click the view name, and click Duplicate View ► Duplicate.
copy a view with view-specific elements	right-click the view name, and click Duplicate View ► Duplicate with Detailing. View-specific elements (such as detail components and dimensions) are copied into the view. This tool is available for plan views, callout views, drafting views, and section views. You cannot copy callouts from plan views.
rename views, schedules	right-click the view name, and click Rename. In the Rename View dialog, enter a new name, and click OK.
rename a sheet	right-click the sheet name, and click Rename. In the Sheet Title dialog, enter a name and number for the sheet, and click OK.
close a view	right-click the view name, and click Close.
delete a view	right-click the view name and click Delete.
change properties	right-click the view name and click Properties, or open the view, click in the drawing area, and click View tab ► Graphics panel ► View Properties.
expand or collapse branches in the Project Browser	click + to expand, or click – to collapse. Use the arrow keys to navigate between branches.
find referring views	right-click the view name, and click Find Referring Views. See Finding Referring Views on page 255.

Families

If you want to...	then...
create a new family type	right-click the family name, and click Duplicate. A new type name displays in the type list. The new type name uses the family name and is designated by a numeral. As you add more types, Revit Architecture continues using this naming scheme: for example, right-click a family name called Desk and click Duplicate; the family name Desk1 displays. If you repeat the process, the names display as follows: Desk2, Desk3,


If you want to...	then...
	Desk4, and so on. You can then double-click a new type and set properties for it in the Type Properties dialog. See Revit Families on page 415.
rename a family	right-click the family name, and click Rename. Enter a new name. (You cannot rename a system family.)
create a new family instance in a view	right-click the family name, and click Create Instance. This tool activates the appropriate tool and selects the appropriate type to create the selected family in the drawing area.
reload a family	right-click a loaded family, and click Reload. In the Open dialog, navigate to the family location, select it, and click Open. See Loading and Saving Families on page 427.
edit a family	right-click a loaded family, and click Edit. You can edit and reload the family directly into the project. See Modifying Families in a Project (or Nested Family) on page 430.
delete a family	<p>right-click the family name and click Delete, or click the family name and press <i>Delete</i>. If the project includes instances of that family, a dialog displays asking if you want to unload the family and delete all instances of it in your project. Click Yes to delete the family, or click No to cancel.</p> <p>NOTE This tool is not enabled for wall types.</p>
duplicate/modify family types	<p>right-click the family type, and select one of the following tools:</p> <ul style="list-style-type: none"> ■ Duplicate: Copies the selected family and assigns a numeral to the copy. ■ Delete: Deletes the type. (This tool is not enabled for wall types.) ■ Rename: Renames the type. ■ Select All Instances: Selects all instances of a type or group in the project. ■ Properties: Changes type properties.
modify type properties	double-click the type name under a family. For example, under the Walls family, double-click Exterior - Brick on CMU. The

If you want to...	then...
	Type Properties dialog opens, and you can edit values.
delete a family type	<p>do any one of the following:</p> <ul style="list-style-type: none"> ■ Select the family type name in the Project Browser, and press <i>Delete</i>. ■ Right-click the family type name, and click Delete. <p>This function deletes family types that you may have created and families loaded into the project.</p>
drag and drop family types into a project	select the family type, and drag it into the appropriate view. You can drag families created from loadable families and system families.
Groups	
If you want to...	then...
place a group instance in a view	under Groups, navigate to the desired group, then drag the group into the drawing area. See Placing Groups on page 358.
modify group types	<p>right-click the group type, and select one of the following tools:</p> <ul style="list-style-type: none"> ■ Delete: Deletes the group type. ■ Rename: Renames the group type. ■ Select All Instances: Selects all instances of a group type in the project. ■ Properties: Changes type properties.
duplicate a group type	under Groups, navigate to the desired group, right-click the group name, and click Duplicate. The new group type displays in the Project Browser. See Duplicating Group Types on page 357.
reload a group	under Groups, navigate to the desired group, right-click the group name, and click Reload. See Loading Groups on page 358.

Revit Links

If you want to...	then...
create a new link to a Revit model	right-click the Revit Links branch, and click New Link. See Linking Revit Models on page 1277.
manage links to Revit models	right-click the Revit Links branch, click Manage Links, and click the Revit tab. See Managing Links on page 1286.
copy a linked Revit model to another project file	under Revit Links, navigate to the linked model to copy, right-click the link name, and click Create Instance. Click in the drawing area to place the new instance of the linked model. See Copying Linked Revit Models on page 1281.
unload or reload a linked Revit model	under Revit Links, navigate to the linked model, right-click the link name, and click the desired tool to unload or reload the model. See Managing Links on page 1286.

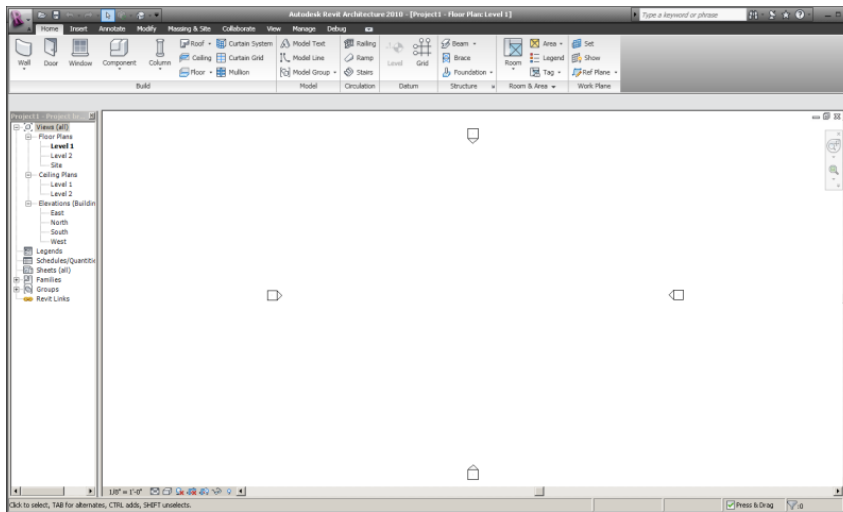
Renderings

If you want to...	then...
view rendered images	click  (Show Rendering Dialog) on the View Control Bar, then select Render on the Rendering dialog.
place rendered images onto sheets	drag the rendered image name onto the sheet in the drawing area.

Drawing Area

The drawing area of the Revit window displays views (and sheets and schedules) of the current project. Each time you open a view in a project, by default the view displays in the drawing area on top of other open views. The other views are still open, but they are underneath the current view. Use tools of the View tab ► Windows panel to arrange project views to suit your work style.


The default color of the drawing area background is white; you can invert the color to black. (See instructions below.)



To manage views in the drawing area

- To display a project view that has not yet been opened, navigate to the view in the Project Browser, and double-click the view name.
- To see a list of open views, click View tab ► Windows panel ► Switch Windows drop-down. The bottom of the menu lists the open views. A check mark indicates the view that currently has focus in the drawing area.
- To display another open (but hidden) view in the drawing area, click View tab ► Windows panel ► Switch Windows drop-down, and click the view to display.
- To open a second window for the current view, click View tab ► Windows panel ► Replicate. This tool is useful if you want to pan and zoom on certain areas of the design, while also viewing the entire design in another window. (Use the Tile tool to see both views at the same time.) Any changes that you make to the project in the new window also appear in other windows of the project.
- To arrange all open windows in a series in the drawing area, click View tab ► Windows panel ► Cascade.
- To see all open views at the same time, click View tab ► Windows panel ► Tile.
- To close all hidden views, click View tab ► Windows panel ► Close Hidden Windows. If more than one project is open, one window per project remains open.
- To increase the size of the drawing area, click View tab ► Windows panel ► User Interface drop-down, and clear check boxes to hide interface components, such as the Project Browser and the status bar.

To invert the background color of the drawing area:

- 1 Click  ► Options.
- 2 In the Options dialog, click the Graphics tab.
- 3 Select or clear the Invert background color option.
- 4 Click OK.

Status Bar

The status bar is located along the bottom of the Revit Architecture window. When you are using a tool, the left side of the status bar provides tips or hints on what to do. When you are highlighting an element or component, the status bar displays the name of the family and type.



The progress bar appears on the left side of the status bar when a large file is opening and indicates how much of the file has downloaded.



Several other controls appear on the right side of the status bar:


- **Press & Drag:** Allows you to drag an element without selecting it first.
- **Editable Only:** Filters selections to select only editable, workshared components. See [Filtering Non-Editable Workset Elements from Selection](#) on page 1264.
- **Active Only:** Filters selections to select only active design option components. See [Selecting Elements in Design Options and the Main Model](#) on page 1314.
- **Exclude Options:** Filters selections to exclude components that are part of a design option. See [Selecting Elements in Design Options and the Main Model](#) on page 1314.
- **Filter:** Refines the element categories selected in a view. See [Selecting Elements Using a Filter](#) on page 341.

To hide the status bar, click View tab ► Windows panel ► User Interface drop-down. Clear the Status Bar check box.

Getting Hints About What to Do Next

If you start a tool (such as Rotate) and are not sure what to do next, check the status bar. It often displays tips or hints about what to do next for the current tool. In addition, a tooltip appears next to the cursor, displaying the same information.

To cancel or exit the current tool, do either of the following:

- Press *Esc* twice.
- On the Quick Access toolbar, click  (Modify).

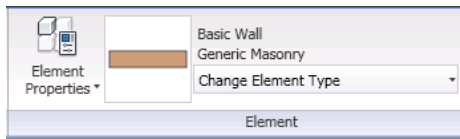
Options Bar

The Options Bar is located below the ribbon. Its contents change depending on the current tool or selected element.

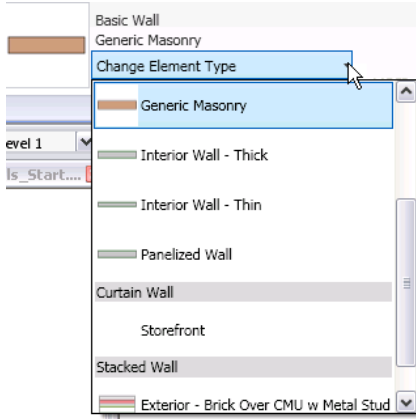


Type Selector

The Type Selector is located on the Element panel for the currently invoked tool, for example, Place Wall. Its contents change depending on the current function or selected elements. When you place an element in a drawing, use the Type Selector to specify the type of element to add.



To change existing elements to a different type, select one or more elements of the same category. Then use the Type Selector to select the desired type.



View Control Bar

The View Control Bar is located at the bottom of the Revit window above the status bar.



It provides quick access to functions that affect the drawing area, including the following:

- Scale (See [View Scale](#) on page 243.)
- Detail Level (See [Detail Level](#) on page 511.)
- Model Graphics Style (See [Model Graphics Styles](#) on page 250.)
- Shadows On/Off (See [Creating a Solar Study](#) on page 1241.)
- Show/Hide Rendering Dialog (Available only when the drawing area displays a 3D view. See [Defining Render Settings](#) on page 1221.)
- Crop Region On/Off (See [Crop Regions](#) on page 211.)
- Show/Hide Crop Region (See [Showing or Hiding Crop Regions](#) on page 212.)
- Temporary Hide/Isolate (See [Temporarily Hiding or Isolating Elements or Element Categories](#) on page 209.)
- Reveal Hidden Elements (See [Revealing and Unhiding Hidden Elements](#) on page 209.)

InfoCenter

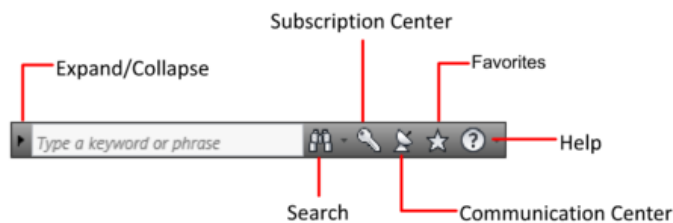
You can use InfoCenter to search a variety of information sources with one query. You can also easily access product updates and announcements.

Overview of InfoCenter

You can use InfoCenter to search for information, display the Subscription Center panel for subscription services, display the Communication Center panel for product updates, and display favorites panel to access saved topics.

You can use InfoCenter to:

- Search for information through keywords (or by entering a phrase)
- Access subscription services through Subscription Center panel
- Access to product-related updates and announcements through Communication Center panel
- Access saved topics through Favorites panel
- Access topics in Help



To display the InfoCenter box in a collapsed state, click the arrow to its left.



To browse search results

- On the panel for Search Results, Subscription Center, Communication Center, or Favorites, on the right side of the category header, do one of the following:
 - Click the Next button.
 - Click the Previous button.

To rearrange the topics displayed on a panel

- 1 Display a panel by doing one of the following:
 - In the InfoCenter box, enter a keyword or phrase. Then press ENTER or click the Search button.
 - In the InfoCenter box, click the Communication Center button.
 - In the InfoCenter box, click the Favorites button.
- 2 Click and drag a category or group header to the desired position.

NOTE You can rearrange categories within a group, but you cannot move them into other groups.

Search For Information

You can enter keywords or a phrase in the InfoCenter box to search for information.



When you enter keywords or a phrase in the InfoCenter box, you search the contents of multiple Help resources as well as any additional documents that have been specified in the InfoCenter Settings dialog box or through the CAD Manager Control Utility.

NOTE You must have Internet access to display search results from the Autodesk Online category.

Keyword searches produce better results. In case of a misspelled word, spelling suggestions are displayed on the panel.

The results are displayed as links on the InfoCenter Search Results panel. Click a link to display the topic, article, or document.

To keep Search Results, Subscription Center, Communication Center, and the Favorites panel expanded, click the push pin icon in the bottom-right corner of the panel.

When you use InfoCenter to search for information, you can use the following special symbols in your query to refine or expand it. These symbols can be used alone or can be combined.

Symbol	Description
*	Replaces one or more characters when used at the beginning, middle, or end of a word. For example, <i>"*lish"</i> , <i>"p*lish"</i> , and <i>"pub*"</i> will find <i>"publish"</i> . Also, <i>"anno*"</i> will find <i>"annotative"</i> , <i>"annotation"</i> , <i>"annoupdate"</i> , <i>"annoreset"</i> , and so on.
?	Replaces a single character. For example, <i>"cop?"</i> will find <i>"copy"</i> , but not <i>"copybase"</i> .
~	Adds grammatical form variations to a keyword when added at the beginning or end of a word. For example, <i>"plotting~"</i> will find <i>"plots"</i> , <i>"plotted"</i> , and so on. Also, <i>"~plot"</i> will find <i>"preplot"</i> , <i>"replot"</i> , and so on.

When performing the exact phrase search, use double quotation marks (" ") to enclose words that must appear next to each other in the specified text string. For example, enter **"specify units of measurement"** to find only topics with all those words in that order. You can also use the previously mentioned symbols in a text string that is enclosed in double quotation marks.

To search multiple sources for information

- 1 In the InfoCenter box, enter a keyword or phrase.
- 2 Click the Search button.

The search results display in the Search Results panel.

To search a single location for information

- 1 In the InfoCenter box, enter a keyword or phrase.
- 2 Click the down arrow next to the Search button.
- 3 Select a location from the list to search.

The search results from that location display in the Search Results panel.

To add a location to search

- 1 In the InfoCenter box, click the down arrow next to the Search button.

- 2 Click Add Search Location.
- 3 In the Add Search Location dialog box, specify a document or a file location to search.
- 4 Click Add.

Receive Product Updates and Announcements

You can click the Communication Center button to display links to information about product updates and announcements, and may include links to RSS feeds.

Overview of Communication Center

To open Communication Center, click the Communication Center button in the InfoCenter box.



Communication Center provides the following types of announcements:

- **Autodesk Channels:** Receive support information, product updates, and other announcements (including articles and tips).
- **CAD Manager Channel.** Receive information (RSS feeds) published by your CAD manager.
- **RSS Feeds.** Receive information from RSS feeds to which you subscribe. RSS feeds generally notify you when new content is posted. You are automatically subscribed to several default RSS feeds when you install the program.

You can customize the items that display in the Communication Center panel.

Communication Center Online Policy

Communication Center is an interactive feature that must be connected to the Internet in order to deliver content and information. Each time Communication Center is connected, it sends your information to Autodesk so that you receive the correct information. All information is sent anonymously to Autodesk to maintain your privacy.

Communication Center sends the following information to Autodesk:

- Product name (in which you are using Communication Center)
- Product release number
- Product language
- Country/region (specified in the Communication Center settings)
- Your unique Customer Involvement Program (CIP) ID if you are participating in the CIP program

Autodesk compiles statistics using the information sent from Communication Center to monitor how it is being used and how it can be improved. Autodesk maintains information provided by or collected from you in accordance with the company's published privacy policy, which is available at <http://www.autodesk.com/privacy>.

Receive New Information Notifications

Whenever new information is available, Communication Center notifies you by displaying a balloon message below the Communication Center button on the InfoCenter box.

Click the link in the balloon message to open the article or announcement.

If you don't want to receive Communication Center notifications, in the InfoCenter Settings dialog box, turn off Balloon Notification.

Save and Access Favorite Topics

You can click the Favorites button to display saved links to topics or web locations.



Any link that displays on the Search Results panel, Subscription Center or Communication Center panel can be marked as a favorite.

A link marked as a favorite displays a star icon on the Search Results panel, Subscription Center panel or the Communication Center panel.

To display the InfoCenter Favorites panel

- In the InfoCenter box, click the Favorites button.

NOTE The links displayed on the Favorites panel are organized into the same groups or categories from which they were added.

To save a link in InfoCenter as a favorite

- 1 Display a panel by doing one of the following:
 - In the InfoCenter box, enter a keyword or phrase. Then press ENTER or click the Search button.
 - In the InfoCenter box, click the Subscription Center button.
 - In the InfoCenter box, click the Communication Center button.
- 2 Click the star icon that is displayed next to the link that you want to save as a favorite.

To remove a favorite link from the InfoCenter Favorites panel

- 1 In the InfoCenter box, click the Favorites button to display the Favorites panel.
- 2 Click the star icon that is displayed next to the link that you want to remove from the Favorites panel.

Specify InfoCenter Settings

You can specify InfoCenter Search and Communication Center settings in the InfoCenter Settings dialog box.

In the InfoCenter Settings dialog box, you can specify the following settings:

- **General.** Your current location, frequency for checking new online content and option to turn on or off animated transition effects for the InfoCenter panels.

- **Search Locations.** Locations (documents, web locations, and files) to search for information, as well as the name that displays for each location and the number of results to display for each. Also, you can add or remove search locations.

The Web Locations check box provides access to important information on the Autodesk website, including the Knowledge Base and discussion groups. When you add document locations, you can specify files on your local drive.

NOTE User-specified CHM (compiled help) files must be located on your local drive. InfoCenter cannot search CHM files located on network drives.

- **Communication Center.** Maximum age of the articles displayed on the Communication Center panel and the location and name of the CAD Manager Channel.
- **Autodesk Channels.** Channels to display in the Communication Center panel as well as the number of articles to display for each channel.
- **Balloon Notification.** Notifications for new product information, software updates, and product support announcements. Also, you can customize the transparency and the display time of the balloon.
- **RSS Feeds.** RSS feed subscriptions. You can add or remove RSS feeds. RSS feeds generally notify you when new content is posted.

You can use the CAD Manager Control Utility to specify InfoCenter Search and Communication Center settings. Click Help in the CAD Manager Control Utility window for details about the CAD Manager Channel settings you can control.

To specify locations to search for information

- 1 In the InfoCenter box, click the down arrow next to the Search button.
- 2 Click Search Settings.
- 3 In the InfoCenter Settings dialog box, Search Locations panel, in the right pane, select or clear the search locations you want to include or exclude when you search for information.
- 4 Click OK.

NOTE With the Search All Available Languages option, you can specify whether to search the default language or all available languages, including English, Japanese, and French. Select the check box if you want to search all available languages.

To add a new location to search for information

- 1 In the InfoCenter box, click the down arrow next to the Search button.
- 2 Click Search Settings.
- 3 In the InfoCenter Settings dialog box, do one of the following:
 - On the Search Locations panel, in the right pane, click Add.
 - On the Search Locations panel, in the right pane, right-click anywhere in the pane. Click Add.
- 4 In the Add Search Location dialog box, specify a file location to search.
- 5 Click Add.

NOTE A warning message is displayed when you add a search location with a file size larger than 5 MB. You cannot continue to work in the application until indexing is complete.

- 6 Click OK.

To remove a search location

- 1 In the InfoCenter box, click the down arrow next to the Search button.
- 2 Click Search Settings.
- 3 In the InfoCenter Settings dialog box, do one of the following:
 - Select a location to remove, and then click Remove.
 - Right-click a search location. Click Remove.
- 4 In the InfoCenter - Remove Search Location dialog box, click Yes.
- 5 Click OK.

To specify the CAD Manager Channel location and name

- 1 Click Start menu (Windows) ► All Programs (or Programs) ► Autodesk ► CAD Manager Tools ► CAD Manager Control Utility.
- 2 Select the product you want to modify. Click OK.
- 3 In the CAD Manager Control Utility window, InfoCenter tab, select the option to enable CAD Manager Channel.
- 4 Under Feed Location, enter an appropriate feed.
- 5 Enter the display name for the CAD Manager and then click Apply. Click OK.
- 6 Restart your Autodesk product.
- 7 In the InfoCenter box, click the down arrow next to the Search button.
- 8 Click Search Settings.
- 9 In the InfoCenter Settings dialog box, in the left pane, click Communication Center.
The CAD Manager Channel location and name are displayed.

NOTE A green check mark is displayed if the channel can be located and a yellow warning sign is displayed if it cannot be located.

To specify the channels to display in the Communication Center panel

- 1 In the InfoCenter box, click the down arrow next to the Search button.
- 2 Click Search Settings.
- 3 In the InfoCenter Settings dialog box, in the left pane, click Autodesk Channels.
- 4 In the right pane, select or clear the channels you want to display in the Communication Center panel.
- 5 Click OK.

To specify InfoCenter balloon notification settings

- 1 In the InfoCenter box, click the down arrow next to the Search button.
- 2 Click Search Settings.
- 3 In the InfoCenter Settings dialog box, in the left pane, click Balloon Notification.

- 4 In the right pane, select or clear the options to turn balloon notification on or off.
- 5 Enter the number of seconds to set the length of time for balloon notifications to display.
- 6 Enter the transparency value of the balloon or set the value using the slider.
- 7 Click OK.

To add an RSS feed to Communication Center

- 1 In the InfoCenter box, click the down arrow next to the Search button.
- 2 Click Search Settings.
- 3 In the InfoCenter Settings dialog box, in the left pane, click RSS Feeds.
- 4 In the right pane, do one of the following:
 - Click Add.
 - Right-click anywhere in the right pane. Click Add.
- 5 In the Add RSS Feed dialog box, enter the location of the RSS feed you want to add. Click Add.
- 6 In the InfoCenter - RSS Feed Confirmation dialog box, click Close.
- 7 Click OK.

To remove an RSS feed from Communication Center

- 1 In the InfoCenter box, click the down arrow next to the Search button.
- 2 Click Search Settings.
- 3 In the InfoCenter Settings dialog box, in the left pane, click RSS Feeds.
- 4 In the right pane, do one of the following:
 - Click Remove.
 - Right-click an RSS feed. Click Remove.
- 5 In the InfoCenter - Remove RSS Feed dialog box, click Yes.
- 6 Click OK.

Search Topics in Help

You can click the Help button to display topics in Help.



You can get much more benefit from the Help system when you learn how to use it efficiently. You can quickly find general descriptions, procedures, details about dialog boxes and palettes, or definitions of terms.

To display topics in Help


- In the InfoCenter box, click the Help button.

Autodesk® Seek

Use Autodesk Seek to search for and share product design content from AutoCAD® and Revit® products. For information about sharing product design content with Autodesk Seek, see [Publishing to Autodesk® Seek](#) on page 1382.

NOTE Autodesk Seek is currently available only in the English edition of the software.

You can access Autodesk Seek in the following ways:

- Go to the Autodesk Seek home page <http://seek.autodesk.com>.
- Click Insert tab ➤ Autodesk Seek panel to search for content.
- Click  ➤ Publish ➤ Share with Autodesk Seek to share online content.
- Click View tab ➤ Windows panel ➤ User Interface drop-down ➤ Recent Files. In the Recent Files window, click Web Library.

With Autodesk® Seek you can find and share product design information with the online design community to enhance designs and to meet specific customer needs. It allows designers to search for, download, and integrate generic or manufacturer-specific building products or components and associated design information.

When you are working in a design program, you may want to include products that, for example, meet design standards for Leadership in Energy and Environmental Design (LEED) or the Americans with Disabilities Act (ADA). Autodesk Seek can help you locate such information and products, and get them into your design.

- For more information about LEED green building certification, visit the U.S. Green Building Council website: <http://www.usgbc.org>.
- For more information about ADA standards for accessible design, visit U.S. Department of Justice website: <http://www.usdoj.gov/crt/ada/>.

The design and product information available on Autodesk Seek depends on what content providers, both corporate partners and individual contributors, publish to Autodesk Seek. Such content could include 3D models, 2D drawings, specifications, brochures, or descriptions of products or components.

Autodesk has partnered with content aggregators such as BIMWorld™ and the McGraw-Hill Construction Sweets Network®, who maintain relationships with manufacturers, to provide and maintain product and design information within Autodesk Seek.

Autodesk® Seek also contains all files from the content libraries provided with the 2008 and later releases of the following products:

- AutoCAD®
- AutoCAD® Architecture
- AutoCAD® MEP
- Revit® Structure
- Revit® Architecture
- Revit® MEP

Currently, Autodesk Seek is intended primarily for the AEC/building industry. In the future, Autodesk Seek will expand to include product information that is more typically used in other industries.

File Types Supported by Autodesk Seek

The following list includes file types currently supported by Autodesk Seek.

File Type	Description
3DS	3D Studio scene file
DGN	MicroStation drawing file
DOC	Microsoft Word document
DWF	Autodesk's open, secure format for sharing design information
DWG	Industry standard file format for 2D and 3D design data
DXF	Autodesk Drawing Exchange Format — enables data interoperability between AutoCAD and other design programs
IES	Photometric data file
GSM	ArchiCAD Graphic Description Language file
LCF	ArchiCAD library container file
MCD	Mathcad document file
MLIB	Revit material library file
PDF	Adobe portable document format
RFA	Revit family file
RTE	Revit template file
RTF	Rich Text Format file
RVG	Revit External Group file
RVT	Revit project file
SKP	Sketchup Document file
TXT	Text file
XLS	Microsoft Excel spreadsheet
ZIP	Compressed archive file

Searching for Content with Autodesk Seek

You can enhance your designs by acquiring product or design information published by Autodesk, partner content providers, or other designers on Autodesk Seek.

NOTE Autodesk Seek is currently available only in the English edition of the software.

Autodesk® Seek supports parametric searches, meaning that the search results returned are more or less specific depending on what you enter in the search text box. More search terms return fewer results.

Filtering Search Results

After you have searched for product information, you can reduce the number of displayed results by applying filters. On the Autodesk Seek web page, apply filters to narrow the results of a search.

Available filters depend on information supplied by content providers when the design files are added to the Autodesk Seek website.

Filters

- **Product Attributes.** Filter results by attributes common to the returned results. The attribute filters available vary depending upon the type of product searched.
- **Manufacturer.** Filter results by manufacturer. Manufacturer names are displayed in descending order by the number of results associated with each manufacturer. The Generic filter displays results for which no manufacturer information has been supplied.
- **File Type.** Filter results by file type. The file type filter excludes results that do not contain product or design information of the type selected.
- **External Catalogs.** Filter results by supplier catalog, such as BIMWorld.
- **Product Libraries.** Filter results by Autodesk product library, such as Revit Structure.

Downloading Content from Autodesk Seek

After you have located product or design information that you want to add to your design, you need to get it from the Autodesk Seek website and into your drawing.

NOTE The first time you download a file, you must agree to and accept the Autodesk Seek terms and conditions. Accepting the terms installs a cookie on your computer. If you clear your web browser's cookies, you will need to accept the Autodesk Seek terms and conditions the next time you download a file.

To perform a search

- 1 Click Insert tab ► Autodesk Seek panel ► Find product design files online, and enter the desired search term.

NOTE Autodesk Seek searches all available product information by default.

- 2 Press *Enter* or click to search.
The Autodesk website displays the results.

NOTE To return fewer results, enter more terms in the text box. For example, a search for “window” returns more results than a search for “fixed window 3D.”

To accept the Autodesk Seek Terms and Conditions and download a file

- 1 To review the terms and conditions of use, click Terms and Conditions.
The Autodesk Seek Terms of Use are displayed in a browser window. When ready to proceed, close the browser window to return to the Terms and Conditions page.
- 2 Click the I Have Read and Agree to the Terms and Conditions check box.
- 3 Click Accept. The File Download dialog box displays.

- 4 Do one of the following:
 - To display the file in its associated program, click Open.
 - To save the file, click Save. If necessary, specify a new file location and file name.

You can use Autodesk i-drop® to drag and drop content from a website into your drawing session. However, you cannot use i-drop to download ZIP files.

NOTE To enable i-drop you must first download and install it. For more information visit <http://www.autodesk.com/idrop>.

To i-drop a file into your drawing

- 1 On the Autodesk Seek website, move your cursor over an available download displaying the i-drop icon.
- 2 Click and drag the file.
- 3 Drop the file at the desired location in your drawing and, if necessary, reposition it.

Where to extract the contents from a ZIP file

- 1 If a Readme TXT file exists, open it to determine where you should extract each file in the ZIP file.
- 2 Extract the files to the locations specified in the Readme. If the family does not have a Readme, extract the files to the locations specified in the following table.

NOTE These locations are the default Windows XP and Windows Vista® paths that are set during installation. Because these paths can be changed during installation, your paths might be different.




File Type	Location
Family (RFA)	<p>The Revit library, which is installed by default in</p> <ul style="list-style-type: none"> ■ Windows XP: <i>C:\Documents and Settings\All Users\Application Data\Autodesk\<Revit release name>\<Imperial or Metric> Library</i> ■ Windows Vista: <i>C:\Program-Data\Autodesk\<Revit release name>\<Imperial or Metric> Library</i>
Type catalogs (TXT) that manage parameters for families with many type variations	The same folder as the RFA file
NOTE The type catalog must have exactly the same name as its family RFA file. The names are case-sensitive.	
Lookup tables (CSV) that Revit MEP components use to define instance parameters	<ul style="list-style-type: none"> ■ Windows XP: <i>C:\Documents and Settings\All Users\Application Data\Autodesk\<Revit MEP release name>\LookupTables</i> ■ Windows Vista: <i>C:\Program-Data\Autodesk\<Revit MEP release name>\LookupTables</i>

File Type	Location
Image files (BMP, JPG, JPEG, or PNG) used to create a custom color, design, texture, or bump map for a render appearance	<ul style="list-style-type: none"> ■ Windows XP: <i>C:\Program Files\Autodesk\<Revit release name>\Data\Rendering\assetlibrary_base.fbm</i> ■ Windows Vista: <i>C:\Program Files\Autodesk\<Revit release name>\Data\Rendering\assetlibrary_base.fbm</i>
Photometric data files (IES) for use with lighting families	<i>C:\Documents and Settings\All Users\Application Data\Autodesk\<Revit release name>\IES</i>

Opening Revit Files

When you start Revit Architecture, the Recent Files window displays, listing the projects and families that you opened most recently. If you are already working in a Revit session, you can return to the Recent Files window by clicking View tab ► Windows panel ► User Interface drop-down ► Recent Files.


To open a Revit file, use any of the following methods:

- Press **CTRL+O**.
- Click  ► Open.
- Click  ► Open, and select a Revit file type.
- Click  and select a file from the Recent Documents list.
- Click on the Quick Access toolbar.

When you click a file under Projects or Families, Revit Architecture opens the file.

NOTE If you are editing a non-workshared file, other users will have read-only access to the file.

Opening a Revit Project File

- 1 Click  ► Open ► Project.
- 2 In the Open dialog, navigate to the folder where the project file resides. To see only files of a certain type, select that type from the Files of type drop-down list.
- 3 Select the desired options:


If you want to...	Then...
scan, detect and fix corrupt elements in the project	select Audit. This can greatly increase the time required to open files. Use this option only for periodic maintenance of large

If you want to...	Then...
	workshared files or when you are preparing to upgrade.
open a workshared local file separate from the central file	select Detach from Central. See Opening Workshared Files Independent of the Central File on page 1268.
open a local copy of the central file	select Create new local. See Creating a Local Copy of the Central File on page 1258.

4 Select the project file, and click Open.

NOTE If you are editing a non-workshared file, other users will have read-only access to the file.

Opening Families and Training Files

- 1 Click  ► Open ► Family.
- 2 On the left side of the Open dialog, select a family library or the Training Files folder.
- 3 Navigate to the appropriate directory, select the file, and click Open.

To make other directories available from the Open dialog, see [Setting Options](#) on page 516.

NOTE If you are editing a non-workshared file, other users will have read-only access to the file.

Opening Files from the Conceptual Design Environment

The conceptual design environment contains family files and templates that you can download and use in a massing study. See [Template Files for the Conceptual Design Environment](#) on page 532.

To open files from the conceptual design environment

- 1 Click View tab ► Windows panel ► User Interface drop-down ► Recent Files.
- 2 Under Families, click New Conceptual Mass.
The New Concept Mass Model - Select Template File window opens.
- 3 In the browser window, navigate to the desired file, and click Open.

See [Conceptual Design Environment](#) on page 527.

Opening Files from the Web Library

To download family files or templates from the web library for use in a project, do the following:

- 1 Click View tab ► Windows panel ► User Interface drop-down ► Recent Files.
- 2 Under Families, click Web Library.
The web library opens in a browser window.
- 3 In the browser window, navigate to the desired collection, and click the family or template to download.

- 4 In the File Download dialog, click Open to open the item in Revit Architecture, or click Save to save it in a specified folder, from which it can be loaded into a project.
- 5 If you opened a family and want to immediately use it in a project, do the following:
 - a Click Create tab ► Family Editor panel ► Load into Project.
 - b In the Load into Projects dialog, select the open projects to receive the family, and click OK.

You can see the new family in the Project Browser under Families.

Opening Revit Files from Windows Explorer

The following alternative methods open Revit files from Windows Explorer.



- Double-click a project or family file.
- Drag a project file from Windows Explorer into Revit Architecture.
- Drag a family file from Windows Explorer into the Project Browser or drawing area of Revit Architecture to load it into the project.
- Drag a family file from Windows Explorer into anywhere other than the Project Browser or the drawing area (such as the ribbon, Quick Access toolbar, or the title bar) to open the family in the Family Editor.
- Drag multiple files from Windows Explorer into an active session of Revit Architecture. A dialog opens, asking whether you want to open dropped files in separate windows or load dropped families into the current project.


NOTE If you are editing a non-workshared file and another user attempts to open the same file, the user will be given access to the file in a read-only state.

Saving Revit Files

The Save tool saves the active file to its current name and folder.

To save a file, do any of the following:


- Click  ► Save.
- Press *Ctrl+S*.
- On the Quick Access toolbar, click  (Save).

If you want to save the current file to a different file name or location, click  ► Save As.

If you are working in a project that has worksharing enabled and you want to save your changes to the central file, select Collaborate tab ► Central panel ► Synchronize with Central drop-down ► Synchronize Now. See [Synchronizing with the Central File](#) on page 1265.

NOTE The first time that you save across the network in a Revit Architecture session, you may see a dialog that advises you to install current Microsoft® hotfixes. Installing these hotfixes may prevent future loss of data in the Revit project. To obtain the hotfixes, click (Help) drop-down ► Documents on the Web.

Saving a File with a Different Name or Location

- 1 Click  ► Save As.
- 2 Select a Project, Family, Template, or Library file type to save.
- 3 In the Save As dialog, navigate to the desired folder.
- 4 If desired, change the file name.
- 5 To specify save options, click Options, set the options as desired, and click OK.
See [Save Options](#) on page 115.
- 6 Click Save.

Save Options

When using Save As from the application menu, click Options in the Save As dialog, and specify the following in the File Save Options dialog:

- **Maximum backups.** Specifies the maximum number of backup files. By default, non-workshared projects have 3 backups, and workshared projects have up to 20 backups. See [Backup and Journal Files](#) on page 116.
- **Make this a Central File after save:** Sets the current workset-enabled file to be the central file. See [Creating a Central File from an Existing Workshared File](#) on page 1272.
- **Compact File.** Reduces file sizes when saving workset-enabled files. During a normal save, Revit Architecture only writes new and changed elements to the existing files. This can cause files to become large, but it increases the speed of the save operation. The compacting process rewrites the entire file and removes obsolete parts to save space. Because it takes more time than a normal save, use the compact option when the workflow can be interrupted. See [Using Workshared Files](#) on page 1257.
- **Open workset default.** Sets the workset default for the central file when opened locally. From this list, you save a worksharing file to always default to one of the following options: All, Editable, Last Viewed, or Specify. See [Creating a Central File from an Existing Workshared File](#) on page 1272. The only way a user can change this option is to resave a new central file by selecting "Make this a Central File after save" on the File Save Options dialog. The local file can use the Reload Latest tool to update the changed option. To change this setting in an existing central file, resave the file using Save As and adjust the Save Options.
When opened locally, you can override this default setting each time the project is opened. The override only affects that work session, and will revert to defaults the next time the file is opened.
- **Preview.** Specifies the preview image that displays when you open or save a project. The default value for this option is Active View/Sheet. Revit Architecture can create a preview image only from open views. If you select Regenerate if View/Sheet is not up-to-date, Revit Architecture updates the preview image whenever you open or save the project. This option can consume considerable resources on a complex model. Use it only if you want the preview image to update frequently.

Setting Save Reminders

You can specify how often Revit Architecture reminds you to save an open project, or you can turn off the reminder.

To set save reminders

- 1 Click  ► Options.

- 2 In the Options dialog, click the General tab.
- 3 To change how often Revit Architecture reminds you to save an open project, select a time interval for Save Reminder Interval.
- 4 To turn off the save reminder, for Save Reminder Interval, select No Reminders.
- 5 Click OK.

Related topics

- [General Options](#) on page 516
- [Options](#) on page 516

Backup and Journal Files

All backup operations (such as copying, purging, and so on) occur when you save changes to a project. If necessary, you can use backup files to roll back the latest changes to a project, restoring the project to a previously saved state.

NOTE This topic describes backup files for non-workshared projects. For information about backup files for workshared projects, see [Workshared Project Rollback](#) on page 1271.


When you save a non-workshared project, Revit Architecture makes a backup copy of the previous version of the project (that is, the project file before the current save). This backup copy has the name <project_name>.<nnnn>.rvt, where <nnnn> is a 4-digit number indicating how many times the file has been saved. The backup file resides in the same folder as the project file.

You can specify the maximum number of backup files that Revit Architecture saves. (See [Specifying the Number of Backup Files](#) on page 116.) If the number of backup files exceeds the maximum, then Revit Architecture purges the oldest files. For example, if the maximum is 3 backup files, and the project folder contains 5 backup files, then Revit Architecture deletes the oldest 2 backup files.

Specifying the Number of Backup Files

By default, Revit Architecture saves up to 3 backup files for each project. You can change the number of backup files that Revit Architecture saves for a project.

To specify the number of backup files

- 1 Click  ► Save As.
- 2 In the Save As dialog, click Options.
- 3 In the File Save Options dialog, for Maximum backups, specify the number of backup files to save.
- 4 Click OK.
- 5 Click Save.

Backup Files for Network Saves

Suppose you work on a project whose file is stored in a network location, and the project is not workshared. When you save changes to the project, Revit Architecture does the following:

- Saves the current changes to the project file in the network location.

- Makes a backup copy of the saved file, and places it in the Journal folder on the local computer. (See [Journal Files](#) on page 117.)

The local backup file provides protection in case the network save fails. Revit Architecture saves up to 3 local backup files. It purges older backup files.

The local backup file uses the same name as the project file, with a GMT (Greenwich Mean Time) date and time stamp appended to it. For example, when you save project.rvt, Revit Architecture saves a local copy to the Journal folder, using the file name format project_YYYYMMDD-hhmmss-mmm.rvt.

Journal Files

Journal files capture the actions taken by the software during a session of Revit Architecture, from the time the software starts to the time it stops. These text files can be used to troubleshoot technical problems with the software.

Revit Architecture creates a new journal file each time you use the software. The journal file with the highest number is the most recent file. By default, journal files reside in the following location:

C:\Program Files\<Revit product name and version>\Journals

If you encounter problems during a Revit session, your support provider may ask you to send the journal file and any backup files to help with the troubleshooting process. If you do not encounter problems during a Revit session, the journal file is of little use and can be deleted. To automate the deletion of old journal files, see [General Options](#) on page 516.

Refreshing the Screen

The Refresh tool repaints the screen to remove any extraneous images. You do not normally need to use this tool, but it assures a clean image.

Press *F5* to refresh the screen.

What Is a Project?

In Revit Architecture, the project is the single database of information for your design—the building information model. The project file contains all information for a building design, from geometry to construction data. This information includes components used to design the model, views of the project, and drawings of the design. By using a single project file, Revit Architecture makes it easy to alter the design and have changes reflected in all associated areas (plan views, elevation views, section views, schedules, and so on). Having only one file to track also makes it easier to manage the project.

As you design the building, you create different views of the project, such as sections, plans, and elevations. When you change the building design in one view, Revit Architecture propagates those changes throughout the project. This means that the 3D model, any views of the model, the drawings, and the schedules are associative; they all update to reflect the changes.

Before You Begin a Project

Before you create a project in Revit Architecture, consider the following approaches to the design process:

- **Using levels and grids.** You can begin the design process by defining levels and grids for the structure. See [Levels](#) on page 1101 and [Grids](#) on page 1093.


- **Importing data.** If you started the design process using another CAD program (such as AutoCAD), you can import existing data. Revit Architecture imports various CAD formats, including DWG, DXF, DGN, and ACIS SAT files, as well as SketchUp (SKP) files and Industry Foundation Classes (IFC). See [Import/Link](#) on page 1386.
- **Massing.** You can start a project by designing a conceptual model. After you create basic shapes with the massing tools, you can convert mass faces to building elements. See [Massing Studies](#) on page 589 and [Conceptual Design Environment](#) on page 527.

Starting a New Project


When you start a new project in Revit Architecture, the new project file uses default settings, which are defined in a project template. Revit Architecture includes a default template called *default.rte*, which contains several settings to help you begin the design process immediately. Alternatively, you can start a project using a custom template. (See [Creating a Custom Project Template](#) on page 445.)

For information about changing the default template, see [Setting Options](#) on page 516.


Starting a New Project Using Default Settings


- 1 Start Revit Architecture.
- 2 Start a new project using one of the following methods:
 - Press *Ctrl+N*.
 - Click  ► New ► Project. In the New Project dialog, for Template, select None. For Create New, click Project. Click OK. In the Select Initial Units dialog, click Imperial or Metric.

Revit Architecture creates a new project file, using the default settings. The default project name displays in

the title bar of the Revit window. To assign a different file name, click  ► Save As.

Starting a New Project Using a Template

- 1 Start Revit Architecture.
- 2 Click  ► New ► Project.
- 3 In the New Project dialog, for Template, click Browse.
- 4 Navigate to the location of the desired project template, select the template file (with the file type RTE), and click Open.
Revit Architecture provides several project templates, which reside in the Metric Templates or Imperial Templates folder at:
 - Documents and Settings\All Users\Application Data\Autodesk\<product name>\
 You can use one of these templates or create your own templates as needed to maintain corporate standards or to simplify the setup process for different types of projects. See [Creating a Custom Project Template](#) on page 445.
- 5 For Create New, click Project.
- 6 Click OK.

Revit Architecture creates a new project file using the settings defined by the specified template. The default project name appears in the title bar of the Revit window. To assign a different file name, click  ► Save As.

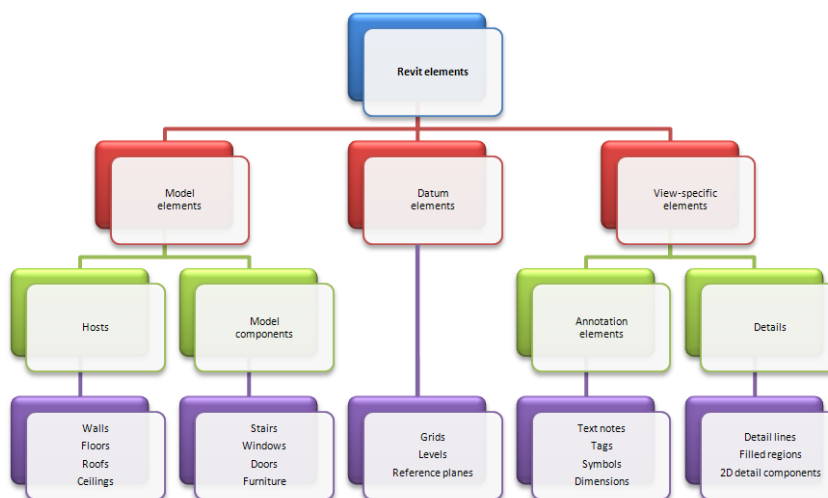
Related topics

- [Creating a Template](#) on page 445
- [Project Template Settings](#) on page 446

Building with Elements

You create buildings by adding elements to a design. In projects, Revit Architecture uses 3 types of elements:

- **Model elements** represent the actual 3D geometry of the building. They display in relevant views of the model. For example, walls, windows, doors, and roofs are model elements.
- **Datum elements** help to define project context. For example, grids, levels, and reference planes are datum elements.
- **View-specific elements** display only in the views in which they are placed. They help to describe or document the model. For example, dimensions, tags, and 2D detail components are view-specific elements.



There are 2 types of model elements:

- **Hosts** (or host elements) are generally built in place at the construction site. Walls and roofs are examples of hosts.
- **Model components** are all the other types of elements in the building model. For example, windows, doors, and cabinets are model components.

There are 2 types of view-specific elements:

- **Annotation elements** are 2D components that document the model and maintain scale on paper. For example, dimensions, tags, and keynotes are annotation elements.
- **Details** are 2D items that provide details about the building model in a particular view. Examples include detail lines, filled regions, and 2D detail components.

Categories, Families, and Types

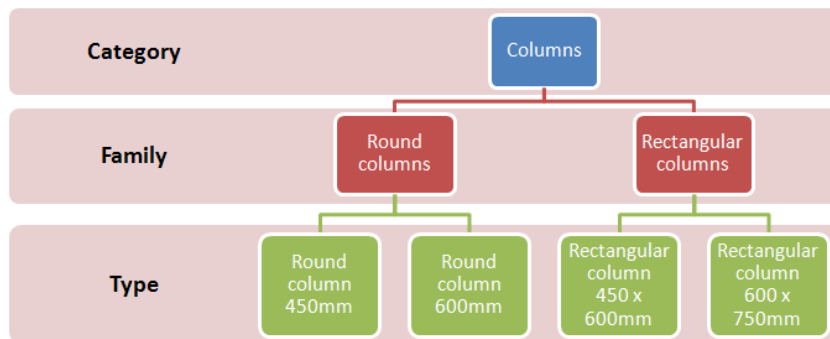
Revit Architecture classifies elements by categories, families, types, and instances.

Category: A category is a group of elements that you use to model or document a building design. For example, categories of model elements include walls and beams. Categories of annotation elements include tags and text notes.

Family: Families are classes of elements in a category. A family groups elements with a common set of parameters (properties), identical use, and similar graphical representation. Different elements in a family may have different values for some or all properties, but the set of properties—their names and meaning—is the same. For example, six-panel colonial doors could be considered one family, although the doors that compose the family come in different sizes and materials. Structural members (such as wall shapes) are another family. See [Revit Families](#) on page 415.

Type: Each family can have different types. A type can be a specific size of a family, such as a 30" X 42" (A0) title block or a 32" x 84" (910 x 2110) door. A type can also be a style, such as default aligned or default angular style for dimensions. A family can have several types. For example, a table may be available in several sizes. Each size table is a different type within the same family.

Instance: Instances are the actual items (individual elements) that are placed in the project and have specific locations in the building (model instances) or on a drawing sheet (annotation instances). Each instance belongs to a family and, within that family, a particular type.



Element Properties

In Revit Architecture, most elements have two sets of properties that control their appearance and behavior:

- **Type properties** are common to many elements in a family. A type property affects all instances (individual elements) of that family in the project and any future instances that you place in the project.
- **Instance properties** apply to individual instances (elements) of a family type in the project. Instance properties tend to vary with the location of an element in a building or project. An instance property affects only one selected element, or the element that you are about to place. For example, suppose that you select a beam, right-click, and click Element Properties. You change one of the instance properties and click OK. Only that beam is affected, even if the project contains other instances (individual beams) of the same type.

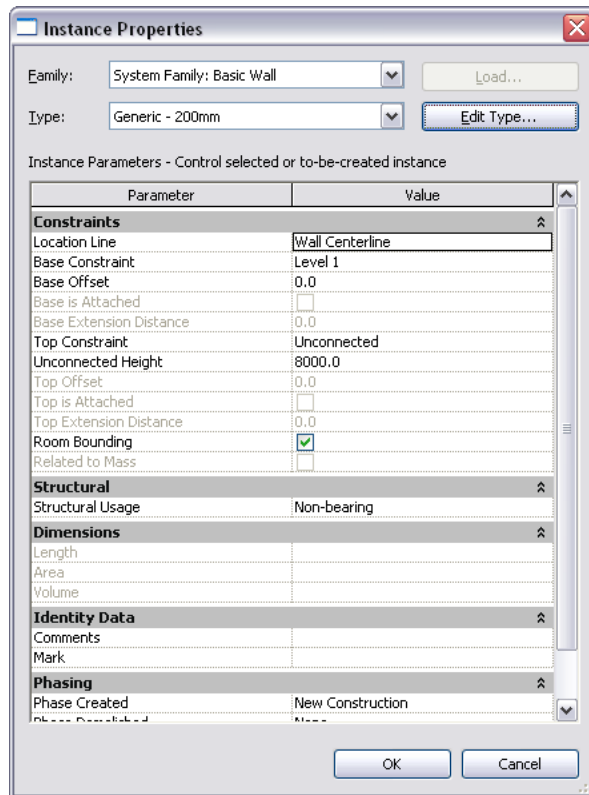
For example, the dimensions of a window are type properties, while its elevation from the level is an instance property. Similarly, cross-sectional dimensions of a beam are type properties, while beam length is an instance property.

Modifying Instance Properties

To modify the instance properties of an element, use either of the following methods:

- Select the element in the drawing area. Then click Modify <Element> tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- Select the element in the drawing area. Then right-click, and click Element Properties.

The content of the Instance Properties dialog varies, depending on the type of element. The following image shows the Instance Properties dialog for a wall.



Modifying Type Properties

To modify type properties for elements, use either of the following methods:

- In the drawing area, select an element belonging to the desired type. Then click Modify <Element> tab ► Element panel ► Element Properties drop-down ► Type Properties.
- In the drawing area, select an element belonging to the desired type. Then right-click, and click Element Properties. In the Instance Properties dialog, click Edit Type.

Related topics

- [Creating a New Family Type in a Project](#) on page 122
- [Previewing Family Types](#) on page 122

Creating a New Family Type in a Project

You can add a new type to the family and change the parameters for that type. This feature allows you to define an entire family of different-sized components within the project.

NOTE A new family type created in the project exists only in that project.

To create a new family type in a project

- 1 In the drawing area, select an element belonging to the desired type. Then click Modify <Element> tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 2 In the Type Properties dialog, click Duplicate.
- 3 In the Name dialog, enter a name for the new type and click OK.
- 4 Specify properties for the type, as desired.
- 5 To preview the new element type, click Preview. See [Previewing Family Types](#) on page 122.
- 6 In the Type Properties dialog, click OK.

On the Modify <Element> tab ► Element panel, the new type displays in the Type Selector, indicating that the new type is assigned to the selected element.

Related topics

- [Revit Families](#) on page 415
- [Working with Families](#) on page 418
- [Loading and Saving Families](#) on page 427

Previewing Family Types

The Type Properties dialog features a preview window that shows an image of the family type. As you set parameters and change values for the type, the image in the window updates accordingly.

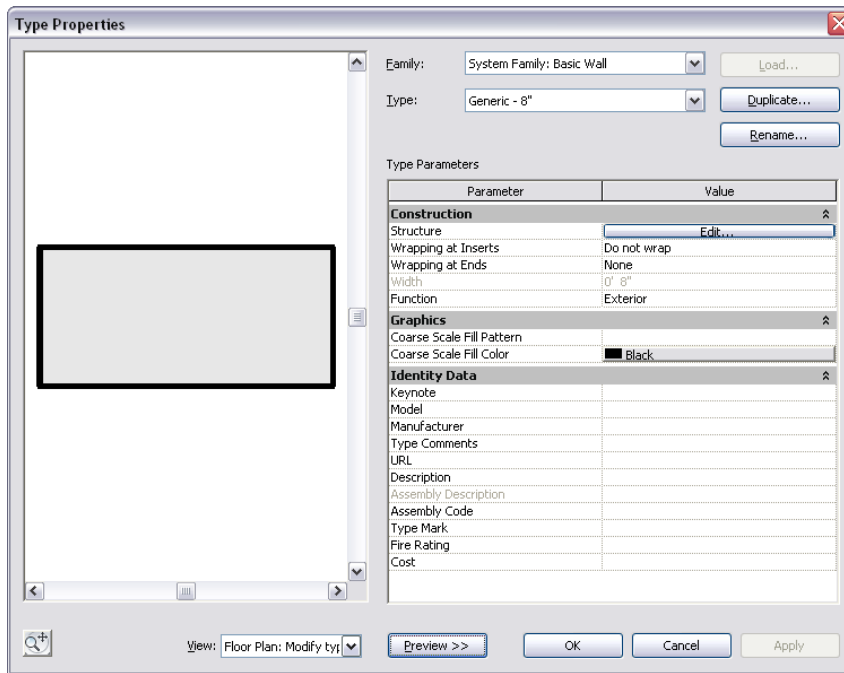
To preview a family type

- 1 In the drawing area, select an element belonging to the desired type.
- 2 Click Modify <Element> tab ► Element panel ► Element Properties drop-down ► Type Properties. The Type Properties dialog displays.
- 3 To see (or hide) a preview of the family type, click the Preview button at the bottom of the dialog.
As you change type parameters, the preview image updates to reflect the changes.

Manipulating the preview image of a family type

- 4 To control the appearance of the preview image, do any of the following:
 - For View, select a view name to see how this type of element will appear in a different view.
 - Use the scroll bars to move the image up, down, left, or right in the preview window.
 - Click or to activate the SteeringWheels navigation tool. If you are previewing a 3D view of the element, you can also use the ViewCube. See [Navigating Views](#) on page 217.

The following is an example of a Type Properties dialog for a wall type, with the Preview pane displayed.



Revit Tutorials

A complete set of Revit tutorials are available to help you be more productive using Revit Architecture.

Follow the self-paced exercises to get comfortable with using Revit Architecture.

To access the Revit Architecture tutorials, click (Help) drop-down ► Tutorials.

Project Views

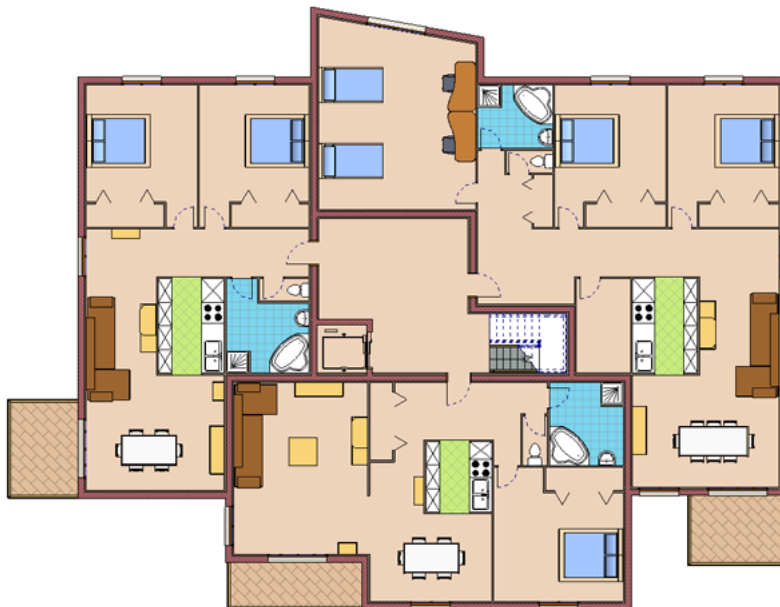
5

This topic covers most project views in Revit Architecture. The following project views are covered in other topics:

- Sheet views (see [Preparing Construction Documents](#) on page 1029)
- Detail views and drafting views (see [Detailing](#) on page 1134)
- Area plans (see [Area Analysis](#) on page 1008)
- Linked Revit models (see [Linking Revit Models](#) on page 1277)

Plan Views

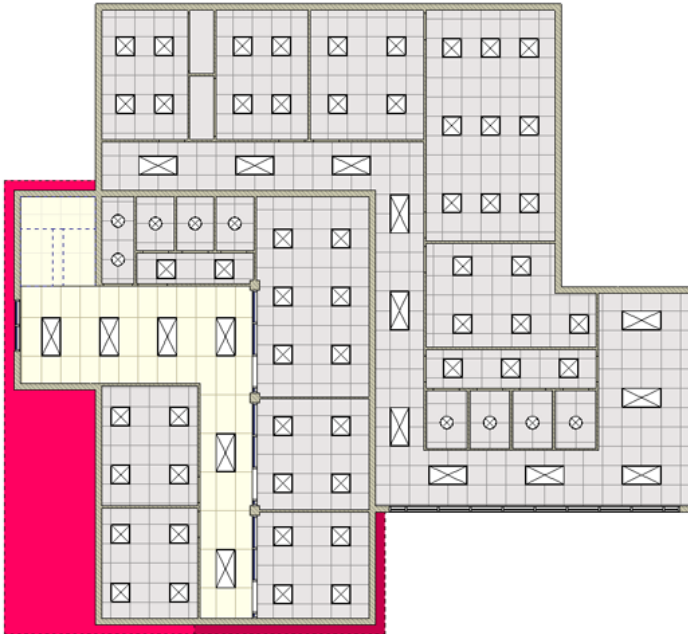
The floor plan view is the default view in a new project. Most projects include at least one floor plan.



Floor plan views are created automatically as you add new levels to your project.

Reflected Ceiling Plan View

Most projects include at least one reflected ceiling plan (RCP) view.



Reflected ceiling plan views are also created automatically, as you add new levels to your project.

Creating a Plan View

- 1 Click View tab ► Create panel ► Plan Views drop-down ► Floor Plan.
- 2 From the New Plan dialog, select one or more levels for which you want to create a plan view.
- 3 If you want to create a plan view for a level that has an existing plan view, clear Do not duplicate existing views.
- 4 For Scale, select an appropriate view scale for the new view.
- 5 Click OK.

NOTE If you create duplicate plan views, the duplicate view displays in the Project Browser with the following notation: Level 1(1), where the value in parentheses increases with the number of duplicates.

Creating a Reflected Ceiling Plan View

- 1 Click View tab ► Create panel ► Plan Views drop-down ► Reflected Ceiling Plan.
- 2 In the New RCP dialog, select one or more levels for which you want to create a view.

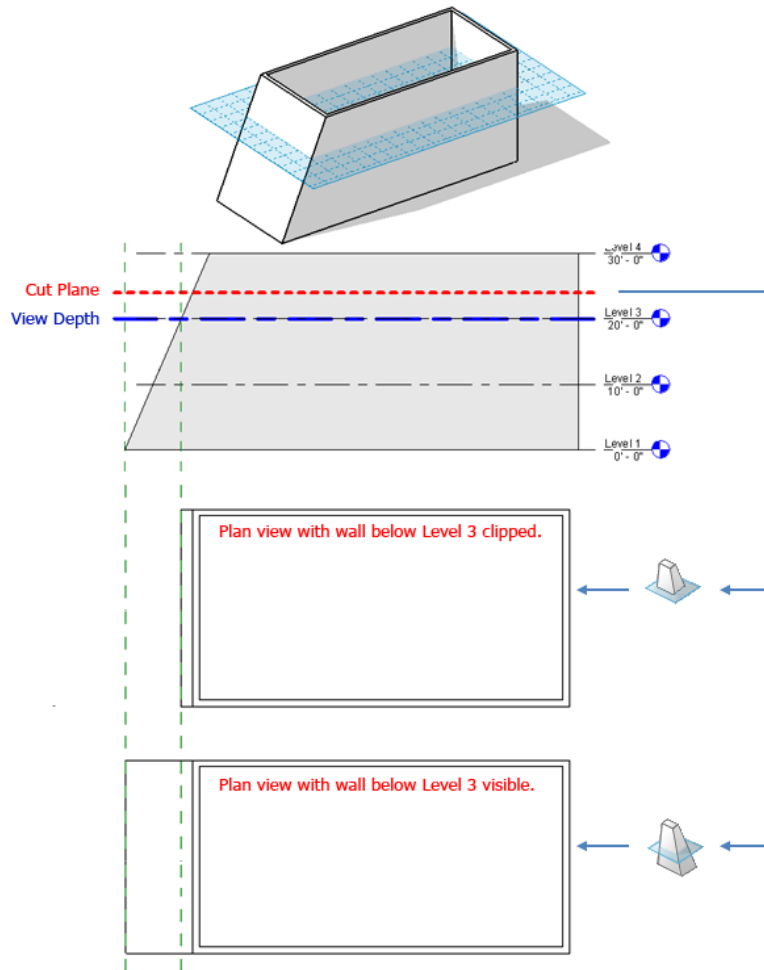
NOTE Hold the *Ctrl* key as you select to choose multiple levels.

- 3 If you want to create a plan view for a level that has an existing plan view, clear Do not duplicate existing views.
- 4 For Scale, select an appropriate view scale for the new view.
- 5 Click OK.

NOTE If you create duplicate plan views, the duplicate view appears in the Project Browser with the following notation: Level 1(1), where the value in parentheses increases with the number of duplicate views.

Cutting a Plan View by the Back Clip Plane

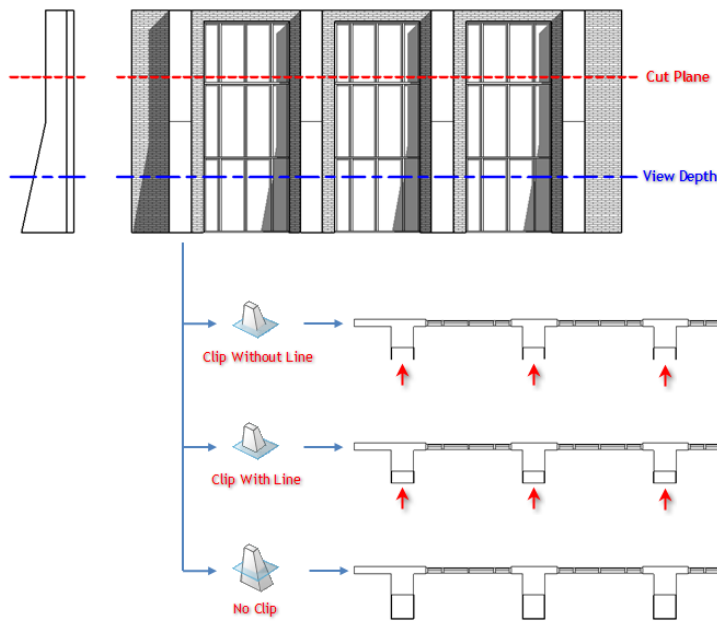
You may want to cut a plan view at the back clip plane when you have an element (such as a slanted wall) that spans multiple levels. If you only want the wall visible in the plan view as it appears in the view range of level 3, you can clip the wall from view using the Depth Clipping parameter. The following image illustrates this.



You activate this feature using the Depth Clipping parameter for the plan view. The back clip plane is defined by the View Depth parameter, which is part of the view's View Range properties.

NOTE Plan views include floor plan views, reflected ceiling plan views, detail plan views, and callout plan views.

The following image shows the cut plane and view depth for this model and the resulting plan view representations for the Depth Clipping parameter options (Clip without line, Clip with line, and No clip).



Plan regions respect the Depth Clipping parameter setting of their parent view, but follow their own View Range settings.

Elements that have symbolic representation in certain views (such as structural beams) and non-cutttable families are not affected when you cut a plan view by the back clip plane. They will display and are not cut.

This property does affect printing.

To cut by the back clip plane:

- 1 In the Project Browser, right-click the plan view you want to cut by the back clip plane, and click Properties.

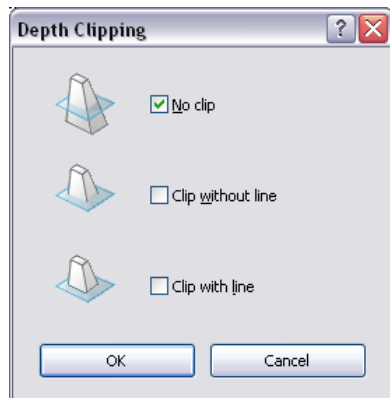
Alternatively, if the view is active in the drawing area, right-click and click View Properties.

- 2 In the Instance Properties dialog, find the Depth Clipping parameter.

The Depth Clipping parameter is available for plan and site views.

- 3 Click the button in the Value column.

The Depth Clipping dialog displays.



- 4 In the Depth Clipping dialog, select an option and click OK.

- 5 Optionally, click View Range, and modify the View Depth setting if necessary. The level you select for View Depth is where the view will be clipped, when the Depth Clipping property is active.
- 6 Click OK to exit the Instance Properties dialog.

Plan View Properties

Each plan view has type properties for callout tags and reference labels. The reference label parameter sets the text displayed in a callout tag when a reference callout is made to the plan view. To define the look of callout tags click Manage tab ► Project Settings panel ► Settings drop-down ► Callout Tags.

See [View Properties](#) on page 259.

Displaying a Plan View

- Double-click its name in the Project Browser.
- If the view is open but hidden behind another view, click View tab ► Windows panel ► Switch Windows drop-down ► <view name>.

Plan Region

The Plan Region tool lets you define a region within a plan view that has a different view range from the overall view. Plan regions are useful for split level plans or for displaying inserts above or below the cut plane. Plan regions are closed sketches and cannot overlap each other. They can have coincident edges.



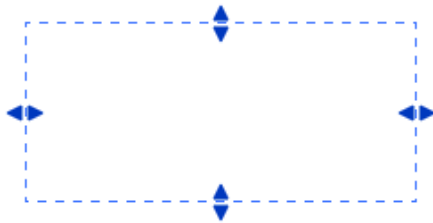
Plan regions are view-specific. You can copy and paste them into the same view or different views. When you copy a plan region into a different view, the view range settings are maintained from the previous view.

Plan regions export and print when they are visible in a view.

Creating a Plan Region

- 1 Open a plan view.
 - 2 Click View tab ► Create panel ► Plan Views drop-down ► Plan Region.
 - 3 Sketch a closed loop using lines, rectangles, or polygons.
For more information, see [Sketching](#) on page 303.
 - 4 Click Create Plan Region Boundary tab ► Element panel ► Plan Region Properties.
 - 5 In the Instance Properties dialog, for View Range, click Edit.
 - 6 In the View Range dialog, specify the primary range and view depth.
If the value for Cut Plane is specified as Parent View's Level, then the level used to define all the clip planes (Top, Bottom, Cut, and View Depth) is the same as for the entire plan view.
-
- NOTE** Values for offsets need to make sense with respect to each other. For example, the top offset cannot be lower than the cut plane offset, and the cut plane offset cannot be lower than the bottom offset.
-
- 7 Click OK to exit the View Range dialog.
 - 8 Click OK to exit the Instance Properties dialog.
 - 9 Click Finish Plan Region.

You do not have to enter sketch mode to edit the shape of a plan region. Each boundary line of the plan region is a shape handle, as shown in the following image. Select the shape handle and drag it to modify the size.



Related topics

- [Plan Region](#) on page 129
- [Controlling Visibility of Plan Regions](#) on page 130
- [Cutting a Plan View by the Back Clip Plane](#) on page 127

Controlling Visibility of Plan Regions

- 1 Click View tab ► Graphics panel ► Visibility/Graphics, or type the shortcut key combination VG.
- 2 In the Visibility/Graphics dialog, click the Annotation Categories tab.
- 3 Scroll to the Plan Region category.
- 4 Select or clear the check box to show or hide the plan region.
- 5 Click in the Projection/Surface Lines column, and click Override to make changes to the line weight, line color, and line pattern of the plan region.

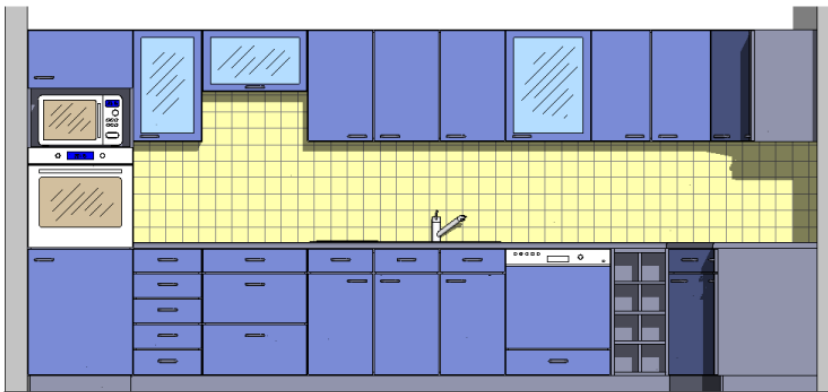
6 Click OK.

Elevation Views


Elevation views are part of the default template in Revit Architecture. When you create a project with the default template, 4 elevation views are included: north, south, east, and west. It is in elevation views where you sketch level lines. For each level line that you sketch, a corresponding plan view is created.



You can create additional exterior elevation views and interior elevation views. Interior elevation views depict detailed views of interior walls and show how the features of the wall should be built. Examples of rooms that might be shown in an interior elevation are kitchens and bathrooms.



Elevation Tags

You designate elevations with an elevation tag . The tag snaps to walls as you drag it around with the cursor. You can set different properties for the tag. See [Modifying Elevation Symbol Properties](#) on page 137.

The elevation view arrowhead is visible in a plan view, provided the elevation view's crop region intersects the view range of the plan view. If you resize the crop region of the elevation such that it no longer intersects the view range, the arrowhead is not visible in the plan view.

Creating an Elevation View

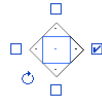
- 1 Open a plan view.
- 2 Click View tab ► Create panel ► Elevation.
The cursor appears with the elevation symbol.
- 3 On the Options Bar, select a view scale.

4 Place the cursor near a wall, and click to place the elevation symbol.

NOTE As you move the cursor, you can press *Tab* to change the position of the arrowhead. The arrowhead snaps to perpendicular walls.

5 To set different interior elevation views, highlight the square shape of the elevation symbol, and click.

The elevation symbol displays with check box options for creating views, as the following image shows.



TIP The rotation control is useful for aligning to angled elements in the plan.

6 Select the check boxes to indicate where you want to create elevation views.

7 Click away from the elevation symbol to hide the check boxes.

8 Highlight an arrowhead on the symbol to select it.

9 Click the arrowhead once to view the clip plane:

Elevation symbol with clip plane



The end points of clip planes snap and join to walls. You can resize the width of the elevation by dragging the blue controls. If the blue controls do not display in the view, select the clip plane and click **Modify Views** tab ► **Element panel** ► **Element Properties**. In the **Instance Properties** dialog, select the **Crop View** parameter, and click **OK**.

10 In the Project Browser, select the new elevation view.

The elevation view is designated by a letter and number, for example, Elevation: 1 - a.

Related topics

- [Displaying an Elevation View](#) on page 132
- [Changing the Clip Plane in an Elevation View](#) on page 133
- [Changing the Elevation Symbol](#) on page 133
- [Framing Elevation Views](#) on page 135

Displaying an Elevation View

There are several ways to display an elevation view.

- Double-click the view name from the Project Browser.
- Double-click the arrowhead on the elevation symbol.
- Select the elevation symbol arrowhead, right-click, and select **Go to Elevation View**.

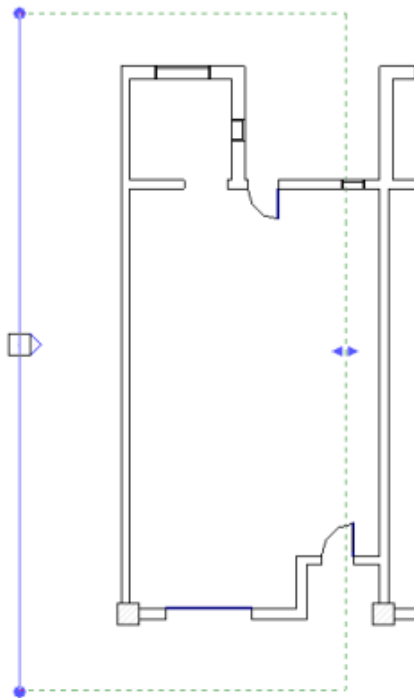
Changing the Elevation Symbol

- 1 Select the elevation tag arrowhead.
- 2 Click Modify Views tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 Modify the appropriate property values by clicking in the Value fields.
- 4 Click OK.

Changing the Clip Plane in an Elevation View

Clip planes define the boundaries for an elevation view. The end points of clip planes snap and join to walls. You can resize the viewing area of an elevation by resizing the clip planes.

- 1 In a plan view, select the elevation tag arrowhead.
The clip planes for the elevation display in the drawing area, as shown in the following image.



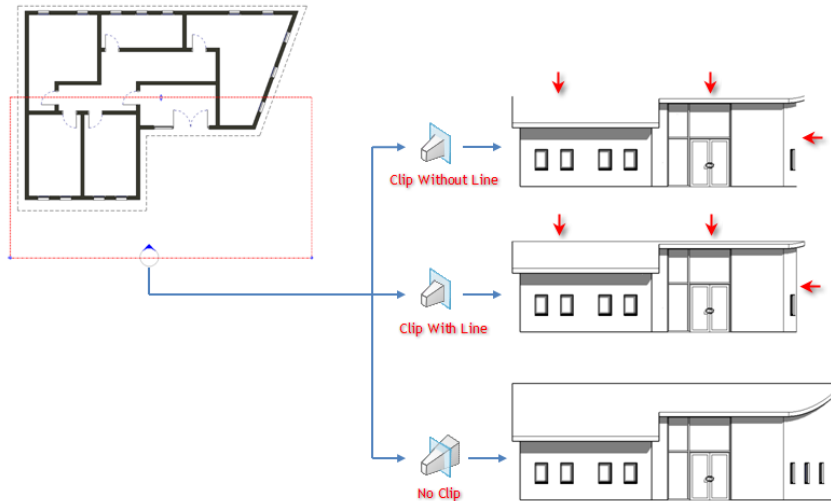
NOTE If the far clip plane (the dotted green line) is not visible, right-click the elevation arrowhead, and click Element Properties. Find the Far Clipping parameter, and select an option. For more information, see [Cutting an Elevation, Section, or Callout View by the Far Clip Plane](#) on page 133.

- 2 Drag the blue dots or the arrows to resize the clip plane.

Cutting an Elevation, Section, or Callout View by the Far Clip Plane

You can cut an elevation, section, or callout view at the far clip plane. You activate this feature using the Far Clipping parameter for the view. The far clip plane is defined with the Far Clip Offset parameter.

The following image shows the clip plane for the model and the resulting elevation view representations for the Far Clipping parameter options (Clip without line, Clip with line, and No clip).



Elements that have symbolic representation in certain views (such as structural beams) and non-cuttable families are not affected when you cut an elevation, section, or callout view by the far clip plane. They will display and are not cut.

This property does affect printing.

To cut by the far clip plane:

- 1 In the Project Browser, right-click the view you want to cut by the far clip plane, and click Properties.
Alternatively, if the view is active in the drawing area, right-click and click View Properties.
- 2 In the Instance Properties dialog, find the Far Clipping parameter.
The Far Clipping parameter is available for elevation, section, and callout views. To use this parameter in a callout view, for the Far Clip Settings parameter, specify Independent.
- 3 Click the button in the Value column.
The Far Clipping dialog displays.



- 4 In the Far Clipping dialog, select an option, and click OK.
- 5 Enter a value for Far Clip Offset. This is where the view will be clipped when the Clipping property is active.
- 6 Click OK to exit the Instance Properties dialog.

Reference Elevation

Reference elevations are elevations that reference an existing elevation or drafting view. They do not create a new view when you add them to your project.

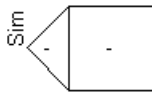
You can place a reference elevation in a plan or callout view.

Placing a Reference Elevation

- 1 Open a plan or callout view.
- 2 Click View tab ► Create panel ► Elevation.
- 3 On the Options Bar, select Reference other view.
- 4 Select a reference view from the adjacent menu. If there are no existing views to reference, you can select <New Drafting View> from the menu. This creates an empty drafting view that is added to the Project Browser under Drafting Views. The default name is Elevation of <level name>. You can edit this view as necessary and rename it.

NOTE If a view from the menu list is on a sheet, the detail number and sheet number display next to the view. For example, if you choose a drafting view, and it is on a sheet, its name displays as Drafting View: Drafting 1 (1/A101), where the values in the parentheses represent the detail number and sheet number.

- 5 Place the cursor in the drawing area and click to place the reference elevation.
The reference elevation displays in the drawing area with the default reference label, as shown in the following image.

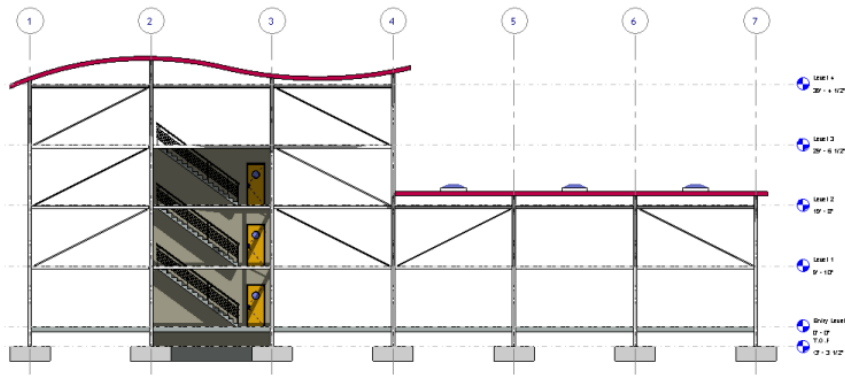


To change the label text, select the reference elevation symbol, and click Modify Elevations tab ► Element panel ► Element Properties drop-down ► Type Properties. Edit the Reference Label type parameter and click OK.

- 6 Click Elevation tab ► Select panel ► Modify, to exit the Elevation tool.
- 7 Optionally, select the elevation symbol, and add check marks where you want to create additional reference elevations.
When you select a check box, the Select View to Reference dialog opens. Select the view to reference and click OK.

Framing Elevation Views

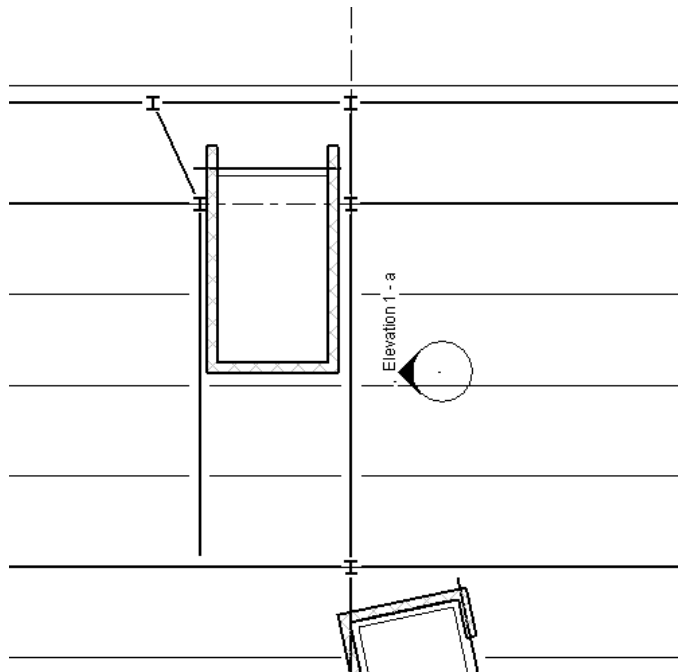
Framing elevation views are useful for adding vertical bracing to your model, or for any task that requires quick work plane alignment to a grid or to a named reference plane. When you add a framed elevation, Revit Architecture automatically sets the work plane and view range at the selected grid or reference plane. The crop region is also confined to the region between adjacent grid lines that are perpendicular to the selected grid line.



Creating a Framing Elevation View

NOTE You must have a grid in your view, before you can add a framing elevation view. See [Grids](#) on page 1093 for information on drawing a grid.

- 1 Click View tab ► Create panel ► Elevation drop-down ► Framing Elevation.
- 2 Place the framing elevation symbol perpendicular to the selected grid line and in the direction of view to display, and click to place it.



- 3 Press *Esc* to finish.
- 4 Double-click the elevation arrowhead to open the framing elevation.
The view represents a full-height view of the area at the work plane of the grid or of the reference plane. The view is constrained to the surrounding grids or limits of the reference plane.

Related topics

- [Framing Elevation Views](#) on page 135

- [Elevation Views](#) on page 131
- [Reference Elevation](#) on page 134

Elevation View Properties

Each elevation has type properties for elevation tags, callout tags, and reference labels. To define the look of elevation tags and callout tags, click Manage tab ► Project Settings panel ► Settings drop-down ► Callout Tags or Elevation Tags. The Reference Label parameter sets the text displayed next to the elevation tag when the elevation is a reference elevation.

Modifying Elevation Symbol Properties

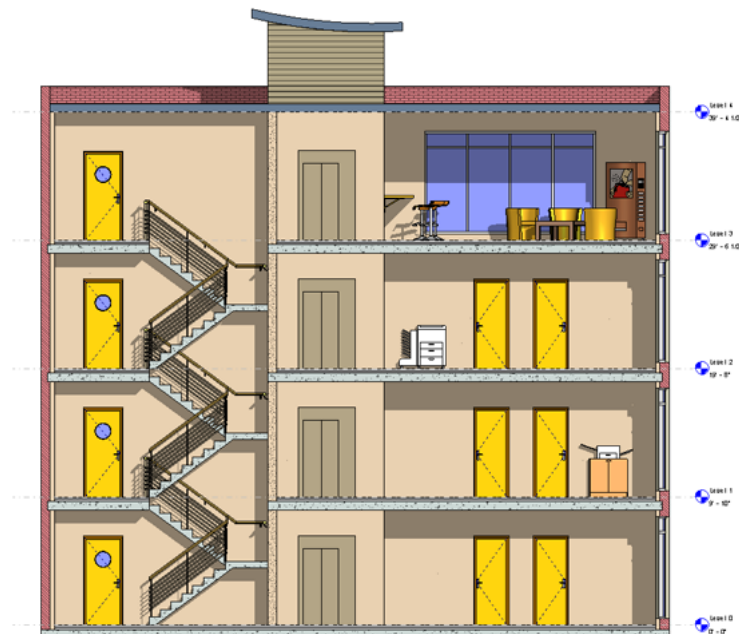
You can set various parameters to modify the display of the elevation symbols.

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Elevation Tags.
- 2 In the Type Properties dialog, make the necessary changes to the elevation symbol properties.
- 3 Click OK.

Section Views

Section views cut through the model. You can draw them in plan, section, elevation, and detail views. Section views display as section representations in intersecting views.

You can create building, wall, and detail section views. Each type has a unique graphical display, and each is listed in a different location in the Project Browser. Building and wall section views display in the Sections (Building Section) branch and Sections (Wall section) branch of the Project Browser. Detail sections appear in the Detail Views branch.



You can cut a section view at the far clip plane. For more information, see [Cutting an Elevation, Section, or Callout View by the Far Clip Plane](#) on page 133.

Considerations for Section Views in the Family Editor

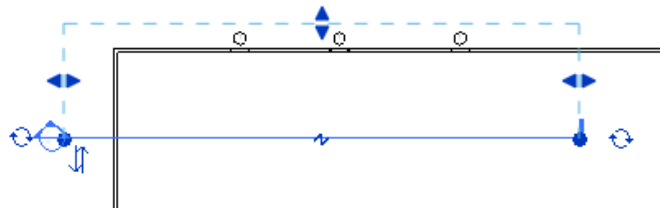
- You can create a section view in the Family Editor.
- Section views are not available for in-place families.
- If the section symbol appears without a head, you need to load the section head. See [Changing the Section Head](#) on page 145.

Creating a Section View

- 1 Open a plan, section, elevation, or detail view.
- 2 Click View tab ► Create panel ► Section.
- 3 Click Section tab ► Element panel, and from the Type Selector select Detail, Building Section, or Wall Section.
- 4 On the Options Bar, select the view scale.
- 5 Place the cursor at the starting point of the section, and drag through the model or family.

NOTE You can snap a section line parallel or perpendicular to a non-orthogonal datum or wall. Snapping to a wall is available in plan views.

- 6 Click when you reach the end point of the section.
The section line and the crop region appear and are selected, as the following image shows.



- 7 If desired, resize the crop region by dragging the blue controls. The depth of the section view changes accordingly.
- 8 Click Modify or press *Esc* to exit the Section tool.
- 9 To open the section view, double-click the section header, or select the section view from the Sections leaf of the Project Browser.
The section view changes when the design changes or the section line is moved.

Related topics

- [Displaying a Section View](#) on page 143
- [Controlling Section View Width and Depth](#) on page 140
- [Breaking Section Lines](#) on page 139
- [Changing the Section Head](#) on page 145

Section Tag Visibility

The section tag is visible in plan, elevation, and other section views, provided its crop region intersects the view range. For example, if you resize the crop region of the section view, so that it no longer intersects the plan view's view range, the section symbol does not appear in the plan view.

TIP The section instance parameter **Hide at Scales Coarser Than** establishes a scale at which sections are either shown or hidden in other views. For example, a section tag can be hidden at scales coarser than 1/4"=1'0".


Section symbols can display in elevation views even if their crop boundary is turned off. The section displays in elevation if the section line intersects the elevation clip plane. To view and modify the position of the elevation clip plane, select the arrowhead of an elevation symbol in a plan view, and the clip plane appears with drag controls on it. If you resize the clip plane such that it no longer intersects the section line, the section is not visible in the elevation view.

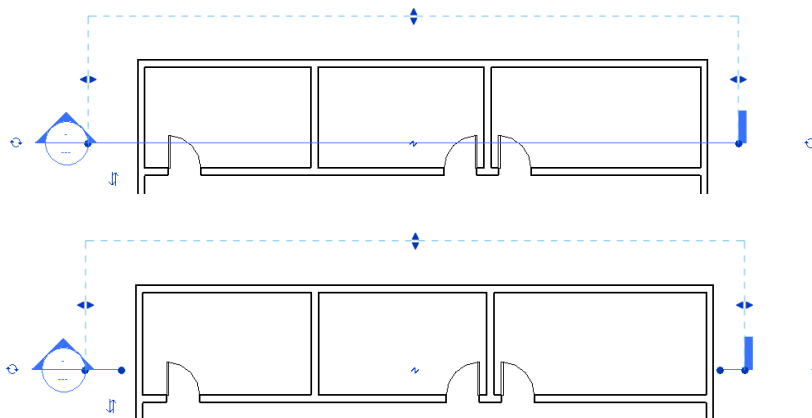
Related topic

- [View Tags in Dedicated Views for Design Options](#) on page 1320

Breaking Section Lines

Breaking section lines is useful when you want to create a section view, but you do not want the section line to appear across the drawing. Breaking a section line has no effect on what displays in the section view.

You can break section lines by clicking the break control () and adjusting the length of the section line segments. The section break is in the middle of the section line. The following images show the same section, whole and broken.



To rejoin the section line, click the break control again.

NOTE A break in a section line is view-specific. It affects the display of the section only in the view where the break was made.

Controlling the Line Style of Broken Section Lines

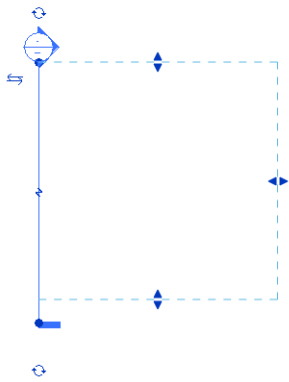
- 1 Click **Manage** tab ► **Project Settings** panel ► **Settings** drop-down ► **Section Tags**.
- 2 Change the value of the **Broken Section Display Style** property to **Continuous** or **Gapped**.

Gapped is the default. If you select Continuous, the section line displays according to the Broken Section Line style defined in the Object Styles dialog. For more information on the Object Styles dialog, see [Object Styles](#) on page 493.

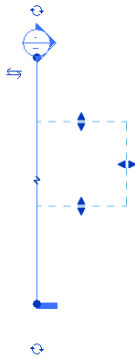
Controlling Section View Width and Depth

When you create a section view, Revit Architecture sets a default view depth and width. By selecting a section and resizing its crop region, you can control more accurately what displays in the section view.

The following image shows a section and its crop region.



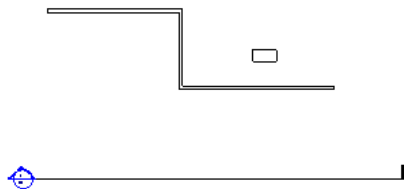
Drag the controls on the crop region to resize the width and the depth of the section view, as necessary. The following image shows the same section as above, but with a resized crop region.



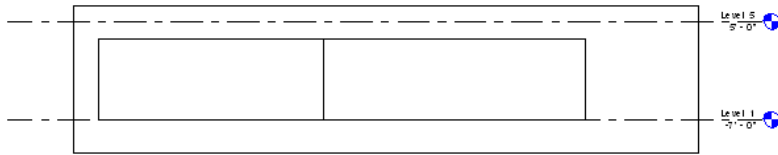
Segmented Section View

You can split sections into segments that are orthogonal to the view direction. This allows you to vary a section view to show disparate parts of the model without having to create a different section.

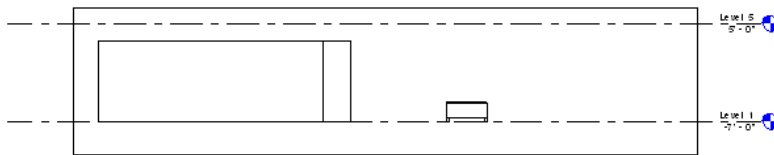
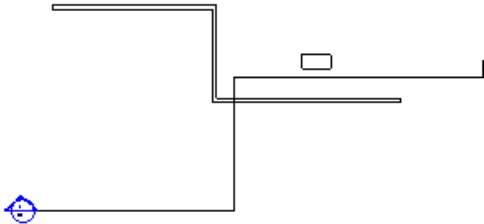
In the following figure, a typical section is drawn on the model.



The section produces the following view.

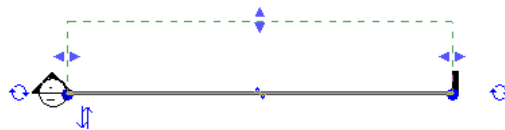


Modify the section as shown and the resulting section view changes.

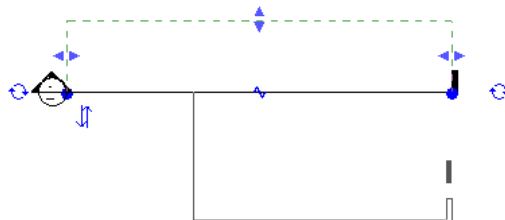


Segmenting a Section View

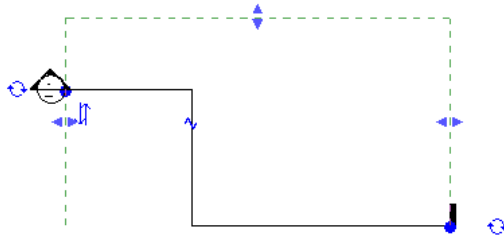
- 1 Sketch a section in a view, or select an existing section.
- 2 Click Modify Views tab ► Section panel ► Split Segment.
- 3 Place the cursor on the section line at the point it is to be segmented, and click.



- 4 Move the cursor to the side of the split to move, and move the cursor in a direction orthogonal to the view direction.

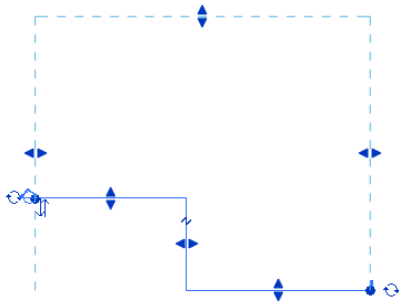


- 5 Click to place the section.

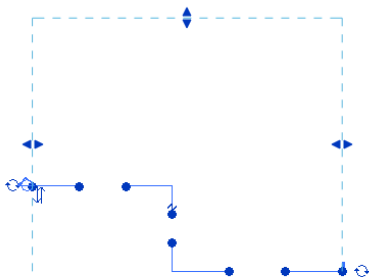


The new segmented section has several controls on it. Controls for resizing the crop region display as a dashed green line. All segments share the same far clip plane.

There are controls for moving the segments of the section line.



There is also a break control that divides the section into smaller segments. The break control displays as a Z on the section line. Click it to break up the section even further. When you do, the section has more controls for resizing segments.



Merging Segmented Section Views

To change the segmented line into a continuous line, move segments toward one another so that they form a continuous line and merge.

Reference Sections

Reference sections are sections that reference an existing view. They do not create a new view when you add them to your project.

You can place reference sections in plan, elevation, section, drafting, and callout views. Reference sections can reference section views, callouts of section views, and drafting views.

To create a reference section:

- 1 Click View tab ► Create panel ► Section.
- 2 On the Options Bar, select Reference other view, and select a section, callout of a section, or drafting view name from the drop-down menu next to it. If there are no existing views to reference, you can select <New Drafting View> to create a new drafting view; the reference section then references this new drafting view.


NOTE If a view from the menu list is on a sheet, the detail number and sheet number display next to the view. For example, if you select a drafting view to be referenced and it is on a sheet, its name displays as Drafting View: Drafting 1 (1/A101), where the values in parentheses represent the detail number and sheet number.

- 3 Sketch the section line.

Reference Section Tips

- There is no parametric relationship between the reference section and the referenced view. Resizing the clip planes of a reference section has no effect on the crop region of the referenced view.
- If you double-click the reference section head, the referenced view opens.
- The reference section head includes a label. To change the label text, edit the Reference Label parameter. It is a type parameter of the section family.
- Any sections placed in a drafting view must be reference sections. They do not create a new section view. The Reference other view option is always selected and cannot be cleared.

Hiding the Section Annotation Symbol

You can hide the annotation line and bubble from the current view by selecting the annotation, right-clicking, and selecting Hide in view ► Elements (to hide only that section annotation) or Category (to hide all section annotations) from the shortcut menu. To display the annotation again, click  (Reveal Hidden Elements) from the View Control Bar, right-click the section annotation symbol and click Unhide in view ► Elements or Category.

Displaying a Section View

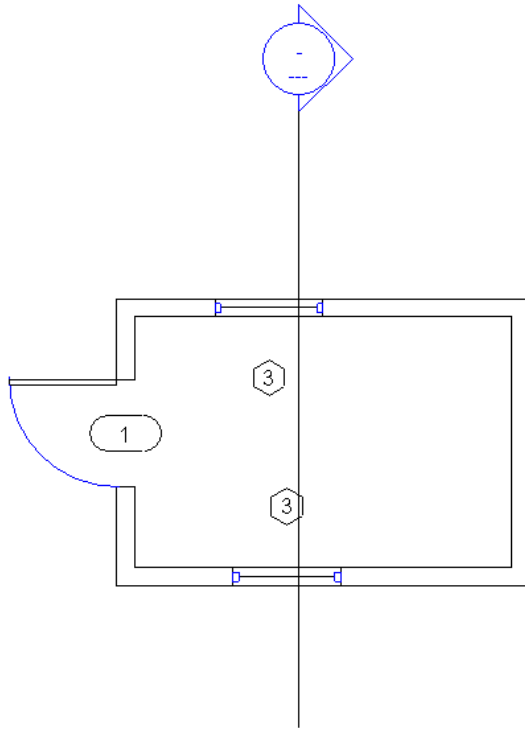
There are several ways to display a section view.

- Select it from the Project Browser. See [Project Browser](#) on page 93.
- Double-click the section head.
- Select the section line, right-click on it, and select Go to View from the shortcut menu.

Section Heads

The Section Head Family creates the symbol that displays at the end of the section line. Revit Architecture designates a default symbol, but you may want to use your own symbols to define different sections. By specifying a family for section heads, your project can include more than one symbol.

Before reading this topic, you should be familiar with families. See [The Families Guide](#) on page 418.

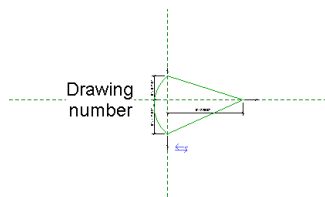


Starting a Section Head Family


When creating a section head family, you define the section head symbol. The section head symbol you create should indicate the viewing direction. You set a viewing direction by sketching an arrow head. The symbol should also include a set of double arrow mirror controls to reverse the viewing direction, if necessary.


Setting Parameters for the Section Head

There are 2 parameters you can set for the symbol: the Drawing Number and the Sheet Number. You can set them by placing Tag Text. The Drawing Number is the number of the view on a sheet. The Sheet Number is the number of the drawing sheet. If you add these parameters to a symbol, they automatically fill in when you add the section view to a project.



The following procedure is a general procedure for creating a section head family. Your steps may differ based on design intent.

- 1 Click  ► New ► Annotation Symbol.
- 2 In the Open dialog, select Section Head.rft from the templates folder and click Open.

- 3 The section head template includes a predefined head. You can use this head or click Create panel ► Detail panel ► Line to create a different one.
- 4 If desired, add text to the symbol by clicking Text.
- 5 If desired, click Label to add text to the symbol for the Detail Number or Sheet Number. To include the view name with the section head, choose the View Name parameter.
- 6 On the Quick Access toolbar, click  (Save). Revit Architecture saves the file with an RFA extension.

Changing the Section Head

- 1 Click Insert tab ► Load From Library panel ► Load Family.
- 2 Double-click the Annotations folder, and select one or more section head families.
- 3 Click Open to load the families.
- 4 Click Manage tab ► Project Settings panel ► Settings drop-down ► Section Tags.
- 5 In the Type Properties dialog, click Duplicate.
- 6 Enter a name for the new section head, and click OK.
- 7 Click in the value box for the Section Head parameter and select the section head family you just loaded.
- 8 Click OK.
- 9 Click View tab ► Create panel ► Section.
- 10 Click Section tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 11 Click in the value box for the Section Tag parameter, and select a tag from the list.
- 12 Click OK to save your changes.

Tip for Creating a Section Head Family

The intersection of the 2 perpendicular reference planes represents the origin of the symbol. The origin is the point at which the symbol attaches to the section line. Sketch the lines accordingly.

Section View Properties

Each section has type properties for section tags, callout tags, and reference labels. To define the look of section tags and callout tags, click Manage tab ► Project Settings panel ► Settings drop-down ► Callout Tags or Elevation Tags. The Reference Label parameter sets the text displayed next to the section bubble when the section is a reference section.

Modifying Section View Properties

- 1 Select the section line.
- 2 Click Modify Views tab ► Element panel ► Element Properties.
- 3 In the Instance Properties dialog, edit Instance properties as desired.
- 4 Click Edit Type to edit Type properties.
- 5 When finished, click OK.

NOTE You cannot modify the Detail Number and Sheet Number properties for a section. These values are automatically filled in when the section view is added to a sheet.

Callout Views

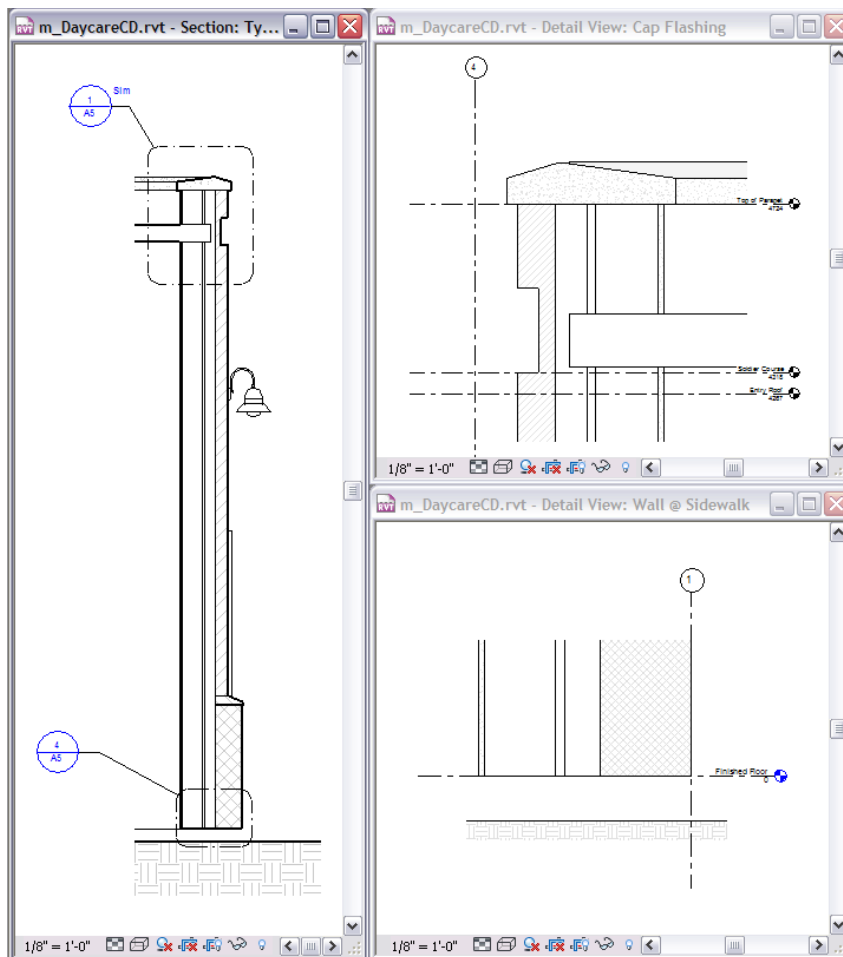
A callout shows part of another view at a larger scale. In a construction document set, use callouts to provide an orderly progression of labeled views at increasing levels of detail.

Callouts Overview

You can add a callout to a plan, section, detail, or elevation view. In these views, the callout tag is linked to the callout view. The callout view shows an enlarged version of part of the parent view, and provides more information or details about that part of the building model.

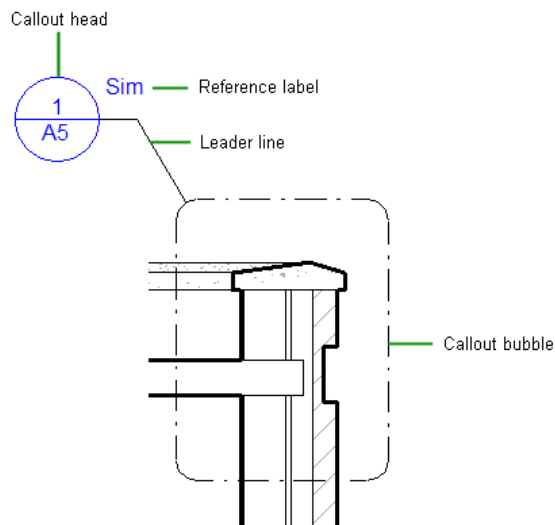
The view in which a callout is drawn is the parent of the callout view. If the parent view is deleted, the callout is also deleted.

Callout views accessed from tags in the parent view



Callout Tag Parts

A callout tag is an annotation element that marks the location of a callout in a parent view.



The callout tag consists of the following parts:

- **Callout bubble.** The line drawn around part of the parent view to define the callout area.
- **Callout head.** A symbol that identifies the callout. When you place the callout on a sheet, the callout head displays the corresponding detail number and sheet number by default.
- **Leader line.** A line that connects the callout head to the callout bubble.
- **Reference label.** For reference callouts only. Text displayed in a callout tag to provide information about the callout.

You can change all parts of the callout tag. See [Callout Tags](#) on page 151.

Callout Types

In Revit Architecture, you can create reference callouts, detail callouts, and view callouts.

Reference callouts

Use multiple callout tags in different views to refer to one callout view. See [Reference Callouts](#) on page 154.

Detail callouts

Use a detail callout when you want to provide details about a part of the building model. The detail callout provides more granular information than the parent view. You can add details and annotations to the detail callout. These details do not display in the parent view.

When you add a detail callout to a view, Revit Architecture creates a detail view. (See [Detail Views](#) on page 1134.) The detail view displays in the Project Browser under Views (all) ► Detail Views.

For a detail callout, you can specify whether its callout tag displays in the parent view only or displays in the parent view and intersecting views. For intersecting views, you can automatically hide the callout tag if the scale is coarser than a specified value.

Furthermore, you can specify whether the detail view uses the style and offset that you specify in the detail view parameters, or the same clipping as the parent view. (Elevation and section views use the Far Clipping parameter. Plan views use the Depth Clipping parameter.)

Related topics

- [Creating a Callout View](#) on page 148
- [Detailing](#) on page 1134
- [Cutting a Plan View by the Back Clip Plane](#) on page 127
- [Cutting an Elevation, Section, or Callout View by the Far Clip Plane](#) on page 133

View callouts

Use a view callout when you want to provide more or different information about a part of the parent view. For example, you can use a view callout to provide a more detailed layout of fixtures in a bathroom.

When you add a view callout to a view, Revit Architecture creates a view that has the same view type as the parent view. For example, if you add a callout tag to a floor plan view, the callout view is also a floor plan view, and displays in the Project Browser under Views (all) ► Floor Plans.

A view callout offers the same capabilities as its parent view. For example, you can specify another view to use as an underlay, assign a color scheme, and specify a view range. Use properties of the callout view to specify these parameters.

See [Creating a Callout View](#) on page 148.

Callouts and Sheets

Callouts are tools for making coherent document sets. They are designed to send the user (builder, contractor, installer) from one view to another. Plan your use of views and callouts to provide a logical sequence that moves the user from large-scale plans to views with greater levels of detail.

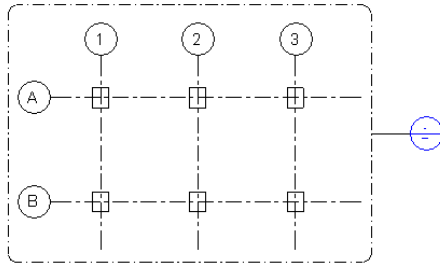
You can place callouts on the same sheet as the parent view, or place details on sheets by category (for example, roof eave details, or window sill details). You can use standard details in drafting views as references for multiple callouts that detail the same condition.


Creating a Callout View

You can add a detail callout or a view callout to a plan, section, detail, or elevation view. (See [Callout Types](#) on page 147.) When you draw the callout bubble in a view, Revit Architecture creates a callout view. You can then add details to the callout view to provide more information about that part of the building model.

NOTE To create a reference callout, see [Creating a Reference Callout](#) on page 154.

- 1 In a project, click View tab ► Create panel ► Callout.
- 2 Click Callout tab ► Element panel, and from the Type Selector, select the type of callout to create: a detail callout or a view callout (a callout view that has the same view type as the parent view).
See [Callout Types](#) on page 147.
- 3 On the Options Bar, for Scale, select a scale for the callout view.
- 4 To define the callout area, drag the cursor from the upper-left to the lower-right, creating a callout bubble as shown by the dashed line enclosing the upper-left corner of the grid.



5 To see the callout view, double-click the callout head  .
The callout view displays in the drawing area.

Related topics

- [Opening a Callout View](#) on page 149
- [Creating Details](#) on page 1142
- [Modifying a Callout](#) on page 149
- [Visibility of Callouts](#) on page 153

Opening a Callout View

To open a callout view, use any of the following methods:

- In the Project Browser, double-click the name of the callout view.
- In the parent view, double-click the callout head.
- In the parent view, right-click the callout head, and click Go to View.

Modifying a Callout

After creating a callout, you can change it in the following ways.

If you want to...	then
change the type of callout tag assigned to a callout	see Changing the Callout Tag for a Callout on page 150.
enlarge or reduce the area shown in a callout view	see Changing the Boundaries of a Callout on page 150.
change the format of the callout head, or the information that it displays	see Creating a Callout Head Family on page 151.
For a callout bubble:	
change the line color, weight, or style	see Changing Display Properties for Callout Tags on page 153.
change the radius of the corners	see Creating a Callout Tag on page 153.
For the leader line:	

If you want to...	then
change the line color, weight, or style	see Changing Display Properties for Callout Tags on page 153.
change the location of the leader line	see Adjusting the Callout Leader Line on page 151.

Changing the Callout Tag for a Callout

The callout tag consists of the callout head, callout bubble, and leader line. (See [Callout Tag Parts](#) on page 146.) You define the style of the callout head and the radius of the corners of the callout bubble in the callout tag. (See [Creating a Callout Tag](#) on page 153.) To assign a callout tag to an existing callout, use the following procedure.

NOTE Define the line weight, color, and style for the callout bubble and the leader line in the project. See [Changing Display Properties for Callout Tags](#) on page 153.

To change the callout tag

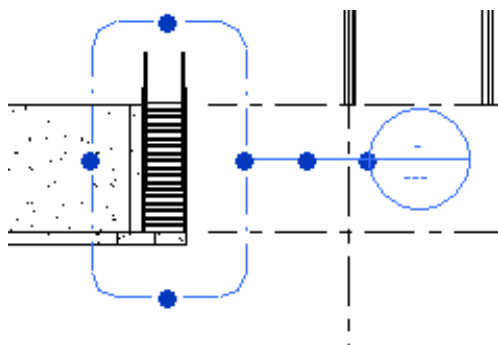
- 1 In the parent view, select the callout bubble.
- 2 Click View tab ► Graphics panel ► View Properties.
- 3 In the Instance Properties dialog, click Edit Type.
- 4 In the Type Properties dialog, for Callout Tag, select the callout tag to use.
If the desired callout tag is not listed, you can create a new call out tag. See [Creating a Callout Tag](#) on page 153.
You can specify the reference label for a reference callout in the Type Properties dialog. (See [Reference Callouts](#) on page 154.) If the callout view is a detail view, you can also specify the section tag to use for this callout.
- 5 Click OK twice to save your changes.

Changing the Boundaries of a Callout

The boundaries of the callout bubble define the part of the building model that displays in the callout view.

To change the callout boundaries, do either of the following:

- In the callout view, drag the crop region boundaries.
- In the parent view of the callout, select the callout bubble. Drag a blue dot to change a boundary of the callout.



If you change a callout boundary in one view, Revit Architecture automatically updates the other view with the same changes.

NOTE You can change the boundaries of a detail callout or a view callout. Resizing the boundaries of a reference callout does not affect the crop region of the referenced view.

Adjusting the Callout Leader Line

In the parent view of a callout, you can move the leader line to any point on the callout bubble.

To adjust the callout leader line

- 1 In the parent view that displays the callout bubble, select the leader line.
A blue elbow control displays in the middle of the line.

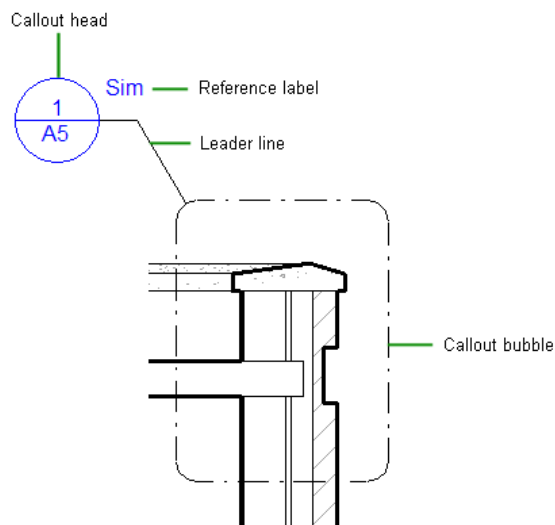
NOTE You may need to zoom in on the callout bubble to see the blue controls.

- 2 Drag the elbow control to the desired location, or drag the blue control near the callout head.
As you move the control, notice that the leader line attaches to different points on the callout bubble. The leader line segments snap to vertical and horizontal planes.

Callout Tags

The callout tag consists of the callout head, callout bubble, and leader line. (See [Callout Tag Parts](#) on page 146.) Use the Family Editor to create a callout head family to define the shape of the callout head and the information that it contains. In a project, create a callout tag to specify the callout head family to use and the radius of the corners of the callout bubble. To define the line weight, color, and style for the callout bubble and leader line, use Settings on the Manage tab.

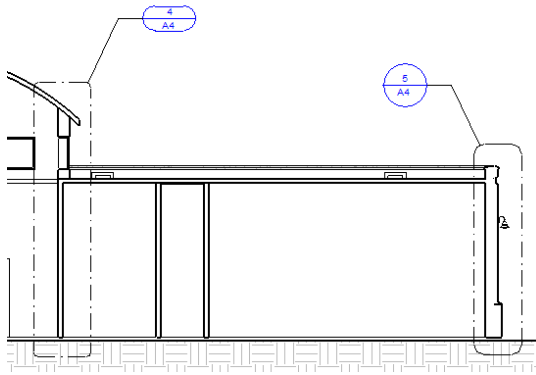
Parts of a callout tag






Creating a Callout Head Family

The callout head is the symbol that displays to identify a callout bubble in a parent view. You can create a callout head family to specify a desired format or to include specific information.

Callout tags that use different callout heads



To create a callout head family

- 1 Click  ► New ► Annotation Symbol.
- 2 In the Open dialog, select Callout Head.rft or M_Callout Head.rft.
- 3 Click Create tab ► Detail panel ► Line, and sketch the shape of the callout head.
See [Sketching Elements](#) on page 304.
- 4 If desired, click Text to add text to the callout head.
This text remains constant for each callout that uses this family.
- 5 Add labels to the callout head.
A label represents a variable field value that displays in the callout head. For example, the default callout head includes a detail number and sheet number. When you place the callout view on a sheet, the callout head in the parent view updates to show the detail number and the sheet number for the callout.
To add a label to the callout head, do the following:
 - a Click Create tab ► Annotate panel ► Label.
 - b Move the cursor to the drawing area, and click where you want the information to display in the callout head.
 - c On the Edit Label dialog, under Category Parameters, select the field to place in the callout head.
 - d Click  (Add parameters to label).
 - e Click OK.
- 6 If desired, add filled regions, masking regions, or other details to the callout head.
- 7 On the Quick Access toolbar, click  (Save), and specify a name and location for the new callout head family.
- 8 To load the callout head family into open projects, click Load into Project.

Creating a Callout Tag

When creating a callout tag, you can specify the following:

- The type of callout head to use. See [Creating a Callout Head Family](#) on page 151.
- The radius of the callout bubble.

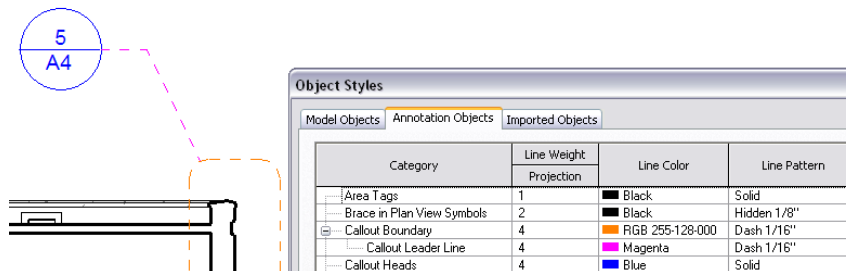
To specify the line weight, color, and style of the callout bubble or leader line, see [Changing Display Properties for Callout Tags](#) on page 153.

To create a callout tag

- 1 In a project, click Manage tab ► Project Settings panel ► Settings drop-down ► Callout Tags.
- 2 In the Type Properties dialog, for Callout Head, specify the type of callout head to use.
- 3 For Corner Radius, specify the radius of the corners for the callout bubble.
If your organization uses round callouts, set the radius to a large value.
- 4 Click OK.

Changing Display Properties for Callout Tags

You can control the line weight, color, and pattern used for callout bubbles and leader lines. The settings that you specify here apply to all callouts in the project.




To change the line styles for callout bubbles and leader lines

- 1 In a project, click Manage tab ► Project Settings panel ► Settings drop-down ► Object Styles.
- 2 Click the Annotation Objects tab.
- 3 Under Category, expand Callout Boundary.
- 4 Use the Line Weight, Line Color, and Line Pattern columns to specify the desired settings for callout boundaries, callout leader lines, and callout heads.
- 5 Click OK.

Visibility of Callouts

Revit Architecture offers several ways to control the visibility of callout bubbles in a view. If you cannot see callout tags in a view as expected, check the following:

- **Visibility/Graphics setting.** Open the view in which you want to see the callout tag. Click View tab ► Graphics panel ► Visibility/Graphics. On the Annotation Categories tab, under Visibility, make sure that Callouts is selected. (To hide all callout tags in the view, clear this option.)

- **Crop region.** If a callout tag does not display in the parent view, check whether the callout tag is outside the parent view's crop region. In the parent view, on the View Control Bar, click  (Show Crop Region). Expand the crop region to the limits of the drawing to find the callout tag. If needed, adjust the crop region to include the callout tag.
- **Hide at scales coarser than.** This view parameter can control whether the tag for a detail callout displays in other views. In the callout detail view, click View tab ► Graphics panel ► View Properties. The Show in parameter controls the Hide at scales coarser than value. When the Show in value is Parent View Only, Hide at scales coarser than is read-only. When the Show in value is Intersecting Views, you can change the value of the Hide at scales coarser than parameter. As a result, Revit Architecture displays the callout tag in any views that intersect the parent view perpendicularly, as long as the view scale is more detailed than the scale specified by Hide at scales coarser than.

Reference Callouts

A reference callout is a callout that refers to an existing view. When you add a reference callout, Revit Architecture does not create a view in the project. Instead, it creates a pointer to a specified, existing view. Multiple reference callouts can point to the same view.

Reference Callouts Overview

You can place reference callouts in plan, elevation, section, callout, and drafting views. Multiple reference callouts can point to the same view.

When using reference callouts, consider the following:

- Reference callouts in section, plan, elevation, or callout views can reference cropped views of the same type as the view in which the reference callout is placed.
- Reference callouts in drafting views can reference any plan, section, elevation, or callout view if the crop region displays in these views. Drafting views must use reference callouts; they cannot use detail callouts or view callouts. (See [Callout Types](#) on page 147.)

Check the properties of the referenced view to be sure that the Crop View parameter is turned on. See [View Properties](#) on page 259.

A reference callout does not have a parametric relationship with the referenced view. Therefore, if you change or resize a reference callout, the changes do not affect the original referenced view. For example, resizing the boundaries of a reference callout does not affect the crop region of the referenced view.

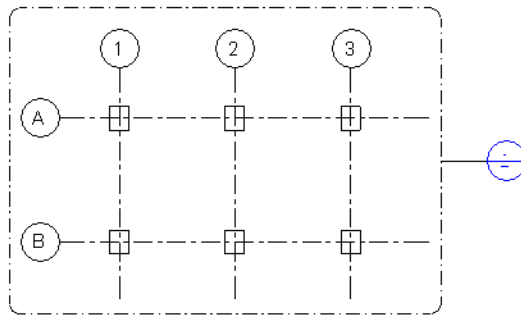
Creating a Reference Callout

NOTE To create a detail callout or a view callout, see [Creating a Callout View](#) on page 148.

- 1 Open the view in which you want to add a callout to a drafting view.
- 2 Click View tab ► Create panel ► Callout.
- 3 On the Options Bar, select Reference other view, and select a reference view name.
If there are no existing views to reference, select <New Drafting View> to create a new drafting view. The reference callout will then point to this new drafting view.

NOTE If the Reference Other View list includes a view on a sheet, the detail number and sheet number display next to the view name.

- 4 To define the callout area, drag the cursor from the upper-left to the lower-right, creating a callout bubble as shown by the dashed line enclosing the upper-left corner of the grid.



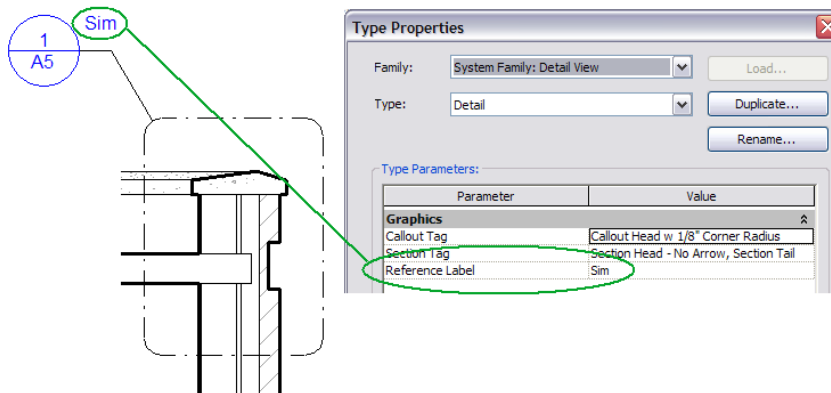
- 5 To see the callout view, double-click the callout head.

The callout view displays in the drawing area.

If you created a new drafting view for the reference callout, the new view displays in the Project Browser under Views (all) ► Drafting Views. Create the drafting view as desired. For instructions, see [Drafting Views](#) on page 1139.

Changing the Reference Label

By default, the callout head for a reference callout includes a label (such as Sim, an abbreviation of Similar). You can change this label to meet project needs or corporate standards. For example, you can use Mirror or Reverse as the reference label.



To change the reference label

- 1 In the parent view, select the callout bubble.
- 2 Click View tab ► Graphics panel ► View Properties.
- 3 In the Instance Properties dialog, click Edit Type.
- 4 In the Type Properties dialog, for Reference Label, enter the desired text.
- 5 Click OK twice to save your changes.

You can change the way that the reference label displays in the callout tag, or add the referencing detail or sheet numbers to the callout head. To do so, create a callout head family, and add labels that use these parameters. See [Creating a Callout Head Family](#) on page 151.

Modifying Callout Properties

- 1 In the Project Browser, right-click the callout view, and click Properties.
- 2 In the Instance Properties dialog, click in the Value text boxes to see the detail and sheet numbers.
You can also change the view name and scale, and manage crop regions.
- 3 Click OK.

Related topics

- [Detail View Instance Properties](#) on page 1137
- [View Properties](#) on page 259

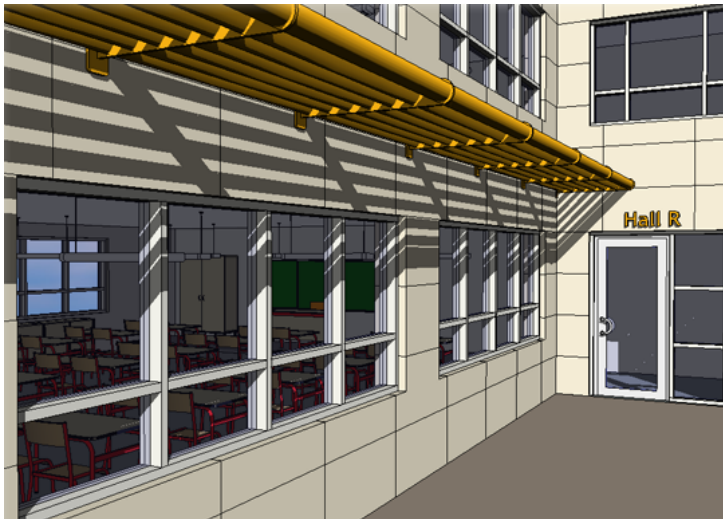
3D Views

You can create perspective and orthographic 3D views in Revit Architecture.

Perspective 3D Views

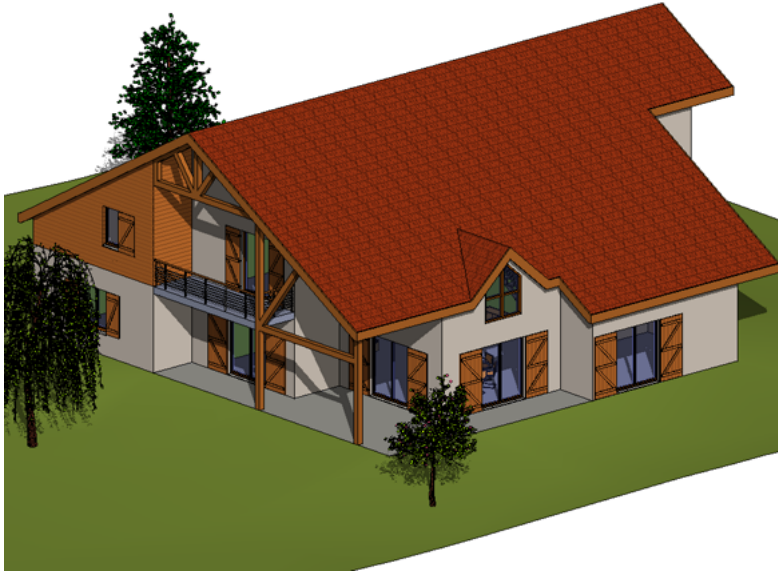
Perspective 3D views show the building model in a 3D view where components that are further away appear smaller, and components that are closer appear larger.

You can select elements in a perspective view and modify their type and instance properties. When you create or view a perspective 3D view, the View Control Bar indicates that the view is a perspective view.



Orthographic 3D Views

Orthographic 3D views show the building model in a 3D view where all components are the same size regardless of the camera's distance.



Creating a Perspective 3D View

You can create a perspective 3D view from a plan, section, or elevation view.

- 1 Open a plan, section, or elevation view.
- 2 Click View tab ► Create panel ► 3D View drop-down ► Camera.

NOTE If you clear the Perspective option on the Options Bar, the view that is created is an orthographic 3D view and not a perspective view.

- 3 Click in the drawing area to place the camera.
- 4 Drag the cursor to the desired target and click.

Revit Architecture creates a perspective 3D view and assigns a name to the view: 3D View1, 3D View2, and so on. To rename the view, in the Project Browser right-click it, and select Rename.

You can use a section box to limit the viewable portion of a 3D view. See [Using a Section Box in a 3D View](#) on page 159.

Creating an Orthographic 3D View

- 1 Click View tab ► Create panel ► 3D View.

This places the camera above the southeast corner of the model with the target positioned on the center of the ground floor. If you want to control camera placement when you create the view, use the following method:

- 2 Open a plan, section, or elevation view.
- 3 Click View tab ► Create panel ► 3D View drop-down ► Camera.
- 4 On the Options Bar, clear the Perspective option.
- 5 For Scale, select a view scale.
- 6 Click once in the drawing area to place the camera, and click again to place the target point.

An unnamed 3D view of the current project opens and displays in the Project Browser. If an unnamed view already exists in the project, the 3D tool opens the existing view.

You can rename the default 3D view by right-clicking the view name in the Project Browser, and clicking Rename. Named 3D views are saved with the project. When you rename the default, unnamed 3D view, the next time you click the 3D tool, Revit Architecture opens a new unnamed view.

You can use a section box to limit the viewable portion of a 3D view. See [Using a Section Box in a 3D View](#) on page 159.

Specifying the Background for a 3D View

After creating a 3D view, you can specify a gradient background for it, with different colors for the sky, horizon, and ground.

In an orthographic view, the gradient is a blend between the horizon color and the sky or ground color. In an orthographic view that is oriented to an elevation view or in a perspective view in which the horizon is visible, the sky meets the ground at the ground plane and blends with the horizon color. The horizon is set to the ground plane for the view (Level 1, by default).



NOTE When you render a 3D view, you can specify clouds and haze for the background of the rendered image. See [Specifying the Background for a Rendered Image](#) on page 1229.

When you export the view to an image or to a 2D DWF file, the gradient background is included. When you export the view to a 3D DWF file, the gradient background is not included.

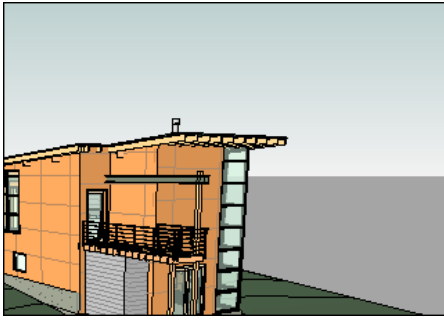
When you print a 3D view with a gradient background, you can print only using raster processing. To print the view using vector processing, you must first turn off the gradient background.

If you create a view template for a 3D view, the gradient background settings are stored as part of the template under Graphic Display Options.

To specify the background for a 3D view

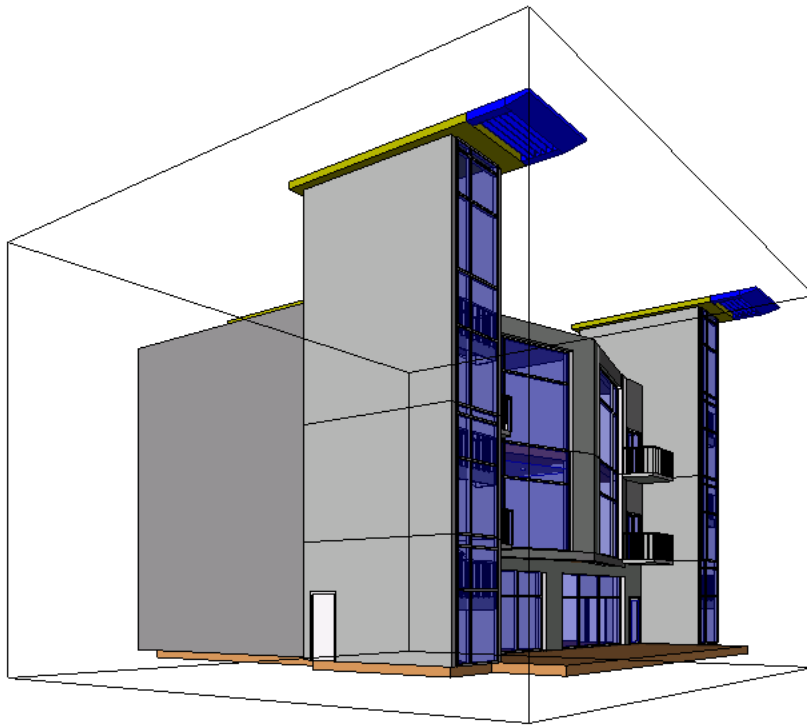
- 1 Open the 3D view.
- 2 Click View tab ► Graphics panel ►  (Graphic Display Options).
- 3 Under Background, select Gradient background.
- 4 Select the desired colors for the sky, horizon, and ground.
- 5 (Optional) If the horizon will be visible in the view, specify the ground level:
 - a In the Graphic Display Options dialog, for Sun Position, click  (Browse).
 - b In the Sun and Shadow Settings dialog, select Ground Plane at Level, and specify the level to use for the ground plane.
 - c Click OK.
- 6 In the Graphic Display Options dialog, click OK.

The view displays the gradient background, and the horizon and ground, if visible.



Using a Section Box in a 3D View

You can use a section box to clip the viewable portion of a 3D view. When you enable a section box in a 3D view, the only change to the view is the addition of the section box. The following image shows a 3D view with a section box enabled.

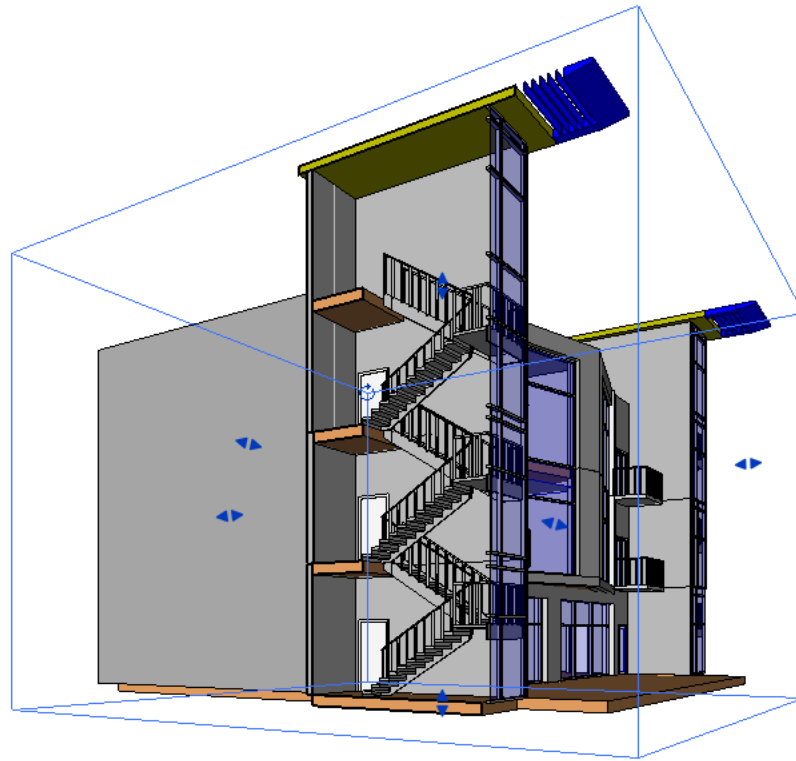


After you enable the section box, you can modify its extents using drag controls in the 3D view, or you can modify extents from other views, for example a plan or elevation view. Section box extents are not cropped by the view's crop region.

To enable a section box:

- 1 Open a 3D view.
- 2 Click Modify Cameras tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 3 In the Instance Properties dialog, under Extents, select the Section Box option.
- 4 Click OK.
- 5 Select the section box and use the drag controls to modify the extents, as necessary.

The following image shows the section box selected with the blue arrow drag controls visible. The section box extents have been modified to cut into the stair tower.



To modify section box extents outside of the 3D view:

- 1 Enable the section box in a 3D view.
- 2 Open an associated view, for example a plan or elevation view.
- 3 In the Project Browser, right-click the 3D view name, and click Show Section Box.
- 4 Drag the blue arrow controls to resize the section box.

To control visibility of section box extents:

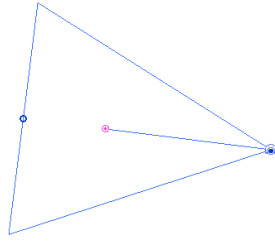
- 1 Click View tab ► Graphics panel ► Visibility/Graphics.
- 2 In the Visibility/Graphics dialog, click the Annotation Categories tab.
- 3 Clear the check box for Section Boxes, and click OK. This hides the section box extents in the view. Select the check box to show the extents.

Rotating a 3D View

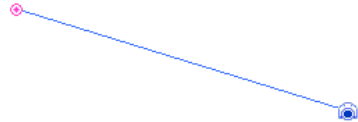
The target point defines the axis of rotation for a 3D view. You can rotate a 3D view about this axis by modifying the camera level and its focal point. You can tile your project views to see the effects of the rotation in different views.

- 1 Open the 3D view and any other views where you want to see the effects of rotation.
- 2 Click View tab ► Windows panel ► Tile.
- 3 In the Project Browser, right-click the 3D view name, and select Show Camera.

Camera for perspective 3D view



Camera for orthographic 3D view



The hollow blue dot is the focal point and the pink dot is the target point.

- 4 Drag the camera to modify the camera level. Drag the hollow blue dot to modify the focal point around the axis of rotation (the target point).

Displaying a 3D View

- Double-click the 3D view name in the Project Browser.
- If the view is open but hidden behind another view, click View tab ► Windows panel ► Switch Windows drop-down ► <view name>.

Specifying Camera Position in a 3D View

You can set the position of the camera in a 3D view. Changes made to the orientation or position of the 3D camera are considered temporary until they are saved. For information on saving a 3D view, see [Saving a 3D View Orientation as a Project View](#) on page 242.

- 1 Open a 3D view.

- 2 Right-click the ViewCube, and click Orient to View or Orient to a Direction.

Orient to View allows you to select another view. The camera moves to the same location as in the view you specify, and a section box is placed around the model that emulates the extents of the selected view.

NOTE To turn off the section box, in the Project Browser right-click the view name, and select Properties. In the Instance Properties dialog, clear the Section Box check box.

Orient to a Direction includes options to orient the camera north, south, east, west, northeast, northwest, southeast, southwest, or top (places the camera at the top of the model).

Modifying the Camera Position in a Perspective 3D View

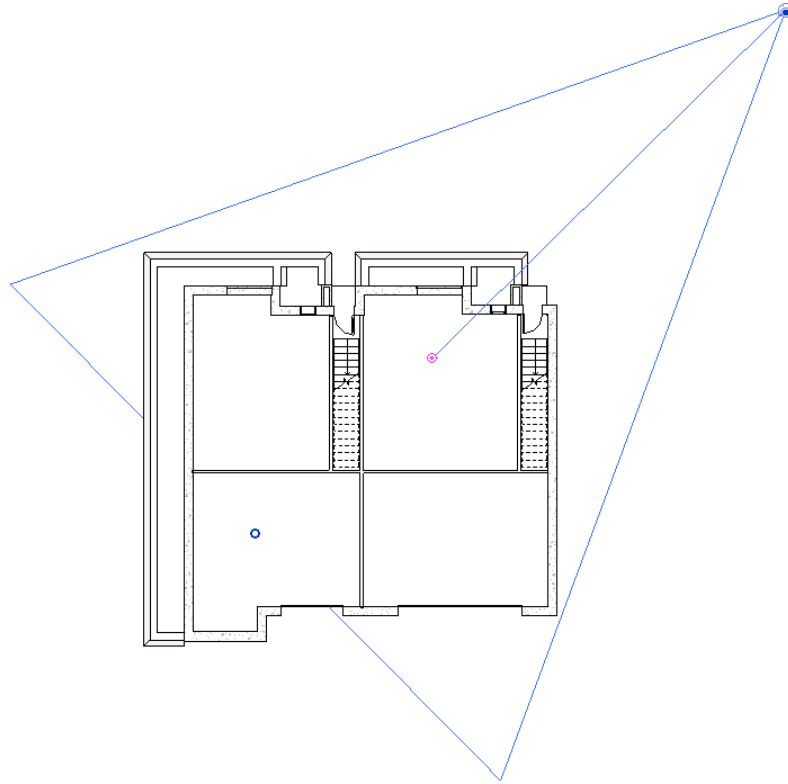
NOTE Changes made to the orientation or position of the 3D camera are considered temporary until they are saved. For information on saving a 3D view, see [Saving a 3D View Orientation as a Project View](#) on page 242.

1 Open the perspective 3D view.

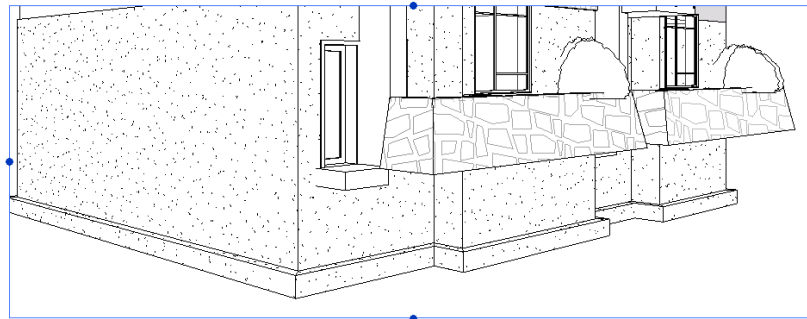
2 In the Project Browser, right-click the perspective 3D view name, and select Show Camera.

The camera is selected in all views where the camera is visible, such as plan, elevation, and other 3D views.

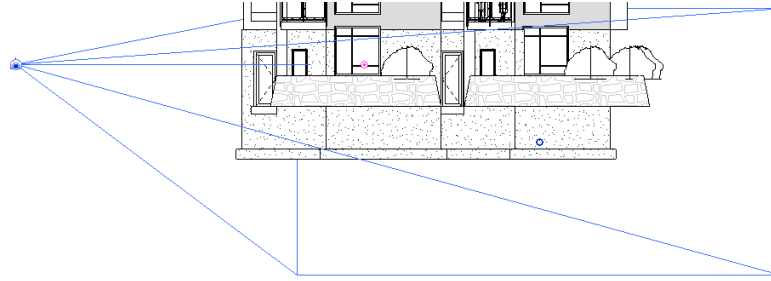
Selected camera in plan view



Selected camera in 3D view



Selected camera in elevation view



- 3 In the Project Browser, double-click the view in which you want to modify the camera position (for example plan or elevation).
- 4 Drag the camera to move it. The view updates according to the new camera position.
- 5 Drag the target to move it. The view updates according to the new target point.
- 6 Select the perspective view. Drag the handles to vary the field of view (FOV).

Turning Off the Camera in a 3D View

Turning off the camera in a 3D view is the same as showing or hiding the crop region. See [Showing or Hiding Crop Regions](#) on page 212.

To turn off the camera in any other view type, click a blank area in the drawing area.

3D View Properties

Parameter names, values, and descriptions for 3D views.

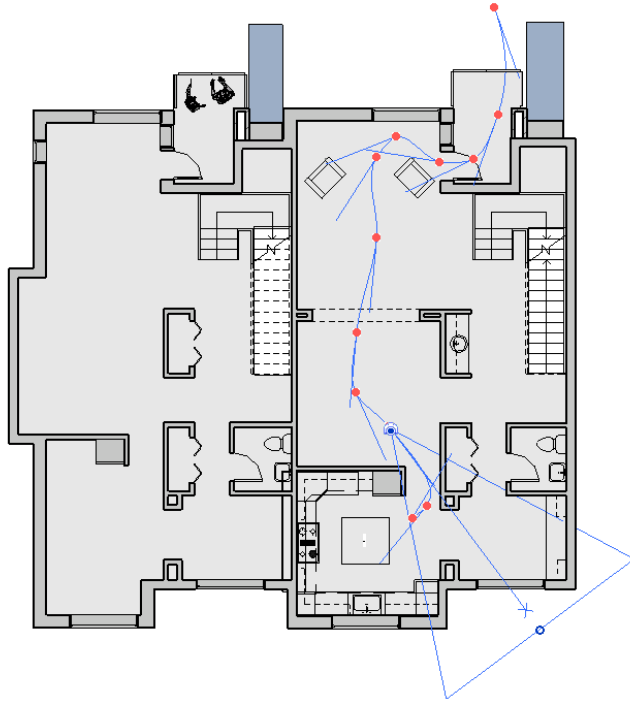
Name	Description
Graphics	
View Scale	The scale of the 3D view.
Scale Value	A ratio derived from the view scale. For example, if the view scale is 1:100, the scale value is the ratio of 100/1 or 100. If you select a value of Custom for the view scale, you can enter a ratio in the value field for this property.
Detail level	Applies the detail level setting to the view: coarse, medium, or fine.
Visibility/Graphics Overrides	Opens the Visibility/Graphics dialog, where you can set visibility options for the view.
Model Graphics Style	Changes the display to Hidden Line, Wireframe, Shading, or Shading with Edges.
Graphic Display Options	Click Edit to access the Graphic Display Options dialog, which controls shadows and silhouette lines.
Discipline	Select the discipline for the view from the list. Select Structural to hide non-load-bearing walls from the view.
Identity Data	

Name	Description
View Name	A name you define for the 3D view.
Title on Sheet	The name of the view as it appears on the sheet; it supersedes any value in the View Name property.
Default View Template	Identifies the default view template for the view. See View Templates on page 507.
Extents	
Crop View	Applies top, bottom, right, and left clip planes to the model. As you move the clip plane, part of the model is either hidden or shown.
Crop Region Visible	Turns on or off the visibility of the crop region.
Annotation Crop	Shows or hides the annotation crop.
Far Clip Active	Shows or hides the far clip plane.
Section Box	Turns on or off the visibility of the section box around a 3D view. The box is different from the crop region in that if you rotate the box, the model moves with it. The viewing area does not change. You can use the section box to clip the viewable portion of a 3D model; to see the clipping, when the section box is visible, you can resize it and rotate it with the handles.
Camera	
Render Settings	Settings used to create a rendered image of the 3D view. See Changing Render Settings for a View on page 1232.
Perspective	Indicates whether the 3D view is a Perspective view. See Creating a Perspective 3D View on page 157. This is a read-only value.
Eye Elevation	Height of the camera.
Target Elevation	Height of the target point.
Phasing	
Phase Filter	Phase Filter name applied to the view. See Phase Filters on page 1333.
Phase	The Phase name applied for the view. See Project Phasing on page 1331.
Type Properties	
Coarse poche material	Defines the material applied to capped faces in coarse-scale views. In coarse scale views, the default material is Poche. In medium and fine views, the capped faces of hosts display the layered structure of the host.

Walkthrough Views

A walkthrough is a camera that follows a path that you define. The path comprises frames and key frames. A key frame is a modifiable frame where you can change the direction and position of the camera.

A walkthrough path might look something like the following image. The red dots indicate key frames.



By default, walkthroughs are created as a series of perspective views, but you can also create them as orthographic 3D views.

Creating a Walkthrough Path

1 Open a view in which to place the walkthrough path.

NOTE Typically, the view is a plan view, but you can also make a walkthrough in other views, including 3D, elevation, and section views.

2 Click View tab ► Create panel ► 3D View drop-down ► Walkthrough.

3 If desired, on the [Options Bar](#) on page 99, clear the Perspective option to create a walkthrough as an orthographic 3D view. Also select a view scale for the 3D view.

4 If you are in a plan view, you can vary the height of the camera by offsetting it from a selected level. Enter a height in the Offset text box and select a level from the From menu. This can give you the effect that the camera is going up a flight of stairs.

5 Place the cursor in a view, and click to place a key frame.

6 Move the cursor in the desired direction to draw the path.

7 Click again to place another key frame. You can place key frames anywhere, but you cannot change their position during creation of the path. You can edit the key frames after you finish the path.

8 To finish the walkthrough path, you can do any of the following:

- Click Finish Walkthrough.
- Double-click to end the path.
- Press *Esc*.

After you finish placing camera key frames, Revit Architecture creates a walkthrough view under the Walkthroughs branch of the [Project Browser](#) on page 93 and assigns it the name Walkthrough 1.

Editing a Walkthrough Path

- 1 In the Project Browser, right-click the walkthrough view name, and select Show Camera.
- 2 To move the entire walkthrough path, drag the path to the desired location. You can also use the Move tool. See [Moving Elements with the Move Tool](#) on page 373.
- 3 To edit the path, click Modify Cameras tab ► Walkthrough panel ► Edit Walkthrough.
You can select which control in the path you want to edit from the drop-down menu. Controls affect the position and direction of the camera.

Dragging the Camera to a New Frame

- 1 For Controls, select Active Camera.
- 2 Drag the camera along the path to the desired frame or key frame. The camera snaps to key frames.
- 3 You can also type the frame number in the Frame text box.
- 4 While the camera is active and located at a key frame, you can drag the target point of the camera and the far clip plane. If the camera is not at a key frame, you can change only the far clip plane.

Changing the Walkthrough Path

- 1 For Controls, select Path.
The key frames become controls along the path.
- 2 Drag a key frame to the desired location.
Notice that the value in the Frame text box stays constant.

Adding Key Frames

- 1 For Controls, select Add Key Frame.
- 2 Place the cursor along the path, and click to add a key frame.


Removing Key Frames

- 1 For Controls, select Remove Key Frame.
- 2 Place the cursor on an existing key frame on the path, and click to remove it.

Displaying the Walkthrough View when Editing

As you edit a walkthrough path, you may want to see the results of your changes on the actual view. To open the walkthrough view, click Modify Cameras tab ► Walkthrough panel ► Open Walkthrough.

Editing Walkthrough Frames

- 1 Open the [Walkthrough Views](#) on page 164.
- 2 Click Modify Cameras tab ► Walkthrough panel ► Edit Walkthrough.
- 3 On the Options Bar, click the Walkthrough frame edit button .

The Walkthrough Frames dialog has 5 columns that show the frame properties:

- The Key Frame column displays the total number of key frames in the walkthrough path. Click a key frame number to display where that key frame appears on the walkthrough path. A camera icon displays at the selected key frame.
- The Frame column displays the frame at which the key frame displays.
- The Accelerator column displays numerical controls for changing the speed of the walkthrough playback at a specific key frame.
- The Speed column displays the speed at which the camera travels along the path at each key frame.
- Elapsed Time displays the amount of time that has elapsed since the first key frame.

4 By default, there is a uniform speed at which the camera travels along the entire walkthrough path. You can change the speed by increasing or decreasing the total number of frames or by increasing or decreasing the number of frames per second. Enter the desired value for either.

5 To change the accelerator value for key frames, clear the Uniform Speed check box, and enter a value for the desired key frame in the Accelerator column. Valid values for the Accelerator are between 0.1 and 10.

Cameras Along Path






To help you visualize the distribution of frames along the walkthrough path, select Indicators. Enter a value for the increment at which you want to see camera indicators.

Resetting Target Points

You can move the position of the camera's target point at a key frame, for example, to create the effect that the camera is looking side to side. To reset the target points back to following the path, click Modify Cameras tab ► Walkthrough panel ► Reset Cameras.

Controlling Walkthrough Playback

Several tools are available to control playback of a walkthrough while you are editing it. See [Editing a Walkthrough Path](#) on page 166.

- Click  to move the camera position back one key frame.
- Click  to move the camera position back one frame.
- Click  to move the camera position forward one frame.
- Click  to move the camera position forward one key frame.
- Click  to move the camera from its current frame to the last frame.
- To stop play back, click Cancel next to the Progress Bar or press *Esc*. Click Yes at the prompt.

Related topics

- [Editing Walkthrough Frames](#) on page 166
- [Editing a Walkthrough Path](#) on page 166


- [Exporting a Walkthrough](#) on page 168
- [Walkthrough Views](#) on page 164

Exporting a Walkthrough

You can export a walkthrough to an AVI or image file. When you export a walkthrough to an image file, each frame of the walkthrough is saved as an individual file. You can export all frames or a range of frames.

To export a walkthrough:

1 Open the walkthrough view.

2 Click  ➤ Export ➤ Images and Animations ➤ Walkthrough.
The Length/Format dialog opens.

3 Under Output Length, specify:

- All frames to include all frames in the output file(s).
- Frame range to export only a specific range of frames. For this option, enter the frame range in the entry boxes.
- Frames/second. As you change the number of frames per second, the total time automatically updates.

4 Under Format, specify Model Graphics Style, [Dimensions](#) on page 263, and Zoom to the desired values.

5 Click OK.

6 Accept the default output file name and path, or browse to a new location and enter a new name.

7 Select the file type, either AVI or an image file (JPEG, TIFF, BMP, or PNG).

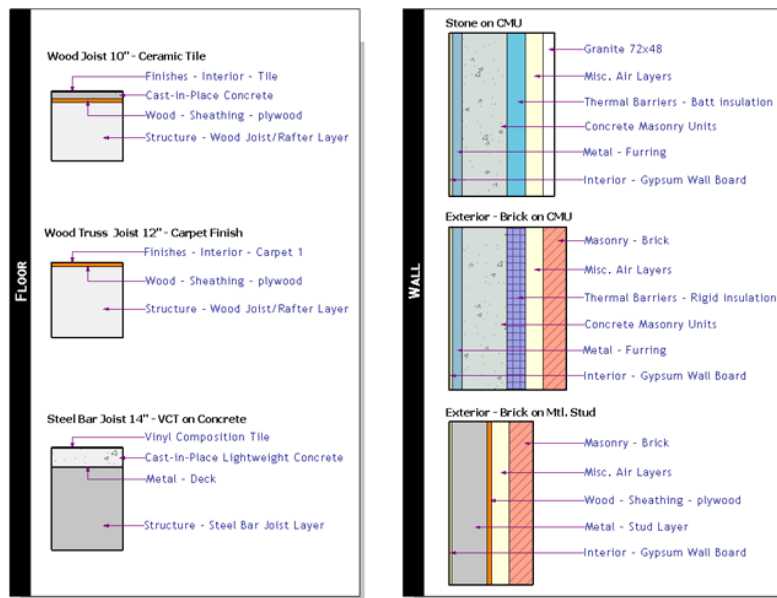
8 Click Save.

9 In the Video Compression dialog, choose a video compressor from the list of compressors you have installed on your computer.

10 To stop recording the AVI file, click Cancel next to the progress indicator at the bottom of the screen or press *Esc*.

Legend Views

Legends provide a way to display a list of the various building components and annotations used in a project.



Some typical legends include

- **Annotation Legend.** Displays sheet annotations such as section heads, level markers, spot elevation marks, elevation symbols, keynote symbol, revision tag, element tags, and other symbols that do not represent model objects. Each symbol has an associated piece of descriptive text. All symbols are shown at printed size.
- **Model Symbol Legend.** Displays symbolic representations of model objects with some descriptive text. Typical elements are electrical fixtures, plumbing fixtures, mechanical equipment, and site objects.
- **Line Styles Legend.** Displays a line in a selected line style and text identifying what that line style represents on drawings. Among the uses are fire rating lines, property lines, setback lines, electric wiring, plumbing, utilities, and center lines.
- **Materials Legend.** Displays a sample of a cut or surface pattern and text identifying the material associated with that pattern.
- **Phasing.** Shows a section of wall drawn with a selected graphic override and identifying text.

Legends can be added to multiple sheets. Any elements that can be placed in drafting views, such as detail lines, text, dimensions, and filled regions, can be placed in a legend.

Legend views are unique to each project, and therefore cannot be transferred from one project to another.

NOTE A component that is placed in a legend does not count as an additional instance of the component in the building model, and thus is not added to the number of instances of that component listed on a schedule or note block.

Visibility of Elements in Legends

You can modify legend views by turning off the visibility of subcategories in the view. For example, you can place several door legend components and then turn off all the door subcategories (except for Frame/Mullion) to produce a Door Frame Legend. For more information on category visibility, see [Visibility and Graphic Display in Project Views](#) on page 198.

Creating a Legend

- 1 Click View tab ► Create panel ► Legends drop-down ► Legend.
- 2 In the New Legend View dialog, enter a name for the legend view and select the view scale.
- 3 Click OK.

The legend view opens and is added to the Project Browser list.
- 4 Add the desired element symbols to the view using any of the following methods:
 - Drag model and annotation family types from the Project Browser into the legend view. They display as view-specific symbols in the view.
 - Alternate method for adding model family symbols:
 - a Click Annotate tab ► Detail panel ► Component drop-down ► Legend Component.
 - b On the Options Bar, for Family, select a model family symbol type.
 - c Specify the view direction for the symbol. Some symbols have more options than others. For example, wall types can be displayed in floor plan or section representations. Wall-hosted elements like doors can be represented in plan, and front and back elevations. If you are placing a hosted symbol, such as a door or window, the symbol displays with the host in floor plan representation. You can specify a value for the Host Length.
 - d Place the symbol in the view.
 - Alternate method for adding annotation symbols:
 - a Click Annotate tab ► Detail panel ► Symbol.
 - b Click Place Symbol tab ► Element panel, and from the Type Selector, select an annotation type and place the symbol in the view.
- 5 Click Annotate tab ► Text panel ► Text.
- 6 Click Place Text tab ► Element panel, and from the Type Selector, select the text type.

NOTE If the text size you want to use is not listed, click Place Text tab ► Element panel ► Element Properties drop-down ► Type Properties. In the Type Properties dialog click Duplicate to create a new text type.

- 7 Place the necessary text in the legend.

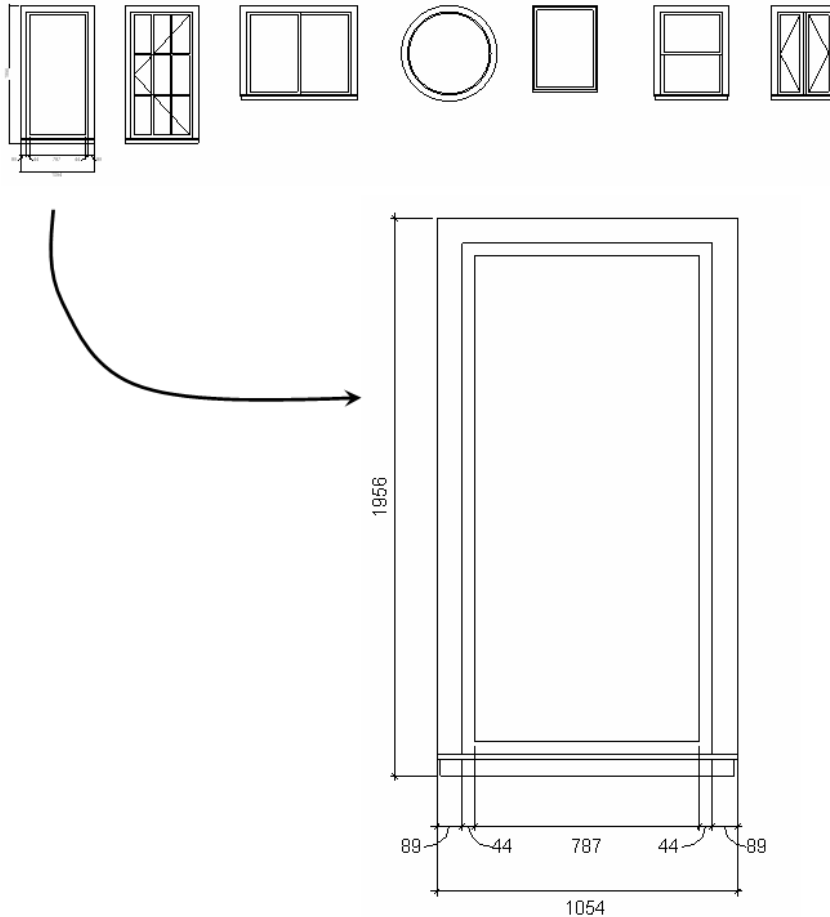
For more information about placing text, see [Text Notes](#) on page 1087.

Dimensioning Legend Components

You can add dimensions to individual legend components using the Dimension tool. See [Dimensions](#) on page 263 for more information.

You can dimension to most lines within a legend component. However, you cannot dimension to host components, such as walls, ceilings, and floors. Likewise, you cannot dimension system family components within a legend.

Window legend with first window dimensioned



Placing Components from a Legend into a Project View

You can use legend views as graphical palettes. This means that you can select a component in a legend view and use the Create Similar or Match tools to place the component in another view.

For more information on these tools, see [Copying Elements with the Create Similar Tool](#) on page 396 and [Changing Component Types Using the Match Type Tool](#) on page 397.

Modifying Legend Component Properties

- 1 Open a legend view.
- 2 Select a legend component, and click Modify Legend Components tab ► Element panel ► Element Properties.
- 3 In the Instance Properties dialog, specify the view direction, host length (if applicable), detail level, and component type.

By default, the legend component acquires its detail level from the project view. If the model family type was created to show different geometry at varying detail levels, you can change the look of the model symbol by specifying different detail levels for the view or the symbol itself.
- 4 Click OK.

Schedule Views

A schedule is a tabular display of information, extracted from the properties of the elements in a project. A schedule can list every instance of the type of element you are scheduling, or it can collapse multiple instances onto a single row, based on the schedule's grouping criteria.

Room Schedule						
Number	Area	Volume	Occupancy	Finishes		
				Floor Finish	Wall Finish	Ceiling Finish
5	115.37 SF	1673 CF	Shared	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
27	1988.39 SF	28833 CF	Shared	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
Circulation: 2 2103.76 SF						
10	436.32 SF	6327 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
13	313.14 SF	4541 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
14	358.36 SF	5196 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
15	350.66 SF	5085 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
17	235.44 SF	3414 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
18	235.44 SF	3414 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
21	265.59 SF	3851 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
22	235.44 SF	3414 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
25	268.48 SF	3893 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
26	262.69 SF	3809 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
Office: 10 2961.54 SF						
28	193.44 SF	2805 CF	Office	Ceramic Tile	N/A	Acoustic Tile 2'x2'
Open Work Area: 1 193.44 SF						
16	293.53 SF	4256 CF	Shipping/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
19	163.62 SF	2372 CF	Shipping/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
20	142.97 SF	2073 CF	Shipping/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
23	165.37 SF	2398 CF	Shipping/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
24	161.86 SF	2347 CF	Shipping/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
Reception: 5 927.35 SF						
6	58.30 SF	845 CF	Shared	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
7	311.76 SF	4521 CF	Shared	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
8	312.28 SF	4528 CF	Shared	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
9	53.79 SF	780 CF	Shared	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
Services: 4 736.13 SF						
2	108.14 SF	1568 CF	Office Support	Laminate	White Painted	Acoustic Tile 2'x2'
3	79.04 SF	1146 CF	Office Support	Laminate	White Painted	Acoustic Tile 2'x2'
Storage: 2 187.18 SF						

You can create a schedule at any point in the design process. As you make changes to the project that affect the schedule, it automatically updates to reflect those changes. You can add a schedule to a drawing sheet. See [Adding a Schedule to a Sheet](#) on page 1063.

You can export a schedule to another software program, such as a spreadsheet program.

Types of Schedules

You can create several types of schedules:

- Schedules (or Quantities)
- Key Schedules
- Material Takeoffs
- Annotation Schedules (or Note Blocks)
- Revision Schedules (see [Revision Schedules on Sheets](#) on page 1078)
- View Lists (see [Using View Lists](#) on page 258)
- Drawing Lists (see [Drawing Lists](#) on page 1066)

Formatting Schedules

You have several choices available for formatting the look of the schedule. You can

- Specify the order and type of properties to display
- Create totals
- Create your own custom properties, which you can then include in the schedule
- Apply phases to a schedule

Schedule Tips

- Mouse-wheel scrolling is available in schedule views. Move the mouse wheel to scroll vertically. Hold *Shift* and move the wheel to scroll horizontally.
- You can select an element in a non-schedule view from a schedule view. This works best if you are tiling windows. (To tile windows, click View tab ► Windows panel ► Tile.) To view an element in a non-schedule view, click in the element's cell in the schedule, and then click Modify Schedule/Quantities tab ► Schedule panel ► Highlight in Model. The Show Elements in View dialog displays. You can continue to click Show in this dialog to open other views that show the element.

Creating a Schedule or Quantity

- 1 Click View tab ► Create panel ► Schedules drop-down ► Schedule/Quantities.
- 2 In the New Schedule dialog, select a component from the category list. A default name appears in the Name text box, which you can change as necessary.
- 3 Select Schedule building components.

NOTE Do not select Schedule keys. If you want to create a key schedule, see [Key Schedules](#) on page 173.

- 4 Specify the phase.
- 5 Click OK.
- 6 In the Schedule Properties dialog, specify the schedule properties. See [Specifying Schedule Properties](#) on page 176.
- 7 Click OK.

Key Schedules

Schedules, particularly for windows, doors, or rooms, can comprise multiple items that have the same characteristics. For example, a room schedule might have 100 rooms with the same floor, ceiling, and base finishes. Rather than enter all this information manually for all 100 rooms in the schedule, you can define keys that automatically fill in information. If a room has a defined key, then as that room is added to a schedule, fields in the schedule automatically update, reducing the time required to produce the schedule.

You define keys using key schedules. Key schedules look very similar to component schedules, except that you define them to your specifications. When you create a key, it is listed as an instance property for the element. When you apply a value for the key, then the key's attributes are applied to the element.

Creating a Key Schedule

- 1 Click View tab ► Create panel ► Schedules drop-down ► Schedule/Quantities.

- 2 In the New Schedule dialog, select the schedule key category.
- 3 Select Schedule keys.

Revit Architecture automatically fills in the Key name. This is the name that appears among the element's instance properties. If desired, enter a new name.
- 4 Click OK.
- 5 In the Schedule Properties dialog, add the predefined fields for the style. For example, add ceiling finish, floor finish, and wall finish.
- 6 Click OK.

The key schedule opens.
- 7 Click Modify Schedule/Quantities tab ► Schedule panel ► New to add rows to the table.

Each row creates a new value for the key. For example, if you are creating a room key schedule, you can create key values for executive conference room, small conference room, large conference room, executive office, standard office, and so on.
- 8 Fill in the appropriate information for each of the key values.

Applying a Key to an Element

- 1 Select an element that has a predefined key. For example, you might select a room in a plan view.
- 2 Click Modify <Element> tab ► Element panel ► Element Properties.
- 3 In the Instance Properties dialog, find the key name (for example, Room Style).
- 4 Select a value for the property from the list.

When you apply the new style, read-only properties appear in the list of instance parameters. These are the properties defined in the key schedule.

Applying the Key to a Component Schedule

- 1 Create a schedule for the appropriate element (such as a room schedule).
- 2 Include in the scheduled fields the key name you created. For example, if you created a key name called Room Style, add this key to the schedule.
- 3 In the schedule, select values for the newly added key. For example, if the key is called Room Style, you add values for it by selecting them from the menus that appear under the key heading.


Scheduled fields update automatically with the information you define in the key schedule. If you edit and modify any values in the key schedule, they update automatically in the component schedule.

When you apply a key value to a schedule row, you cannot modify any fields defined in the key schedule.

Material Takeoff Schedules

Material takeoff schedules list the sub-components or materials of any Revit Architecture family. Material takeoff schedules have all the functionality and characteristics of other schedule views, but they allow you to show more detail about the assembly of a component. Any material that is placed in a component within Revit Architecture can be scheduled.

Wall Material Takeoff			
Family and Type	Material		
	Name	Area	Volume
Basic Wall: Foundation - 1' 5" Concrete	Concrete - Cast-in-Place Concrete	11353 SF	15673.94 CF
Basic Wall: Foundation - 3' 0" Footing	Concrete - Cast-in-Place Concrete	1177 SF	3118.74 CF
		12530 SF	18792.68 CF
Basic Wall: Exterior - Brick on CMU	Concrete - Precast Concrete	3754 SF	1084.31 CF
Basic Wall: Exterior - Brick on CMU - Entrance	Concrete - Precast Concrete	44 SF	13.14 CF
		3798 SF	1097.44 CF
Penthouse Screen Wall: Penthouse Screen Wall	Finishes - Exterior - Metal Panel	13166 SF	11520.28 CF
		13166 SF	11520.28 CF



NOTE When Revit Architecture computes the volume of materials for individual layers within a wall, some approximations are made to maintain performance. Minor discrepancies might appear between the volumes visible in the model and those shown in the material takeoff schedule. These discrepancies tend to occur when you use the wall sweep tool to add a sweep or a reveal to a wall, or under certain join conditions.

Creating a Material Takeoff Schedule

- 1 Click View tab ► Create panel ► Schedules drop-down ► Material Takeoff.
- 2 In the New Material Takeoff dialog, click a category for the material takeoff schedule, and click OK.
- 3 In the Material Takeoff Properties dialog, for Available Fields, select the material attributes.
- 4 Optionally, sort and group, or format the schedule. See [Specifying Schedule Properties](#) on page 176.
- 5 Click OK to create the material takeoff schedule.

The material takeoff schedule displays, and the view is listed in the Project Browser under Schedules/Quantities.

Annotation Schedules (Note Blocks)

Annotation schedules, or note blocks, list all instances of annotations that you can add using the Symbol tool. See [Creating an Annotation Symbol Family](#) on page 1132.

Note blocks are useful for listing notes that are applied to elements in your project. For example, you might want to attach a note to several walls, and that note might have a building description for each of the walls.

Creating an Annotation Schedule (Note Block)

- 1 Load the generic annotation family or families into your project and place them where desired.
Be sure to enter meaningful information in the parameter values for the annotation. For example, enter some comments for the Description parameter.
- 2 Click View tab ► Create panel ► Schedules drop-down ► Note Block.
- 3 In the New Note Block dialog, for Family, select a generic annotation.
- 4 For Note Block Name, enter a name for the new note block, if desired.
- 5 Click OK.
- 6 In the Note Block Properties dialog, for Available Fields, select the parameters to set, and then click Add to add them to Scheduled Fields list.
- 7 Complete any information in the additional Note Block properties tabs. For more information about the tabs, see [Specifying Schedule Properties](#) on page 176.

8 Click OK when finished.

Specifying Schedule Properties

After you have specified the desired type of schedule, you need to specify the information to include on the schedule and how the information should appear.

You set schedule properties in the Schedule Properties dialog. To access this dialog, right-click the schedule name in the Project Browser, and select Properties. Click Edit for any of the parameters in the Other category.

Selecting Fields for a Schedule

On the Fields tab of the Schedule Properties dialog, you can select the fields that appear in the schedule. The following table lists the tasks you can complete from this tab.

If you want to...	then...
add a field to the Scheduled Fields list	click a field name in the Available Fields box, and click Add. The order of the fields in the Scheduled Fields box shows the order in which they appear in the schedule.
remove a name from the Scheduled Fields list	select it from the Scheduled Fields list, and click Remove.
move a field up or down in the list	select the field, and click Move Up or Move Down.
add a custom field	click Add Parameter, and select whether to add a project parameter or shared parameter. For more information, see Custom Parameters on page 450.
modify a custom field	select the field, and click Edit. In the Parameter Properties dialog, enter a new name for the field. Click Delete to delete a custom field.
create a field whose value is calculated from a formula	click Calculated Value. Enter a name for the field, set its type, and enter the formula for it using existing fields in the schedule. For example, if you want to calculate an occupancy load based on the area of a room, you could add a custom field called Occupancy Load that is calculated from the Area field. Formulas support the same mathematical functions as in the Family Editor. For more information on creating formulas, see Using Formulas for Numerical Parameters on page 387.
create a field that is a percentage of another field	click Calculated Value. Enter a name for the field, set its type to percentage, and enter the name of the field to take a percentage of. By default, percentages are calculated based on the total for the entire schedule. If you set grouping fields in the Sorting/Grouping tab, you can choose one of those fields here. For example, if you group a room schedule by level, you can display what percentage of the total area of the level the room occupies.
add room parameters to a non-room schedule	for Select Available Fields From, click Room. This changes the list of fields in the Available Fields box to a list of room para-

If you want to...	then...
	meters. You can then add those room parameters to the list of scheduled fields.
include elements from linked models	select Include elements in linked files. For more information, see Including Elements from Linked Models in a Schedule on page 177.

Including Elements from Linked Models in a Schedule

You can include elements from linked models in schedules of model elements (such as doors, rooms, and walls) and in drawing lists. They are not supported for note blocks, view lists, or key schedules.

All fields that are available for elements in the host project are available for elements in linked models. The behavior of some fields changes when you add elements from linked models to a schedule. For example, the Family, Type, Family and Type, Level, and Material parameters become read-only for elements in both the host and linked model. You also cannot filter a schedule by the Family, Type, Family and Type, Level, or Material parameters.

You can include project information (such as the client name or the project address) and information about the linked Revit model (such as the instance name or the file name) in a schedule. Including information about the linked Revit model is useful when you have multiple copies of a linked model in your project (for example, multiple identical buildings on a site or multiple identical floors in a building) and you need to identify in the schedule which instance of the linked model each element comes from.

For more information, see [Specifying Project Information](#) on page 447. To learn how to specify the instance name for a linked Revit model, see [Linked Model Properties](#) on page 1285.

To include elements from linked models in a schedule:

- 1 In the Project Browser, right-click the schedule name, and select Properties.
- 2 In the Instance Properties dialog, for Fields, click Edit.
- 3 Select the Include elements in linked files option.
- 4 To include project information from a linked model, for Select Available Fields From, select Project Information. Add the desired fields from the Available Fields list to the Scheduled Fields list.
- 5 To include the linked model instance name or the file name, select RVT Links in the Select Available Fields From list. Add the desired fields from the Available Fields list to the Scheduled Fields list.

NOTE The file name does not include the file path or the file extension. In addition, if there are visible nested links in a linked model, the file name that displays for elements in the nested link is the parent link.

- 6 Click OK.

Including Project Parameters or Area Schemes from Linked Revit Models in a Schedule

- 1 In the linked Revit model project, create a schedule that contains the project parameter or area schemes.

Be sure that the schedule or area scheme has a unique name (one that is different from any schedules or area schemes that currently exist in the main model).

- 2 Add the schedule or area scheme to a sheet.
- 3 Select the schedule or area scheme on the sheet, and click Modify Schedule Graphics tab ► Clipboard panel ► Copy.
- 4 Open the main project.
- 5 If the Revit model (from which you want to include project parameters or area schemes) is already linked in the main project, unload the linked model.

To unload the linked Revit model:

- a Click Manage tab ► Manage Project panel ► Manage Links.
 - b In the Manage Links dialog, click the Revit tab.
 - c Select the linked model, and click Unload.
 - d Click Yes to confirm, and click OK to exit the Manage Links dialog.
- 6 In the main model, open a sheet view.
 - 7 Click Modify tab ► Clipboard panel ► Paste.
 - 8 If you unloaded the linked Revit model, you need to reload it.

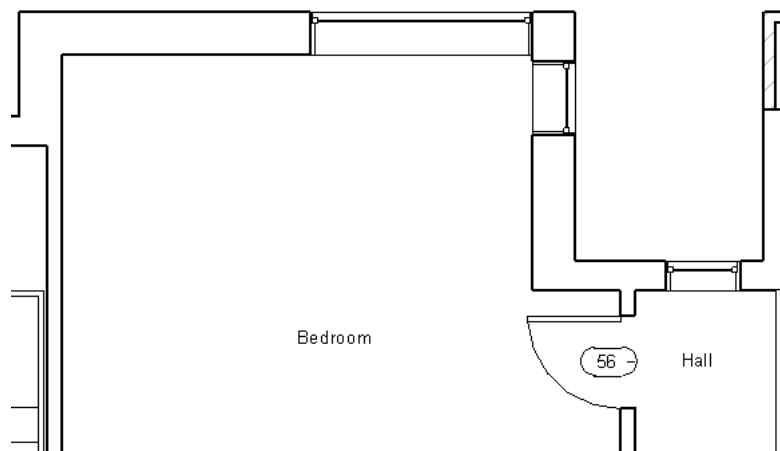
To reload the linked Revit model:

- a Click Manage tab ► Manage Projects panel ► Manage Links.
- b In the Manage Links dialog, click the Revit tab.
- c Select the linked model, and click Reload.
- d Click OK to exit the Manage Links dialog.

The project parameters or area schemes should now be available to schedule.

Including Room Information in a Door Schedule

You can include information in a door schedule about the room a door leads to and the room a door leads from. Typically, the door swing indicates the room the door is leading to or from. For example, in the following image door 56 leads from the hall to the bedroom.



If you change the door swing after you place the door, this will not automatically be reflected in the schedule. The schedule retains the data of the initial door placement. Therefore the particular door opening for door 56, always (by default) leads from the hall to the bedroom regardless of the door swing. If you want door 56 to lead from the bedroom to the hall, you can change the door swing in plan view, and then edit the appropriate field in the door schedule.

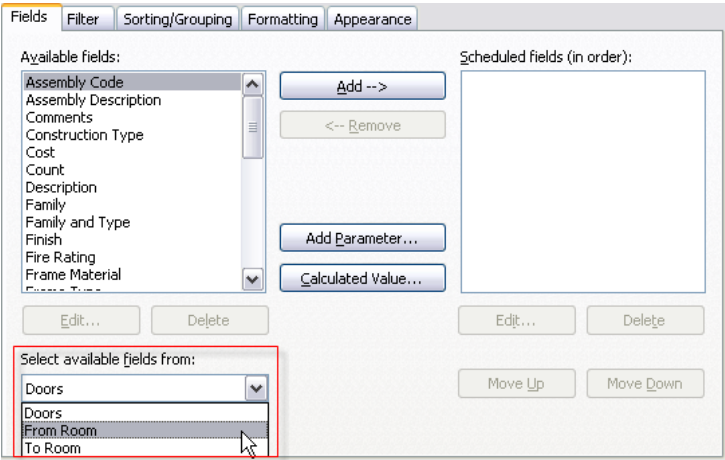
To include room information in a door schedule:

- 1 If you need to include room information in an existing door schedule, do the following:
 - a Open the door schedule.
 - b Right-click in the schedule and click View Properties.
 - c In the Instance Properties dialog, click Edit for the Fields parameter.

If you are creating a new door schedule, do the following:

- a Click View tab ► Create panel ► Schedules drop-down ► Schedules/Quantities.
- b In the New Schedule dialog, select Doors as the category, and click OK.

- 2 On the Fields tab, click From Room or To Room from the Select available fields from list.



The Available fields lists updates to show all the available parameters for a room, prefixed by either To Room or From Room.

- 3 Select the appropriate fields, and click OK.

The door schedule opens. Because To Room and From Room fields do not automatically reflect changes you make to the door swing, after you place the door, you can edit these fields by selecting a value from the list.

Door Schedule			
Family	Level	From Room: Name	To Room: Name
Bifold - 4 panel	1st Floor	CLOSET	HALL
Single-Flush	1st Floor	CLOSET	TOILET
Single-Glass 1	1st Floor	HALL	LIVING

Limiting Data Presented in a Schedule

On the Filter tab of the Schedule Properties dialog, you can create filters that limit the display of data in a schedule. You can create up to 4 filters, and all filters must be satisfied for the data to display. See [Schedule Views](#) on page 172.

Many types of scheduled fields can be used to create filters. Types include text, number, integer, length, area, volume, yes/no, level, and key schedule parameters.

Filtering is not supported for the following scheduled fields:

- Family
- Type
- Family and Type
- Area Type (in area schedules)
- From Room, To Room (in door schedules)
- Material parameters

You create a filter based on fields in the project. To create a filter based on a field that does not display in the schedule, you add the field to the Scheduled Fields list, then hide it on the Formatting tab.

An example of how you might use a filter is in a door schedule that you want to filter by level. In the Filter tab, you can choose Level as your filtering parameter and set its value to Level 3. Only the doors that are on level 3 display in the schedule.

Sorting Fields in a Schedule

On the Sorting/Grouping tab of the Schedule Properties dialog, you can specify sorting options for rows in a schedule, and add headers, footers, and blank lines to sorted rows.

You can also choose to show every instance of an element type, or collapse multiple instances onto a single row.

Also see [Sorting and Grouping Schedule Samples](#) on page 181.

You can sort by any field in a schedule, except Count.

If you want to...	then select...
specify a sort field	a field for Sort By, and select Ascending or Descending. Select additional sort fields for Then By, if necessary.
add the sorting parameter value as a header for the sort group	Header. For example, you have sorted a window schedule by Family and Type. A header might read M_Fixed: (Family) 0406 X 0610 (Type).
add footer information below the sort group	Footer. When you select Footer, you can select the information to display. <ul style="list-style-type: none">■ Title, count, and totals: Title shows the header information. Count shows the number of elements in the group. Both title and count appear left-justified below the group. Total shows the subtotal below a column that can have a total. Examples of columns having subtotals are Cost and Count. You can have totals calculated for these columns on the Formatting tab.■ Title and totals: Displays title and subtotal information.■ Count and totals: Displays both count values and subtotals.■ Totals only: Displays subtotals only for columns that can have them.

If you want to...

then select...

insert a blank line between sort groups

Blank Line.

itemize every instance of an element in the schedule

Itemize every instance. This option displays all instances of an element in individual rows. If you clear this option, multiple instances collapse to the same row based on the sorting parameter. If you do not specify a sorting parameter, all instances collapse to one row.

Sorting and Grouping Schedule Samples

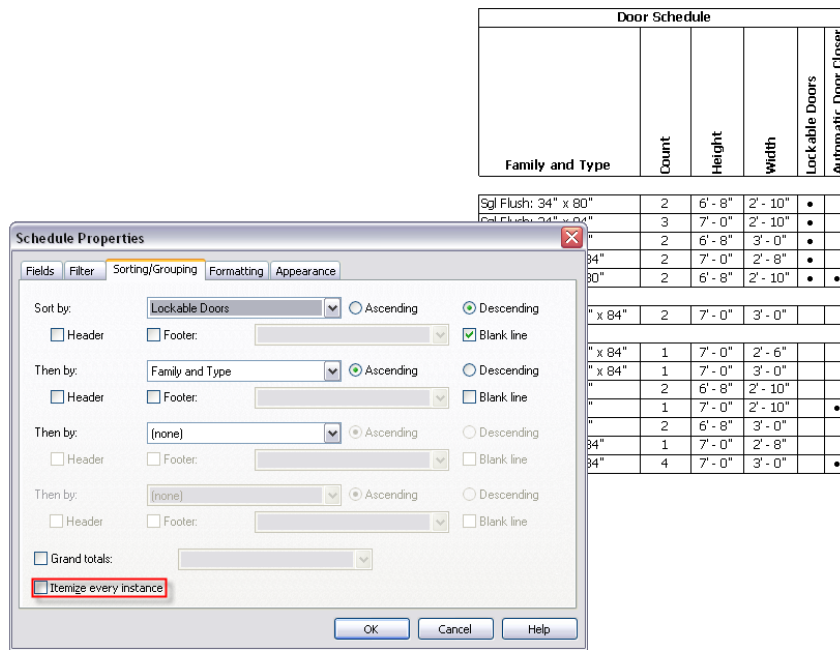
The following images illustrate sorting and grouping examples for schedules, including itemizing instances, sorting, and totals.

Itemizing Element Type Instances

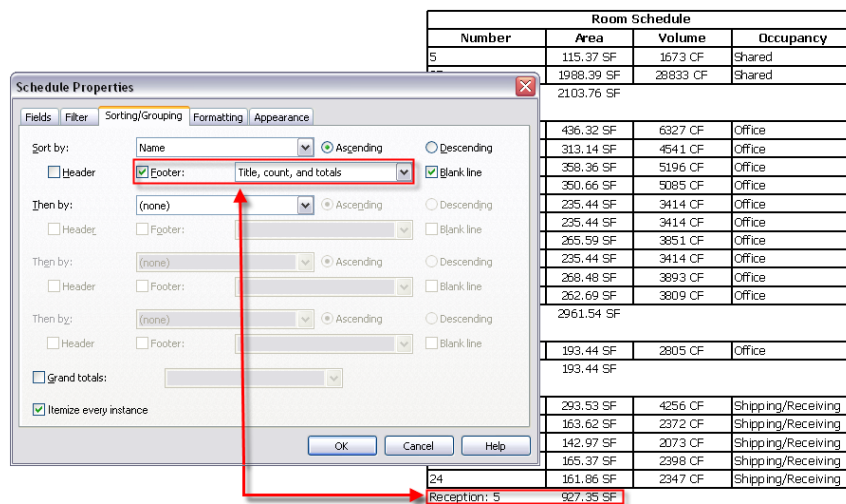
The following images show the same schedule, the first with the Itemize every instance option selected, and the second with this option cleared.

The screenshot shows the 'Schedule Properties' dialog box with the 'Sorting/Grouping' tab selected. The 'Itemize every instance' checkbox is checked and highlighted with a red box. The dialog box also shows settings for sorting by 'Lockable Doors' and 'Family and Type', with options for ascending/descending and blank lines. To the right is a sample schedule table titled 'Door Schedule'.

Family and Type	Count	Height	Width	Lockable Doors	Automatic Door Closer
Sgl Flush: 34" x 80"	1	6' - 8"	2' - 10"	•	•
80"	1	6' - 8"	2' - 10"	•	•
84"	1	7' - 0"	2' - 10"	•	•
84"	1	7' - 0"	2' - 10"	•	•
84"	1	7' - 0"	2' - 10"	•	•
80"	1	6' - 8"	3' - 0"	•	•
80"	1	6' - 8"	3' - 0"	•	•
84"	1	7' - 0"	2' - 8"	•	•
84"	1	7' - 0"	2' - 8"	•	•
80"	1	6' - 8"	2' - 10"	•	•
80"	1	6' - 8"	2' - 10"	•	•
86" x 84"	1	7' - 0"	3' - 0"		
86" x 84"	1	7' - 0"	3' - 0"		
80" x 84"	1	7' - 0"	2' - 6"		
86" x 84"	1	7' - 0"	3' - 0"		
80"	1	6' - 8"	2' - 10"	•	•
80"	1	6' - 8"	2' - 10"	•	•
84"	1	7' - 0"	2' - 10"	•	•
80"	1	6' - 8"	3' - 0"	•	•
80"	1	6' - 8"	3' - 0"	•	•
84"	1	7' - 0"	2' - 8"	•	•
84"	1	7' - 0"	3' - 0"	•	•



Sorted Schedule with Totals



Adding Grand Totals to a Schedule

- 1 In the Project Browser, right-click the schedule name, and select Properties.
- 2 In the Instance Properties dialog, for Sorting/Grouping, click Edit.
- 3 On the Sorting/Grouping tab, select Grand Totals to display the sum of the elements from all the groups.
Grand totals also display the sum of any columns with subtotals.
- 4 Select a display option from the drop-down menu:
 - **Title, count, and totals.** Title shows the header information. Count shows the number of elements in the group. Both title and count appear left-justified below the group. Total shows the subtotal below a column that can have a total. Examples of columns having subtotals are Cost and Count. You add these columns using the Formatting tab.

- **Title and totals.** Displays title and subtotal information.
- **Count and totals.** Displays count values and subtotals.
- **Totals only.** Displays subtotals only for those columns that can have them.

5 Click OK.

Adding Column Totals to a Schedule

- 1 In the Project Browser, right-click the schedule name, and select Properties.
- 2 In the Instance Properties dialog, for Formatting, click Edit.
- 3 Select the field to add a column total for, and select Calculate Totals.

NOTE Column totals will not appear if the Grand Totals option on the Sorting/Grouping tab is not selected. For information on grand total display options, see [Adding Grand Totals to a Schedule](#) on page 182.

4 Click OK.

Formatting a Schedule

On the Formatting and Appearance tabs of the Schedule Properties dialog, you can specify various formatting options, such as column orientation and alignment, grid lines, borders, and font style. Options you select on the Appearance tab display when you add a schedule to a sheet view.

Also see [Schedule Formatting Samples](#) on page 186.

Formatting Tab Options

If you want to...	then...
edit the title that appears above a column in a schedule	select a field to display it in the Heading text box. You can edit each column name.
specify the orientation of a column heading on a sheet only	select a field. Then for Heading Orientation, select an orientation option.
align text in the rows under a column heading	select a field, then select an alignment option from the Alignment drop-down menu.
format the appearance of numeric fields	see Formatting Units and Number Fields in a Schedule on page 184.
format the appearance of currency fields	see Formatting Currency Fields in a Schedule on page 185.
display subtotals for a numeric column in a group	select the field, then select Calculate Totals. This setting is available only for fields that can be totaled, such as room area, cost, count, or room perimeter. If you clear the Grand Totals option on the Sorting/Grouping tab, no totals display. For more information, see Adding Column Totals to a Schedule on page 183.

If you want to...	then...
hide a field in a schedule	select the field, then select Hidden field. This option is useful when you want to sort the schedule by a field, but you do not want that field to display in the schedule.

TIP You can show or hide any columns while in the schedule view. To hide a column, select a cell in the column, and then right-click. From the shortcut menu, select Hide Column(s). To display all hidden columns, right-click in the schedule view, and select Unhide All Columns.

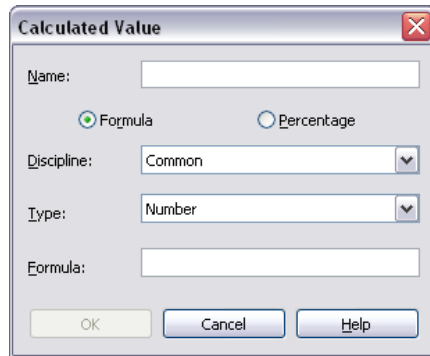
Appearance Tab Options

If you want to...	then select...
display grid lines around schedule rows	Grid lines, and then select the grid line style from the list.
extend vertical grid lines into headers, footers, and spaces	Grid in headers/footers/spacers.
display a border around the schedule	Outline, and then select a line style from the list. The border displays when you add a schedule to a sheet view. If you clear this option, but the Grid lines option is still selected, the grid line style is used as the border style.
specify the font for the heading text	a font from the list, enter a font size, and select bold or italic attributes.
display the title of the schedule	Title. To create a different underscore line style, select Underline, and then select the line style from the list.
display the scheduled fields as column titles	Column headers. To create a different underscore line style, select Underline, and then select the line style from the list.
insert a blank row before the data rows	Blank row before data. This option affects both the schedule segment on the sheet and the schedule view.
specify the font for the body text	a font from the list, enter a font size, and select bold or italic attributes.

Formatting Units and Number Fields in a Schedule

- 1 In the Project Browser, right-click the schedule name, and select Properties.
- 2 In the Instance Properties dialog, for Formatting, click Edit.
- 3 Select a length (includes height fields), area, volume, angle, or Number field from the list.

NOTE A Number field is a project parameter or calculated value that was created as a Number type. When you create a calculated value on the Fields tab of the Schedule Properties dialog, you see the Calculated Value dialog, where you can select the type. The following image shows this dialog with the Number type selected.



4 Click Field Format.

The Format dialog appears. The Use project settings option is selected by default. This means that values display according to the units setting in the project.

5 Clear the Use project settings option.

6 If you selected a length, area, volume, or angle field:

- a For Units, select an appropriate unit.
- b For Rounding, select an appropriate value. If you select Custom, enter a value in the Rounding increment text box.
- c If applicable, select a Unit symbol.

7 If you selected a Number field, select one of the following formatting options:

- **General.** Displays values with up to 6 decimal places, and removes trailing zeros.
- **Fixed.** Allows you to specify rounding, and preserves trailing zeros.
- **Percentage.** Multiplies the value by 100, and inserts a percent sign (%) adjacent to the value.

8 Click OK.

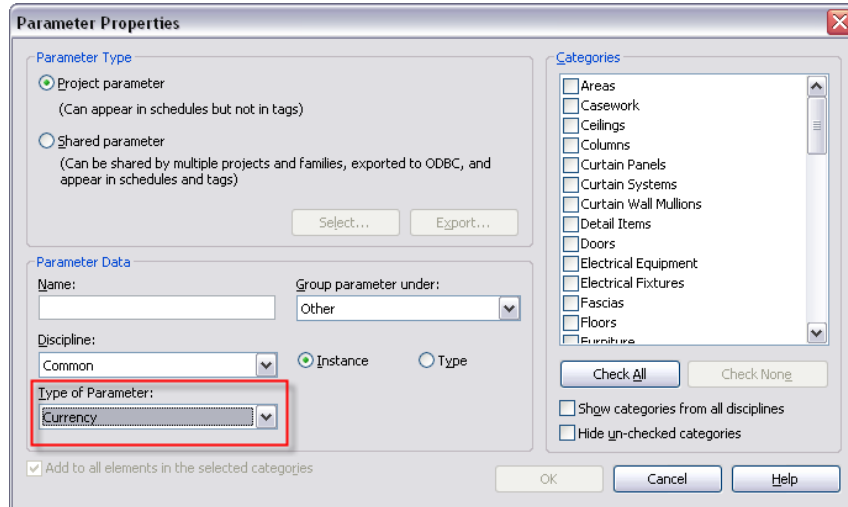
Formatting Currency Fields in a Schedule

1 In the Project Browser, right-click the schedule name, and select Properties.

2 In the Instance Properties dialog, for Formatting, click Edit.

3 Select the Cost field or a Currency field from the Fields list.

NOTE A Currency field is a parameter or calculated value that was created as a Currency type.



- 4 Click Field Format.
- 5 Clear the Use project settings option.
- 6 For Rounding, select an appropriate value. If you select Custom, enter a value in the Rounding increment text box.
- 7 For Unit symbol, select the appropriate currency symbol.
- 8 Optionally, select suppress trailing 0's.
When selected, trailing zeros do not display (for example, 123.400 displays as 123.4).
- 9 Optionally, select Use digit grouping.
When selected, the Decimal symbol/digit grouping option specified in the Project Units dialog is applied to the unit value.
- 10 Click OK.

Schedule Formatting Samples

The following images illustrate some examples of how you can format a schedule, including field formatting, showing or hiding grid lines, calculating totals, outlines, and underlines.

NOTE The grid lines, outlines, and underlines used in these samples are custom line styles. To create your own line styles, see [Creating a Line Style](#) on page 494.

Schedule Field Formatting

Schedule Properties

Format

☐ Use project settings

Units: Square feet

Rounding: 0 decimal places

Unit symbol: SF

☐ Suppress trailing 0's

☐ Suppress 0 feet

☐ Show + for positive values

☐ Use digit grouping

☐ Suppress spaces

Field Format...

OK Cancel Help

Room Schedule			
Number	Area	Volume	Occupancy
5	115 SF	1673 CF	Shared
	1988 SF	28833 CF	Shared
	2104 SF		
	436 SF	6327 CF	Office
	313 SF	4541 CF	Office
	358 SF	5196 CF	Office
	351 SF	5085 CF	Office
	235 SF	3414 CF	Office
	235 SF	3414 CF	Office
	266 SF	3851 CF	Office
	235 SF	3414 CF	Office
	268 SF	3893 CF	Office
	263 SF	3809 CF	Office
	2962 SF		
	193 SF	2805 CF	Office
	193 SF		
	294 SF	4256 CF	Shipping/Receiving
	164 SF	2372 CF	Shipping/Receiving
	143 SF	2073 CF	Shipping/Receiving
	165 SF	2398 CF	Shipping/Receiving
24	162 SF	2347 CF	Shipping/Receiving
	927 SF		
Reception: 5			

Calculating Totals

Schedule Properties

Fields

Number

Name

Area

Volume

Occupancy

Heading: Area

Heading orientation: Horizontal

Alignment: Center

Field formatting: ☒ Calculate totals

☐ Hidden field

Field Format...

OK Cancel Help

Room Schedule			
Number	Area	Volume	Occupancy
5	115.37 SF	1673 CF	Shared
	1988.39 SF	28833 CF	Shared
	2103.76 SF		
	436.32 SF	6327 CF	Office
	313.14 SF	4541 CF	Office
	358.36 SF	5196 CF	Office
	350.66 SF	5085 CF	Office
	235.44 SF	3414 CF	Office
	235.44 SF	3414 CF	Office
	265.59 SF	3851 CF	Office
	235.44 SF	3414 CF	Office
	268.48 SF	3893 CF	Office
	262.69 SF	3809 CF	Office
	2961.54 SF		
	193.44 SF	2805 CF	Office
	193.44 SF		
	293.53 SF	4256 CF	Shipping/Receiving
	163.62 SF	2372 CF	Shipping/Receiving
	142.97 SF	2073 CF	Shipping/Receiving
	165.37 SF	2398 CF	Shipping/Receiving
24	161.86 SF	2347 CF	Shipping/Receiving
	927.35 SF		
Reception: 5			

Schedule with Grid Lines

Room Schedule						
Number	Area	Volume	Occupancy	Floor Finish	Wall Finish	Ceiling Finish
5	115.37 SF	1673 CF	Shared	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
27	1988.39 SF	28833 CF	Shared	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
Circulation: 2						
10	436.32 SF	6327 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
13	313.14 SF	4541 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
14	358.36 SF	5196 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
15	350.66 SF	5085 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
17	235.44 SF	3414 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
18	235.44 SF	3414 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
21	265.59 SF	3951 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
22	235.44 SF	3414 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
25	268.48 SF	3993 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
26	262.69 SF	3809 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
Office: 10						
2961.54 SF						

FieldsFilterSorting/GroupingFormattingAppearance

Graphics

Build schedule:Top-downBottom-up

Grid lines:Grid Lines - CyanGrid in headers/footers/spacers

Outline:Wide Lines

Height:VariableBlank row before data

Text

Show TitleUnderline:Thin Lines

Show HeadersUnderline:Thin Lines

Header text:Tahoma25/128BoldItalic

Body text:Tahoma25/128BoldItalic

OKCancelHelp

	Ceramic Tile	N/A	Acoustic Tile 2'x2'
g/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
g/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
g/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
g/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
g/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
upport	Laminate	White Painted	Acoustic Tile 2'x2'
upport	Laminate	White Painted	Acoustic Tile 2'x2'
al Assistance	Hardwood	Wall Carpet	Acoustic Tile 2'x4'
al Assistance	Hardwood	Wall Carpet	Acoustic Tile 2'x4'

Schedule with Grid Lines and an Outline

Room Schedule						
Number	Area	Volume	Occupancy	Floor Finish	Wall Finish	Ceiling Finish
5	115.37 SF	1673 CF	Shared	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
27	1988.39 SF	28833 CF	Shared	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
Circulation: 2						
10	436.32 SF	6327 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
13	313.14 SF	4541 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
14	358.36 SF	5196 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
15	350.66 SF	5085 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
17	235.44 SF	3414 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
18	235.44 SF	3414 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
21	265.59 SF	3951 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
22	235.44 SF	3414 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
25	268.48 SF	3993 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
26	262.69 SF	3809 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
Office: 10						
2961.54 SF						

FieldsFilterSorting/GroupingFormattingAppearance

Graphics

Build schedule:Top-downBottom-up

Grid lines:Wide LinesGrid in headers/footers/spacers

Outline:Outline - Green

Height:VariableBlank row before data

Text

Show TitleUnderline:Thin Lines

Show HeadersUnderline:Thin Lines

Header text:Tahoma25/128BoldItalic

Body text:Tahoma25/128BoldItalic

OKCancelHelp

	Ceramic Tile	N/A	Acoustic Tile 2'x2'
g/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
g/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
g/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
g/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
g/Receiving	Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
upport	Laminate	White Painted	Acoustic Tile 2'x2'
upport	Laminate	White Painted	Acoustic Tile 2'x2'
al Assistance	Hardwood	Wall Carpet	Acoustic Tile 2'x4'
al Assistance	Hardwood	Wall Carpet	Acoustic Tile 2'x4'

Schedule with an Outline and Underlines

Room Schedule						
Number	Area	Volume	Occupancy	Floor Finish	Wall Finish	Ceiling Finish
5	115.37 SF	1673 CF	Shared	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
27	1988.39 SF	28833 CF	Shared	Ceramic Tile	White Painted	Acoustic Tile 2'x2'
Circulation: 2						
10	436.32 SF	6327 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
13	313.14 SF	4541 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
14	358.36 SF	5196 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
15	350.66 SF	5085 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
17	235.44 SF	3414 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
19	235.44 SF	3414 CF	Office	Ceramic Tile	Light Blue Painted	Acoustic Tile 2'x2'
21	265.59 SF	3851 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
22	235.44 SF	3414 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
25	268.48 SF	3893 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
26	262.69 SF	3809 CF	Office	Ceramic Tile	Light Green Painted	Acoustic Tile 2'x2'
Office: 10						
	2961.54 SF			Ceramic Tile	N/A	Acoustic Tile 2'x2'
g/Receiving						
				Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
g/Receiving						
				Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
g/Receiving						
				Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
g/Receiving						
				Granite Tile	Wall Carpet	Acoustic Tile 2'x2'
Ceramic Tile						
				White Painted		Acoustic Tile 2'x2'
Ceramic Tile						
				White Painted		Acoustic Tile 2'x2'
Ceramic Tile						
				White Painted		Acoustic Tile 2'x2'
Support						
				Laminate	White Painted	Acoustic Tile 2'x2'
Support						
				Laminate	White Painted	Acoustic Tile 2'x2'
al Assistance						
				Hardwood	Wall Carpet	Acoustic Tile 2'x4'
al Assistance						
				Hardwood	Wall Carpet	Acoustic Tile 2'x4'

Applying a Phase to a Schedule

- 1 In the Project Browser, right-click the schedule name, and click Properties.
- 2 In the Instance Properties dialog, enter values for the Phase Filter and Phase parameters.
- 3 Click OK.

For more information on phases, see [Project Phasing](#) on page 1331.

Modifying Schedules

There are various ways to modify schedules to improve the readability and to keep them up to date with changes in your project.

Schedule Updates

All schedules update automatically when you modify the project. For example, if you move a wall, the square footage updates in a room schedule accordingly.

When you change the properties of building components in the project, the associated schedule updates automatically. For example, you could select a door in the project and change its manufacturer property. The door schedule would reflect the change to the manufacturer property.

Editing Cells in a Schedule

You can edit the cells in a schedule by clicking in them. You can either select a value from a list (if available) or enter text. As you add new values, they become available in that field's list.

To enter carriage returns in a text cell, press **Ctrl+Enter**. Carriage returns display when you place the schedule on a sheet.

For schedules grouped by type, changes to a type are propagated to all instances of that type within the project.

Grouping Column Headings in a Schedule

After you create a schedule, you may want to change its organization and structure by grouping columns. You can create several layers of headings and subheadings to provide more detail in your schedule.

1 Open a schedule view.

2 In the group header rows, click and drag to select the headings to group.

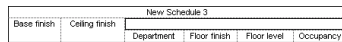
Be sure the cursor appears as an arrowhead as you select the headings, as shown in the following image.



New Schedule 3					
Base finish	Ceiling finish	Department	Floor finish	Floor level	Occupancy

3 Click Modify Schedule/Quantities tab ► Schedule panel ► Group, or right-click the selected headings, and click Group Headers.

A new heading row displays above the grouped column headings, as shown in the following image.



New Schedule 3					
Base finish	Ceiling finish	Department	Floor finish	Floor level	Occupancy

4 Enter text in the new row as necessary.

Text in the new heading row is centered.

To modify the text in a column group heading, click the heading field and edit the text. To delete the column heading row, select the heading and, click Modify Schedule/Quantities tab ► Schedule panel ► Ungroup, or right-click in the heading cell, and click Ungroup Headers.

Hiding Schedule Columns

1 Open a schedule view.

2 Right-click a column, and click Hide Column.

Deleting Schedule Rows

1 Open a schedule view.

2 Select a row in the schedule.

3 Click Modify Schedule/Quantities tab ► Schedule panel ► Delete.

Reusing Schedule Views

Schedule formatting can be saved as a view template and applied to or reused in another project. Templates can be applied to selected schedules or to all schedules on selected sheets. By default, new schedules can be based on a template through a setting on the Apply View Template dialog.

For more information on view templates, see [View Templates](#) on page 507

Saving Schedule Views to an External Project

Use the following procedure to save the format of a schedule view to an external Revit Architecture file for use in another Revit Architecture project.

- 1 In the Project Browser, right-click the schedule view name, and click Save to New File.
- 2 In the Save As dialog, enter a name for the file, and click Save.

This procedure saves the formatting of the schedule, but not the actual scheduled components.

Inserting Schedule Views from Another Project

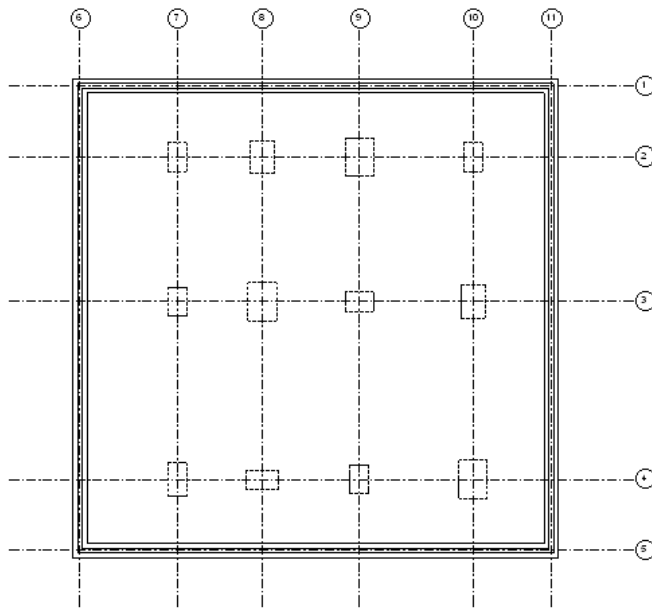
- 1 Click Insert tab ► Import panel ► Insert from File drop-down ► Insert Views from File.
- 2 Select a Revit Architecture project that contains the views to insert, and click Open.
All the views that are saved with the project, display in the Insert Views dialog.
- 3 Select the views to display from the list.
- 4 Check the views you would like to insert, and click OK.

A new schedule view is created in the Project Browser with all the saved formatting of the original schedule, and all the parameter fields that may have been customized for that schedule.

Foundation Footings Schedule Example

In this example, a footing schedule is created. The following illustration is used for the example.

Sample structural foundation plan used for creating schedule



- 1 Click View tab ► Create panel ► Schedules drop-down ► Schedule/Quantities.
- 2 In the New Schedule dialog, select Structural Foundation for Category.
- 3 For Name, enter Foundation Schedule.
- 4 Click OK.


- 5 In the Schedule Properties dialog, add the following available fields (in this order) to the Scheduled Fields list: Type, Length, Width, Volume, Count, and Comments.
- 6 Click the Sorting/Grouping tab.
- 7 Set the first Sort By list to Type.
- 8 Clear the Itemize every instance option.
- 9 Click OK.
- 10 You may add this schedule to a sheet. See [Adding a Schedule to a Sheet](#) on page 1063.

Exporting a Schedule

You can export a schedule as a delimited text file, which can be opened in many spreadsheet programs.

If you add a schedule to a sheet, you can export it as a CAD format.

To export a schedule:

- 1 Open a schedule view.
- 2 Click  ► Export ► Reports ► Schedule.
- 3 In the Export Schedule dialog, specify a name and directory for the schedule, and click Save. The Export Schedule dialog appears.
- 4 Under Schedule appearance, select export options:
 - Export column headers: specifies whether Revit Architecture column headers export.
 - One row: only the bottom column header exports.
 - Multiple rows, as formatted: all column headers export, including grouped column header cells.
 - Export group headers, footers, and blank lines: specifies whether sort group header rows, footers, and blank lines export.
- 5 Under Output options, specify how you want to display the data in the output file:
 - Field delimiter: specifies whether fields in the output file are separated by tabs, spaces, commas, or semi-colons.
 - Text qualifier: specifies whether the text in each field of the output file should be enclosed by a single or double quote, or no annotation.
- 6 Click OK.

Revit Architecture saves the file as delimited text, a format that can be opened in spreadsheet programs, such as Microsoft® Excel or Lotus® 123.

Duplicate Dependent Views

You can create multiple copies of a view that are dependent on the primary view. All copies, known as dependent views, remain synchronous with the primary view and all other dependent views, so that when view-specific changes (such as view scale and annotations) are made in one view, they are reflected in all views.

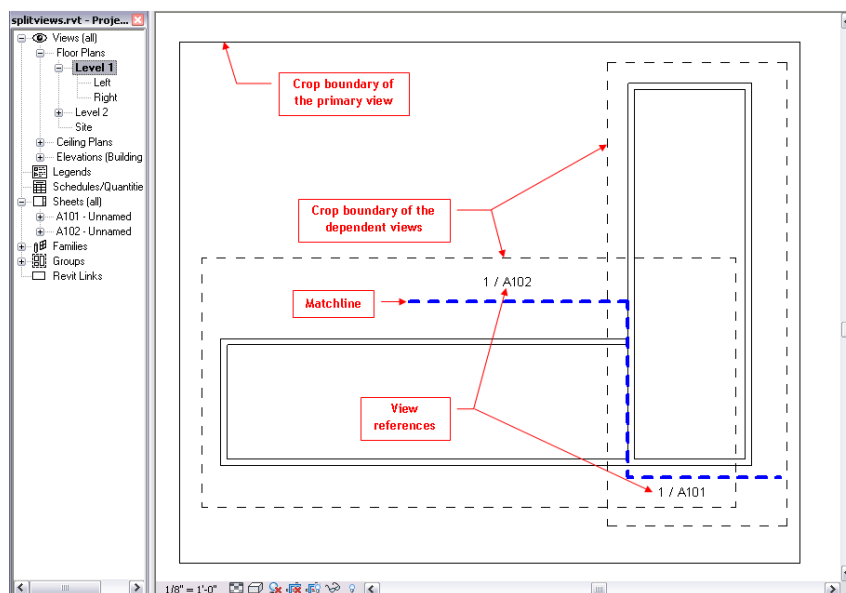
Creating dependent views may be useful in the following scenarios:

- You are working on a large project with an extensive floor plate, and you want to crop the view into smaller segments so you can place them on sheets. When you make changes to dependent segments of the view, you can quickly see how they effect the view as a whole by looking at the primary view.
- You need to place a view on more than one sheet.

Dependent views display in the Project Browser under the primary view. You can insert matchlines to indicate where the view is split, and view references to link views.

The following image shows a project view, Level 1, that has been split into 2 dependent views: Left and Right. Level 1 is the primary view and is shown in the drawing area with its crop region, and the crop regions for the dependent views visible, a matchline indicating where the view is split (dashed blue line), and view references (1/A102 and 1/A101).

NOTE In the following image, the graphic display of the matchline has been overridden. The default graphic display of a matchline is a dashed black line.



Supported View Types for Dependent Views

You can create dependent views for plan views, elevation views, section views, and callout views. When you create dependent section, elevation, or callout views, a new section, elevation, or callout symbol is generated on top of the original symbol. You can move the new symbol independently.

Visibility and Graphic Settings for Dependent Views

When you add view-specific information to a primary view or a dependent view, it is visible in all related views. You can specify visibility and graphic overrides to individual elements on a per-view basis. This allows you to clean up areas where there is overlap between related views. For more information, see [Hiding Elements in a View](#) on page 208.

Dependent Views and View Properties

A dependent view inherits view properties and view-specific elements from the primary view. Synchrony is kept between the primary view and dependent views for the following view properties:

- View Scale

- Display model
- Detail Level
- Visibility settings
- Model Graphics Style
- Graphic Display Options
- Hide at scales coarser than
- Underlay
- Underlay orientation
- Wall Join Display
- Discipline
- Color Scheme Location
- Color Scheme
- Phase Filter
- Phase
- Associated Level
- Default View Template
- View Range
- Depth Clipping
- Far Clipping
- Far Clip Offset

The following properties can vary between the primary view and dependent views:

- Orientation
- Identity Data properties (with the exception of the Default View Template property)
- Extent properties (with the exceptions of View Range and Associated Level)
- Scope Box
- Project parameters
- Shared parameters

Creating Dependent Views


1 In the Project Browser, select the view for which you want to create dependent views.

NOTE You cannot create a dependent view from another dependent view.

2 Click View tab ► Create panel ► Duplicate View drop-down ► Duplicate as Dependent, or right-click the view name, and click Duplicate View ► Duplicate as a Dependent.

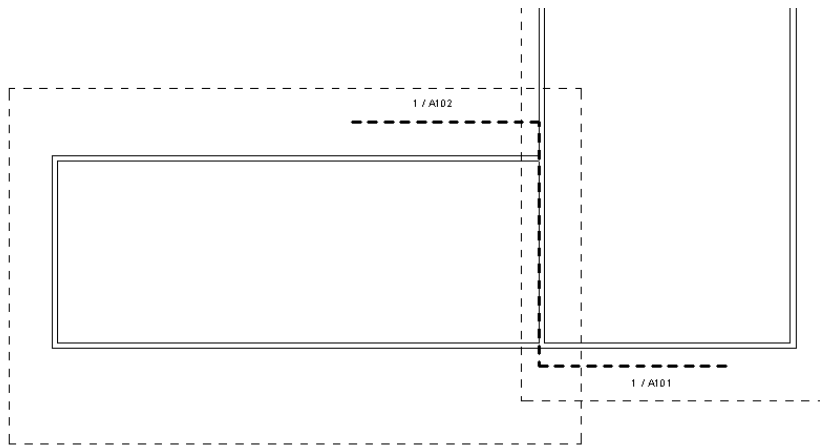
The dependent view opens. In the default Project Browser organization, the dependent view displays under the primary view. If you customize the Project Browser display, dependent views can be grouped and filtered like other view types.

- 3 Optionally, in the Project Browser, right-click the dependent view name, and click Rename. Enter a new name for the view, and click OK.
- 4 Select the crop boundaries and resize as necessary to show only the necessary portion of the view.

If crop regions are not visible click  (Show Crop Region) on the View Control Bar. You can display model and annotation crop regions. For more information, see [Crop Regions](#) on page 211.


Adding Matchlines for Dependent Views

Matchlines are sketch lines that you can add to a view to indicate where a view is split, as shown in the following image.



You can customize the look of matchlines by editing the line weight, color, and pattern in the Object Styles dialog. See [Object Styles](#) on page 493. You can add view references near a matchline to link views. See [Navigating Primary and Dependent Views](#) on page 196.

Adding a Matchline

- 1 Open the primary view from which your dependent views were created.
- 2 If crop regions are not visible, click  (Show Crop Region) on the View Control Bar. The crop region for the primary view and the crop regions for dependent views are visible.
- 3 Click View tab ► Sheet Composition panel ► Matchline.
- 4 Sketch the matchline.
- 5 When finished, click Finish Matchline.

Modifying a Matchline

To edit the matchline sketch:

- 1 Open any view in which the matchline is visible, and select the matchline.

- 2 Click Modify Matchline tab ► Edit panel ► Edit Sketch.
- 3 Edit the sketch line as necessary.
- 4 When finished, click Finish Matchline.

To override matchline graphic format in a view:

- 1 Click View tab ► Graphics panel ► Visibility/Graphics, or use the keyboard shortcut VG.
- 2 Click the Annotation Categories tab.
- 3 Select Matchline from the list.
- 4 Click Override in the Lines column.
- 5 In the Line Graphics dialog, select values for Line Weight, Line Color, and Line Pattern, and click OK.
- 6 Click Apply to see your changes, and click OK to exit the Visibility/Graphics dialog.

Matchline Properties

The following matchline properties are available for matchlines drawn in plan and callout views.

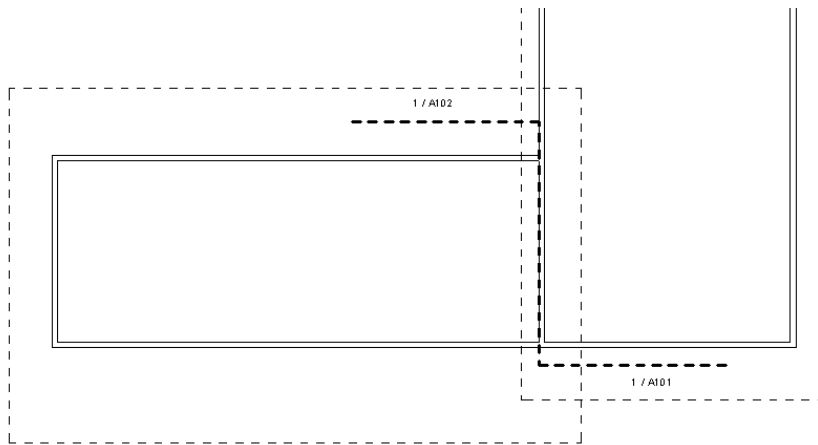
NOTE Matchline properties are not available in elevation or sections views, because specifying top and bottom level constraints do not apply in these view types.

Name	Description
Constraints	
Top Constraint	Specify the top level on which the matchline is visible.
Top Offset	Specify a distance above the top level on which you want the matchline to be visible.
Bottom Constraint	Specify the bottom level on which the matchline is visible.
Bottom Offset	Specify a distance below the bottom level on which you want the matchline to be visible.

Navigating Primary and Dependent Views

Use any of the following methods to navigate between primary and dependent views.

- To go to the primary view from a dependent view, right-click a dependent view crop boundary, and click Go to Primary View.
- To go to a dependent view from the primary view, right-click the crop boundary of the view you want to go to, and click Go to View.
- If there is a view reference, double-click it to open the view that it references. The following image shows view references (1/A102 and 1/A101) on the matchline.



A view reference is a symbol. You can create a view reference family in the Family Editor. View reference families can contain lines, filled regions, text and labels for the view number and sheet number parameter values.


To add a view reference:

- 1 Open the view to which you want to add a reference.

NOTE If the view is on a sheet, right-click the view, and click Activate View.

- 2 Click Annotate tab ► Tag panel ► View Reference.

- 3 On the Options Bar, select the target view.

Alternatively, click the crop region of the view you want to reference. If crop regions are not visible click  (Show Crop Region) on the View Control Bar.

- 4 Click in the drawing area to place the reference.

View references display in the primary view and all related dependent views (except for the view that it is referencing). For example, if you have a view split into 2 dependent views (left and right), and you add a view reference to the right view to reference the left, the view reference appears in the primary view and in the right view, but not in the left view.

To hide view references

- 1 Click View tab ► Graphics panel ► Visibility/Graphics, or use the keyboard shortcut VG.
- 2 Click the Annotation Categories tab.
- 3 Clear the check box for View Reference.

Related topics

- [Duplicate Dependent Views](#) on page 192
- [Adding Views to a Sheet](#) on page 1033

Propagating Dependent View Configuration

After you have set up dependent view configuration for one view, you can propagate the view and crop region configuration to parallel views of the same scale. New dependent views display in the Project Browser under the primary view, but are not placed on sheets.

To propagate dependent view configuration:

- 1 In the Project Browser, select the primary view to propagate.
- 2 Right-click the view name, and click Apply Dependent Views.
The Select Views dialog opens and displays parallel views of the same scale that do not already have dependent views.
- 3 Click to select the appropriate views.
- 4 Click OK.

The new dependent views display in the Project Browser under their primary view. Right-click the view, and click Rename to change the name, as necessary. Associativity is not maintained between the original set of views and the new set of views after the configuration is propagated.

Making a Dependent View Independent

In the Project Browser, right-click a dependent view, and click Convert to independent view.

Deleting Dependent Views

When you delete a view that has dependent views, all dependent views are also deleted. When you delete a dependent view, the view and all view references for that view are deleted.

- 1 In the Project Browser, select the view.
- 2 Right-click, and select Delete.

Visibility and Graphic Display in Project Views

You can override the visibility and graphic display of model elements, annotation elements, imported elements, linked Revit model elements, and workset elements for each view in a project. The settings that you are overriding are those specified at the project level. Project level settings are specified in the Object Styles dialog. See [Object Styles](#) on page 493.

You can override the cut, projection, and surface display for model categories and filters. For annotation categories and imported categories, you can edit the projection and surface display. In addition, for model categories and filters, you can apply transparency to faces. You can also specify visibility, half-tone display, and detail level of an element category, filter, or individual element.

Related topics

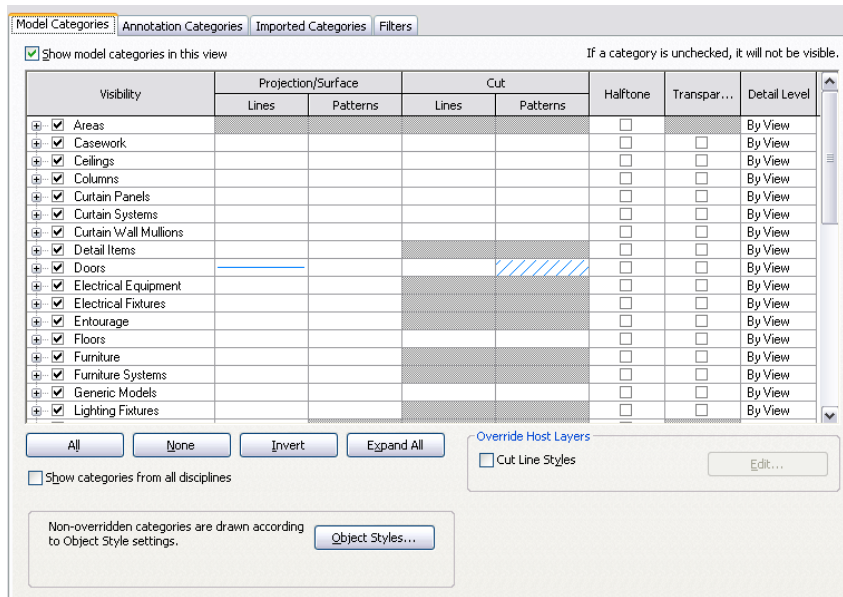
- [Changing the Line Style of Elements](#) on page 398
- [Defining the Graphic Display for Phase Statuses](#) on page 1335

Overview of Visibility and Graphic Display

Most overrides for visibility and graphic display are made in the Visibility/Graphics dialog. The exception is for individual element overrides; these are made in the View-Specific Element Graphics dialog.

From the Visibility/Graphics dialog, you can view overrides that have already been applied to a category. If the graphic display of a category has been overridden, the cell displays a preview of the graphic. If no overrides have been made to a category, the cell is blank, and the element displays as specified in the Object Styles dialog.

In the following image, the doors category has overrides for projection/surface lines and for cut pattern.



For information on visibility settings for elements in linked Revit models and elements in worksets, see [Visibility for Linked Revit Models](#) on page 1282 and [Controlling Workset Visibility](#) on page 1265.

Creating Views for Specific Purposes

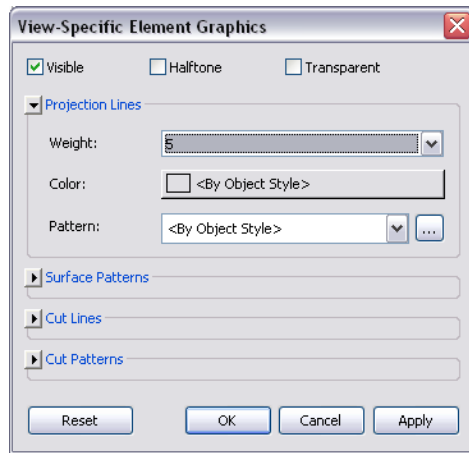
Because you can control element visibility and graphic display by view, you can create views for specific purposes. Some possibilities include:

- Furniture Layout—Show furniture half-toned on lighting RCP plan.
- Sprinkler Layout—Show sprinklers prominently on a half-toned ceiling plan.
- Furniture Plan—Show furniture and associated symbols, with room names and numbers, on a half-toned floor plan.
- Equipment Plan—As in an industrial kitchen layout: floor-mounted equipment shown prominently, wall-mounted equipment shown with an alternate line weight, and ceiling equipment (hoods) shown with a third line weight, on a half-toned power plan.
- Fire-Safety Plan—Show 1-hour, 2-hour, and other fire-rated enclosures on a half-toned floor plan in a manner so that you can distinguish the ratings. Overhead exit signs and sprinklers can appear in one color, and wall-mounted alarm devices and fire-extinguishers can appear in another color.
- Restoration Work—Show periods of existing materials in a building being reviewed for historic alterations. For example, 17th-century features shown in line weight 1, 18th-century features shown in line weight 2, and proposed alterations shown in line weight 3.

Overriding Visibility and Graphic Display of Individual Elements

NOTE If you need to override the visibility and graphic display for element categories, see [Overriding Graphic Display of Element Categories](#) on page 201 and [Specifying Element Category Visibility](#) on page 202. You can also override the graphic display of individual elements using the Linework tool. See [Changing the Line Style of Elements](#) on page 398.

- 1 Open the view in which you want to override the visibility or graphic display of individual elements.
- 2 In the drawing area, right-click the element you want to override, and click **Override Graphics** in **View ► By Element**.
The View-Specific Element Graphics dialog opens and displays the current visibility and graphic display settings for the element. You may need to expand the categories to view setting details.



- 3 In the View-Specific Element Graphics dialog, make your edits.

NOTE For annotation, import, and detail elements, only relevant override options display.

- **Visibility:** show or hide the element in the view.
- **Halftone:** blend the line color of an element with the background color of the view. All line graphics (including fill patterns) and solid fills are drawn halftone when this option is selected. Halftone has no effect on material color in shaded views. See [Halftone/Underlay](#) on page 497.
- **Transparent:** display only lines for the element and not surfaces.
When elements are transparent, only edges and fill patterns (including solid fills) are drawn on element faces. The faces between pattern lines are not drawn. In Hidden Line view and Shaded with Edges view, parts of edges are hidden. An edge can be hidden by the face of any non-transparent element and by a face of its own element (even when it is marked transparent). Edges are not hidden by other transparent elements.
- **Projection Lines:** edit the line weight, color, and pattern.
- **Surface Patterns:** edit visibility, color, and pattern.
- **Cut Lines:** edit the line weight, color, and pattern.
- **Cut Patterns:** edit visibility, color, and pattern.

After you edit any of the above, you can click **Apply** to keep the View-Specific Element Graphics dialog open and instantly see how the change affects the model.

- 4 When finished, click **OK**.

NOTE Individual element overrides are not stored in view templates.

Overriding Graphic Display of Element Categories

NOTE If you need to override the visibility or graphic display for an individual element, see [Overriding Visibility and Graphic Display of Individual Elements](#) on page 199.

- 1 Open the view in which you want to override the graphic display of element categories.
- 2 Right-click an element in the drawing area, and click **Override Graphics in View** ► **By Category**. When you use this method, the element's category is already highlighted when the **Visibility/Graphics** dialog opens.

Alternatively, you can click **View** tab ► **Graphics** panel ► **Visibility/Graphics**, or use the keyboard shortcut **VG** or **VV**.

NOTE If you open the **Visibility/Graphics** dialog from a drafting view, only those categories that can appear in a drafting view display.

- 3 If necessary, click the appropriate tab in the **Visibility/Graphics** dialog (**Model Categories**, **Annotation Categories**, or **Imported Categories**).

If you are overriding element categories in a linked Revit model

- a Click the **Revit Links** tab.
 - b Click the button in the **Display Settings** column.
 - c In the **RVT Link Display Settings** dialog, click **Custom**.
 - d Click the appropriate tab (**Model Categories**, **Annotation Categories**, or **Imported Categories**).
 - e Select **Custom** from the drop-down menu.
- 4 Highlight a category row.
 - 5 Click the **Override** button for the line or pattern to edit.

NOTE For annotation and imported categories, you can only override projection and surface display.

- 6 For lines, edit the line weight, line color, and line pattern. For patterns, edit the fill color and fill pattern.
- 7 (Optional) Select the **Halftone** check box next to a category to blend the line color of an element with the background color of the view. This produces a lighter shade for the line color. (See [Halftone/Underlay](#) on page 497.)
- 8 For model categories, you can also select a detail level at which to display the element category.
The detail level of the category overrides the detail level of the view. For example, you can set a wall to display at medium or fine detail level to see its structure, even if the view detail level is set to coarse.
You cannot set the detail level for subcategories. They inherit it from their parent category.
- 9 Click **Apply** to view your changes, and click **OK** to exit the **Visibility/Graphics** dialog.

Related topics

- [Controlling Visibility and Graphic Display of Elements Using Filters](#) on page 204
- [Removing Graphic Display Overrides for Element Categories](#) on page 202
- [Applying Transparency to Faces of Model Element Categories](#) on page 203

Removing Graphic Display Overrides for Element Categories

- 1 Open the view in which you want to remove graphic overrides.
- 2 Right-click an element in the drawing area, and click **Override Graphics in View** ► **By Category**. When you use this method, the element's category is already highlighted when the **Visibility/Graphics** dialog opens.

Alternatively, you can click **View** tab ► **Graphics** panel ► **Visibility/Graphics**, or use the keyboard shortcut **VG** or **VV**.

NOTE If you open the **Visibility/Graphics** dialog from a drafting view, only those categories that can be shown in a drafting view display.

- 3 If necessary, click the appropriate tab in the **Visibility/Graphics** dialog (**Model Categories**, **Annotation Categories**, or **Imported Categories**).
If you are editing element categories in a linked Revit model:
 - a Click the **Revit Links** tab.
 - b Click the button in the **Display Settings** column.
 - c In the **RVT Link Display Settings** dialog, click **Custom**.
 - d Click the appropriate tab (**Model Categories**, **Annotation Categories**, or **Imported Categories**).
 - e Select **Custom** from the drop-down menu.

- 4 Highlight a category row or rows.
- 5 Click the **Override** button for the line or pattern to edit.
- 6 Click **Clear Overrides**.
- 7 Click **Apply** to view your changes, and click **OK** to exit the **Visibility/Graphics** dialog.

When you remove a graphic display override, the element category displays in the view according to the settings specified in the **Object Styles** dialog. For more information, see [Object Styles](#) on page 493.

Specifying Element Category Visibility

NOTE For information about visibility settings for element categories in linked Revit models and worksets, see [Visibility for Linked Revit Models](#) on page 1282 and [Controlling Workset Visibility](#) on page 1265.

- 1 Right-click an element in the drawing area, and click **Override Graphics in View** ► **By Category**. When you use this method, the element's category is already highlighted when the **Visibility/Graphics** dialog opens.

Alternatively, you can click **View** tab ► **Graphics** panel ► **Visibility/Graphics**, or use the keyboard shortcut **VG** or **VV**.

NOTE If you open the **Visibility/Graphics** dialog from a drafting view, only those categories that can be shown in a drafting view display.

- 2 Click the **Model Categories**, **Annotation Categories**, or **Imported Categories** tab.
- 3 To set category visibility, select or clear the check box next to the category or subcategory. If you clear the check box for a category, all subcategories for that category will not be visible in the view.
- 4 To hide all categories, clear the check box at the top of the tab. For example, to hide all model categories, clear the **Show model categories in this view** check box.

By default, the Visibility/Graphics dialog lists only those element categories that are appropriate to the particular discipline of Revit you are working with (for example, Revit Architecture). To list categories from all disciplines, select the Show categories from all disciplines check box.

5 Click Apply to view your changes, and click OK to exit the Visibility/Graphics dialog.

Controlling Category Selection

- Click All to select all rows in the table. If the visibility of all categories is selected, you can clear it for all categories by clearing one category.
- Click None to clear the selection of any selected rows.
- Click Invert to change the selection of rows between the ones that are selected and the ones that are not. For example, if 6 rows are selected and you click Invert Selection, those 6 rows are no longer selected and all others are.
- Click Expand All to expand the entire category tree and make all subcategories visible. This makes it easier to select all categories and subcategories, using the All tool.
- Select a cell with a check box and press *Spacebar* to select or clear the check box.
- Select a category row with focus in the Visibility cell. Press *Right Arrow* to expand the category tree. Press *Left Arrow* to collapse the tree.

Applying Transparency to Faces of Model Element Categories

NOTE If you need to apply transparency to an individual model element face, see [Overriding Visibility and Graphic Display of Individual Elements](#) on page 199.

- 1 Open the view in which you want to apply transparency to model category faces.
- 2 Click View tab ► Graphics panel ► Visibility/Graphics, or right-click an element in the drawing area, and click Override Graphics in View ► By Category.
- 3 In the Visibility/Graphics dialog, click the Model Categories tab.
If you are editing model categories for elements in a linked Revit model:
 - a Click the Revit Links tab.
 - b Click the button in the Display Settings column.
 - c In the RVT Link Display Settings dialog, click Custom.
 - d Click the Model Categories tab.
 - e Select <Custom> from the drop-down menu.
- 4 Highlight a category row or rows.
- 5 In the Transparent column, select the check box.
- 6 Click Apply to view your changes, and click OK to exit the Visibility/Graphics dialog.

When elements are transparent, only edges and fill patterns (including solid fills) are drawn on element faces. The faces between pattern lines are not drawn. In Hidden Line view and Shading with Edges view, parts of edges are hidden. An edge can be hidden by the face of any non-transparent element, and by a face of its own element (even when it is marked transparent). Edges are not hidden by other transparent elements.

The following images show the same model in 3D view. The second image shows how part of the roof looks when transparency is applied.





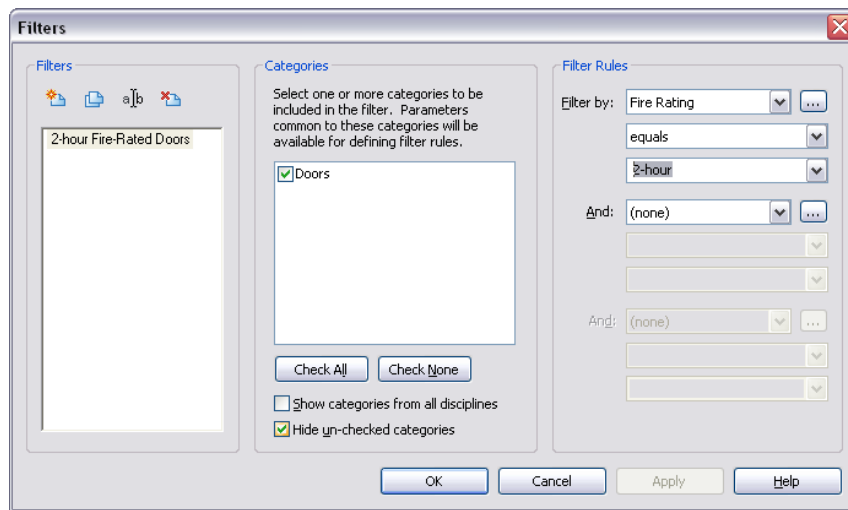
Controlling Visibility and Graphic Display of Elements Using Filters

Filters provide a way to override the graphic display and control the visibility of elements that share common properties in a view. For example, if you need to change the line style and color for 2-hour fire-rated walls, you can create a filter that selects all walls in the view that have the 2-hour value for the Fire Rating parameter. You can then select the filter, define the visibility and graphic display settings (such as line style and color), and apply the filter to the view. When you do this, all walls that meet the criteria defined in the filter update with the appropriate visibility and graphics settings.

Creating a Filter

1 Click View tab ► Graphics panel ► Filters.


2 In the Filters dialog, click  (New), or select an existing filter and click  (Duplicate).



NOTE If you open a Revit project that was created in Revit Structure, you may see in the list of available filters Selection Filters and Rule-based filters. You can modify and apply rule-based filters in Revit Architecture. You can also apply selection filters in Revit Architecture, but selection filters can only be modified in Revit Structure.

- 3 If you are creating a new filter, in the Filter Name dialog, enter a name for the filter.

If you are duplicating an existing filter, the new filter displays in the Filters list. For example, if you are duplicating a filter called 2-hour Fire-Rated Doors, the name 2-hour Fire-Rated Doors 1

displays in the Filters list. To rename the filter, click the name, and click  (or right-click the name, and click Rename).

- 4 Click OK.

- 5 Under Categories, click one or more categories to include in the filter.

The categories that you select determine the parameters that are available in the Filter By lists. The parameters that display are those that are common to all selected categories.

For example, you can create a filter to show only 2-hour fire-rated doors. In this case, you would select only the doors category. If you wanted to create a filter to show 2-hour fire-rated doors and walls, you would select the doors and walls categories.

- 6 From the Filter By list, select the parameter to filter by (for example, fire rating).

If the parameter you want to filter by is not in the list, click More Parameters to view additional parameters or to create a custom parameter. To create a custom parameter (for example, NIC [not in contract]):

- a In the Project Parameters dialog, click Add.
- b In the Parameter Properties dialog, enter the parameter data. In this example, the parameter name is NIC, the discipline is Common, the Type of Parameter is Yes/No, the parameter is grouped in the Instance Properties dialog under Other, the parameter is an instance parameter, and the parameter only applies to elements in the Casework and Furniture categories.

- c Click OK.
- d If elements are selected in the drawing area, the Parameter Value dialog opens. Specify a parameter value for the selected elements, and click OK.
- e In the Project Parameters dialog, click OK.
- f In the Filters dialog, select the parameter from the Filter By list.

For more information on creating custom parameters, see [Custom Parameters](#) on page 450.

7 Select the filter operator from the following options:

- **Equals.** The characters must match exactly.
- **Does not equal.** Excludes everything that does not match the value you enter.
- **Is greater than.** Looks for values greater than the value you enter. If you enter 23, values greater than but not equal to 23 are returned.
- **Is greater than or equal to.** Looks for values greater than or equal to the value you enter. If you enter 23, values of 23 and greater are returned.
- **Is less than.** Looks for values less than the value you enter. If you enter 23, values less than but not equal to 23 are returned.
- **Is less than or equal to.** Looks for values less than or equal to the value you enter. If you enter 23, values of 23 and lower are returned.
- **Contains.** Selects a character anywhere in a string. If you enter the character H, all attributes that contain the character H are returned.
- **Does not contain.** Excludes a character anywhere in a string. If you enter the character H, all attributes that contain the letter H are excluded.
- **Begins with.** Selects a character at the beginning of a string. If you enter the character H, all attributes that begin with H are returned.
- **Does not begin with.** Excludes a character at the beginning of a string. If you enter the character H, all attributes that begin with H are excluded.
- **Ends with.** Selects a character at the end of a string. If you enter the character H, all attributes that end with H are returned.
- **Does not end with.** Excludes a character at the end of a string. If you enter the character H, all attributes that end with H are excluded.

8 Enter a value for the filter, or select a value from the list (available for some parameter types).

NOTE If you select the equals operator, the value that you enter must match the search value. The search is case-sensitive.

9 Enter additional filter criteria as necessary. You can add up to 3 additional criteria. When you enter more than one filter criterion, elements must meet all criteria to be selected.

10 Click OK when you are done creating filter criteria.

Applying a Filter

1 Click View tab ► Graphics panel ► Visibility/Graphics, or type VV or VG to open the Visibility/Graphics dialog.

Alternatively, right-click an element in the drawing area, and click Override Graphics in View ► By Filter.

2 Click the Filters tab.

3 Click Add.

The Filters dialog opens, which contains a list of filters created in the project. If no filters exist in the project, click Edit/New to create a filter.

For details on creating a filter, see [Creating a Filter](#) on page 204.

4 Select a filter, and click OK.

5 Select or clear the Visibility check box to turn visibility of the filtered object on or off.

6 Override the projection, surface, and cut line styles and projection patterns as necessary.

7 Check the Halftone option to make filtered objects appear at halftone.

See [Halftone/Underlay](#) on page 497.

8 Check the Transparent option to make filtered objects transparent.

9 Click OK or Apply to activate the filter for that view.

Filters are view-specific. OK activates the filter and closes the dialog. Apply activates the filter and keeps the dialog open.

NOTE If multiple selection filters are applied to the same view, the order in which they are listed denotes priority. The selection filter nearest the top of the list takes precedence.

Related topics

- [Controlling Visibility and Graphic Display of Elements Using Filters](#) on page 204
- [Overriding Visibility and Graphic Display of Individual Elements](#) on page 199
- [Overriding Graphic Display of Element Categories](#) on page 201



Modifying Filter Criteria

1 Click View tab ► Graphics panel ► Filters.

Alternatively, click View tab ► Graphics panel ► Visibility/Graphics, click the Filters tab, and then click Edit/New.

2 In the Filters dialog, select the filter you want to modify from the filters list.

NOTE If you open a Revit project that was created in Revit Structure, you may see in the list of available filters Selection Filters and Rule-based filters. You can modify and apply rule-based filters in Revit Architecture. You can also apply selection filters in Revit Architecture, but selection filters can only be modified in Revit Structure.

- 3 To rename the filter, click . Enter a new name for the filter, and click OK.
- 4 To delete the filter, click . Click Yes to confirm the deletion.
- 5 Modify the categories and filter rules, as necessary.
- 6 Click OK.

Modifying Filter Visibility and Graphics Settings

- 1 Click View tab ► Graphics panel ► Visibility/Graphics, or type VV or VG to open the Visibility/Graphics dialog.
Alternatively, right-click an element in the drawing area, and click Override Graphics in View ► By Filter.
- 2 For Name, select the filter to modify.
- 3 Modify visibility, projection, surface, and cut line patterns and styles, halftone, and transparency, as necessary.
- 4 Click OK.

Hiding Elements in a View

You can hide individual elements or categories of elements in a view permanently or temporarily. When you hide an element that is used as a reference for a tag or a dimension, the tag or dimension is also hidden. Hiding a revision cloud does not affect the revision table.

Hiding Elements

- 1 In the drawing area, select the element to hide.
- 2 Click Modify <Element> tab ► View Graphics panel ► Hide drop-down ► Elements, By Category, or By Filter.
Alternatively, right-click the element, and click Hide in View ► Elements, By Category, or By Filter.

If you select Element, the element is hidden in the view. If you select By Category, all elements of that category are hidden in the view. If you select By Filter, the Filters tab on the Visibility/Graphic Overrides dialog displays for modifying, adding, or removing filters.

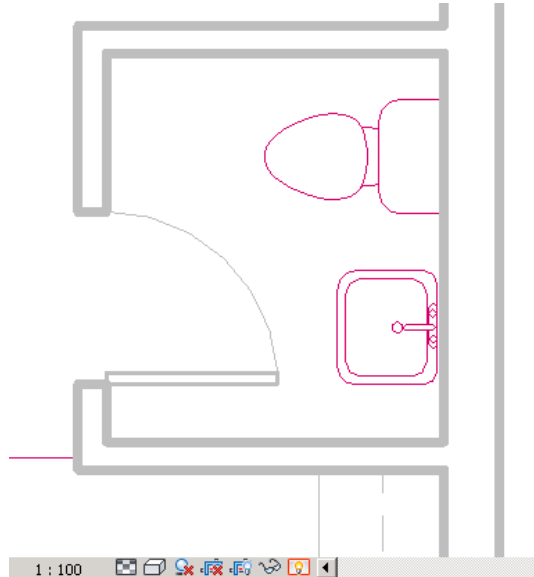
Related topics

- [Revealing and Unhiding Hidden Elements](#) on page 209
- [Temporarily Hiding or Isolating Elements or Element Categories](#) on page 209
- [Applying Transparency to Faces of Model Element Categories](#) on page 203
- [Controlling Visibility and Graphic Display of Elements Using Filters](#) on page 204

Revealing and Unhiding Hidden Elements

- 1 On the View Control Bar, click .

The Reveal Hidden Elements icon displays with a color border to indicate that you are in Reveal Hidden Element mode. All hidden elements display in color, and visible elements display in half-tone.



To unhide hidden elements:

- 2 Select the element.
- 3 Do one of the following:
 - Click Modify <Element> tab ► Reveal Hidden Elements panel ► Unhide Element or Unhide Category.
 - Right-click the element, and click Unhide in View ► Elements or Category.

NOTE The Unhide Element and Unhide Category options become active when you select an element that was hidden by element or, a category that was hidden by category.

- 4 On the View Control Bar, click  to exit Reveal Hidden Elements mode.

Temporarily Hiding or Isolating Elements or Element Categories

Temporarily hiding or isolating elements or element categories may be useful when you want to see or edit only a few elements of a certain category in a view. The Hide tool hides the selected elements in the view, and the Isolate tool shows the selected elements and hides all other elements in the view. The tool affects only the active view in the drawing area.


Element visibility reverts back to its original state when you close the project, unless you make the changes permanent. Temporary Hide/Isolate also does not affect printing.

To temporarily hide or isolate elements or element categories:


- 1 In the drawing area, select one or more elements.

2 On the View Control Bar, click  (Temporary Hide/Isolate) and then select one of the following:


- **Isolate Category.** In other words, if you select some walls and doors, only walls and doors will remain visible in the view.
- **Hide Category.** Hides all selected categories in the view. If you select some walls and doors, all walls and doors will be hidden in the view.
- **Isolate Element.** Isolates only the selected elements.
- **Hide Element.** Hides only the selected elements.

When you temporarily hide an element or element category, the Temporary Hide/Isolate icon displays with a border ().

To exit temporary hide/isolate mode without saving changes:

3 On the View Control Bar, click , and then click Reset Temporary Hide/Isolate.
All temporarily hidden elements are restored to the view.

To exit temporary hide/isolate mode and make changes permanent:

4 On the View Control Bar, click , and then click Apply Hide/Isolate to View.

If you make temporarily hidden elements permanent, you can reveal them at a later time, and unhide them if necessary. For information, see [Revealing and Unhiding Hidden Elements](#) on page 209.

Overriding Individual Lines in an Element

You can use the Linework tool to override the line style of individual element lines. For more information, see [Changing the Line Style of Elements](#) on page 398.

Overriding Host Layers

Using overrides, you can control the visibility of cut edges in host layers in plan and section views. The hosts to which you can apply an override are walls, roofs, floors, and ceilings. You can assign line weight, line color, and line pattern to each of the layer functions: Structure, Substrate, Thermal/Air, Finish 1, and Finish 2. You can also control the line styles for common edges, which occur when a line is common to 2 layers of differing functions. If both layers are drawn in line styles with the same pen weight, the properties assigned to common edges are used.

You can also select from the following core layer clean-up options:

- **Default.** This is the current behavior.
- **Use Function.** Ignores the material settings (the line is never invisible) and sets the style of the separating line based on the layers' functional priorities. The style of a separating line is determined by the layer with the higher functional priority.
- **Use Common Edge Style.** Ignores the functional priorities and material settings, and always uses the common edge style.
- **No Edge.** Sets the separating line to invisible whenever the layers have the same fill pattern.

The line styles that you assign to the host structure are view-specific; they are visible only in the view in which you create them. The overrides are applied to the cut edges of all hosts in the view.

Override Cut Line Styles

Use the override feature to assign different line weights to the cut lines and structural core lines of a wall in plan view.

- 1 Open a plan view.
- 2 Click View tab ► Graphics panel ► Visibility/Graphics.
- 3 Under Override Host Layers, select Cut Line Styles, and click Edit.
- 4 In the Host Layer Line Styles dialog, assign line weights, line colors, and line patterns to host layers, as desired.
- 5 For Core layer clean-up, select an option. See [Overriding Host Layers](#) on page 210.
- 6 Click OK.
- 7 In the Visibility/Graphics dialog, click OK.

Crop Regions

The crop region defines the boundaries for a project view. You can display a model crop region and an annotation crop region in all graphical project views. Perspective 3D views do not support the annotation crop region.

The following image shows a plan view with the model and annotation crop regions visible. The annotation crop is the exterior crop region, and the model crop is the interior crop region.

You can show or hide model and annotation crop regions. See [Showing or Hiding Crop Regions](#) on page 212. You can also resize a crop region by dragging the blue controls or by explicitly setting the size. See [Resizing Crop Regions Graphically](#) on page 212 and [Resizing Crop Regions Explicitly](#) on page 215.

Model Crop Region

The model crop region crops model elements, detail elements (such as insulation and detail lines), section boxes, and scope boxes at the model crop boundary. Visible crop boundaries of other related views are also cropped at the model crop boundary.


Annotation Crop Region

An annotation crop region fully crops annotation elements when it touches any portion of the annotation element, so that no partial annotations are drawn. Annotations (such as symbols, tags, keynotes, and dimensions) that reference hidden or cropped model elements do not display in the view, even if they are inside the annotation crop region. For example, if a door has been cropped from the view by the model crop, the door tag will not be visible even if it is positioned inside the annotation crop.


Datum (grids and levels) that cross the model crop region display their heads and tails so that they are visible inside the annotation crop boundary. Datum are not resized when you turn off the crop region, (the Do Not Crop View option) datum display at the original size they were drawn.

The annotation crop does not display by default, when you show crop regions in a primary view. The annotation crop does display by default, when you show crop regions in dependent views. For more information on primary and dependent views, see [Duplicate Dependent Views](#) on page 192.

Cropping a View

- 1 If the crop region is not visible, click  (Show Crop Region) on the View Control Bar.
- 2 Resize the crop region as necessary by using the drag control or setting the size explicitly.

For more information, see [Resizing Crop Regions Graphically](#) on page 212 and [Resizing Crop Regions Explicitly](#) on page 215.

3 On the View Control Bar, click  (Crop View).

Showing or Hiding Crop Regions

On the View Control Bar, click  (Show Crop Region or Hide Crop Region).

To show or hide the annotation crop:

- 1 After you show crop regions, if the annotation crop region is hidden, right-click in the drawing area, and click View Properties.
- 2 In the Instance Properties dialog, select (or clear) the check box for Annotation Crop.
- 3 Click OK.

In the drawing area, select the crop region, and both annotation and model crops display. The interior crop is the model crop, and the exterior crop is the annotation crop.

Resizing Crop Regions Graphically

You can use drag controls and break line controls to resize a crop region. Break line controls remove portions of the view. If you need to show the crop region, see [Showing or Hiding Crop Regions](#) on page 212.

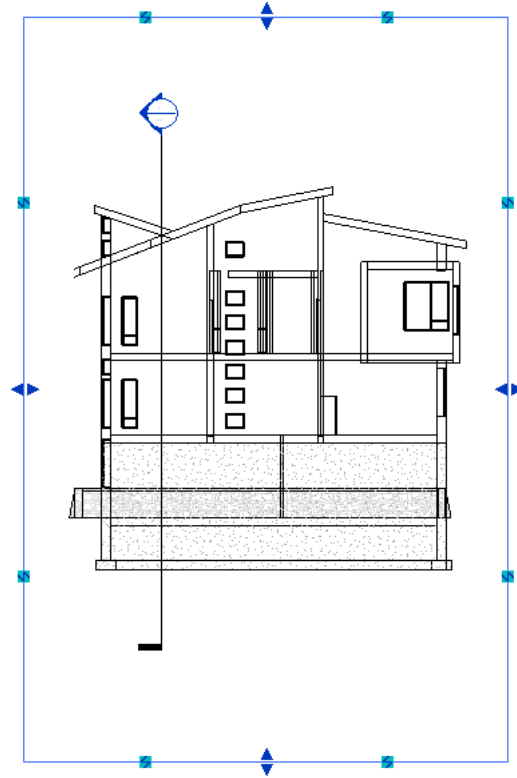
To resize a crop region using drag controls:


- 1 Select the crop region.
- 2 Drag the blue arrow controls to the desired size.

To resize a crop region using break line controls:

- 1 Select the crop region.

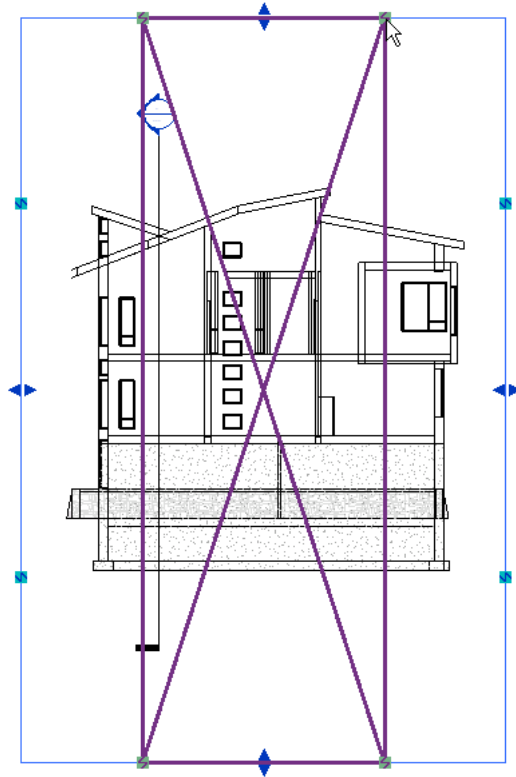
Selected elevation view crop region with break line controls



2 Move the cursor near a break line control ().

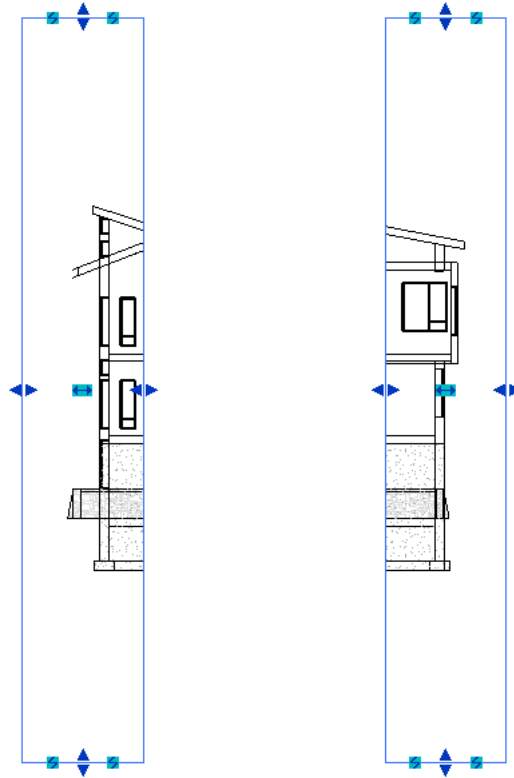
As you place the cursor near a break line control, the portion of the view that will be removed is indicated by the X.

Highlighted view portion to be removed



3 Click the control to break the view into separate regions.

Two new crop regions created



You can resize the split crop regions using the drag controls and the break line controls. You can consolidate the split crop regions by dragging the boundary of one crop region on top of the other. A message indicates that the regions will be consolidated.

NOTE If you turn off the crop region in the view, all split crop region information is lost. If you later turn on the crop region, you need to recreate the split crop regions. Turning off the crop region is not the same as hiding the crop region. When you turn off the crop region, a message notifies you that split crop region information will be lost. If you can hide a crop region and then show it again, the split crop region information is retained.

Resizing Crop Regions Explicitly

You can explicitly set the height and width of a crop region in paper space. This means the size of the region in the view is the same size as the region on a sheet. You can also specify the offset of the annotation crop region from the model crop region.

- 1 In the drawing area, select the crop region.
- 2 Click Modify <view type> tab ► Crop panel ► Size Crop.
The Crop Region Size dialog opens.
- 3 If you are modifying a crop region in a perspective 3D view, select either Field of view or Scale (locked proportions). Examples of these modes are provided at the end of this procedure.
- 4 Modify the values for width and height.

NOTE If you selected Scale for a perspective 3D view, you can modify only height or width, because the values are locked.

5 Modify the offset values for the annotation crop.

Annotation crop options are not available for perspective 3D views.

6 Click Apply to make the changes, or click OK to make the changes, and close the dialog.

There are 2 modes for resizing the crop region: Field of View mode and Scale mode.

- In Field of View mode, you are stretching the crop region to the specified size. For example, if you change a crop region from 100 mm wide by 75 mm high to 50 mm wide by 25 mm high, the crop region updates accordingly. Field of View mode is for perspective and non-perspective views.
- In Scale mode, you change either the height or the width, and Revit Architecture maintains the aspect ratio. When you change the value, the view scales, but the field of view remains the same. Scale mode is for perspective views only.

Rotating Views

You can rotate section views, scope boxes, and viewports using the Rotate tool. You can also rotate a crop region, which in effect rotates a view.

For information on rotating a project to True North, see [Rotating a View to True North](#) on page 449.

Rotating a Section View or Scope Box

- 1 Open the project view that contains the section (callout) or scope box to rotate.
- 2 Select the section (callout) or scope box.
- 3 Click Modify <view type> tab ► Modify panel ► Rotate.
- 4 Rotate the view.

For more information about the Rotate tool, see [Rotating Elements](#) on page 379.

Rotating a Viewport on a Sheet View

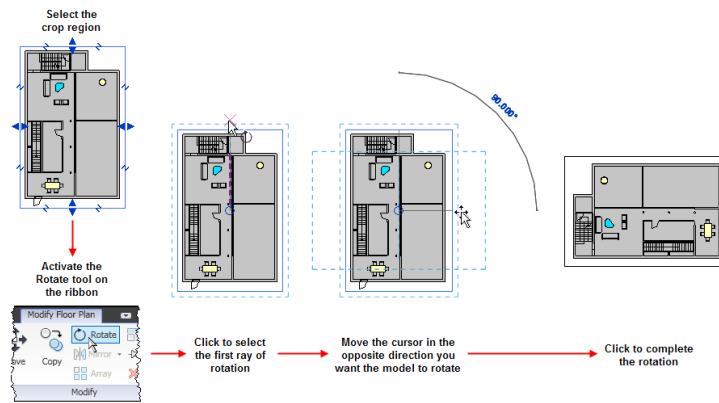
- 1 Open the sheet view that contains the viewport to rotate.
- 2 Select the viewport.
- 3 On the Options Bar, select a value for Rotation on Sheet.

The view rotates, and the value is propagated to the viewport's View Rotation on Sheet instance parameter.


When you rotate a viewport, the view title also rotates.

Rotating a View by the Crop Region

When you rotate a view by rotating the crop region, the model rotates in the opposite direction of the crop region.



To rotate a view by its crop region:

- 1 Open the project view to rotate.
- 2 On the View Control Bar, click  (Show Crop Region).
The crop region displays in the view. You may need to zoom out to see it.
- 3 Select the crop region.
- 4 Click Modify <view type> tab ► Modify panel ► Rotate.
- 5 Rotate the view.

For more information about the Rotate tool, see [Rotating Elements](#) on page 379.

Navigating Views

Use the ViewCube to navigate 3D views. Use SteeringWheels to navigate 2D and 3D views.

ViewCube

Autodesk® ViewCube® navigation tool provides visual feedback of the current orientation of a model. You can use the ViewCube tool to adjust the viewpoint of the model.

Overview of the ViewCube

The ViewCube tool is a persistent, clickable and draggable interface that you use to switch between standard and isometric views of your model. When you display the ViewCube tool, it is shown in one of the corners of the window over the model in an inactive state. While the ViewCube tool is inactive, it provides visual feedback about the current viewpoint of the model as view changes occur. When the cursor is positioned over the ViewCube tool, it becomes active; you can switch to one of the available preset views, roll the current view, or change to the Home view of the model.



Control the Appearance of ViewCube

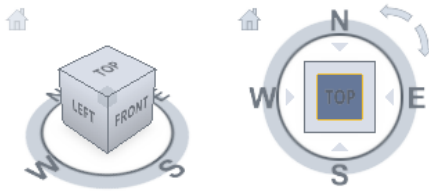
The ViewCube tool is displayed in one of two states: inactive and active. When the ViewCube tool is inactive, it appears partially transparent by default so that it does not obscure the view of the model. When active, it is opaque and may obscure the view of the objects in the current view of the model.

In addition to controlling the inactive opacity level of the ViewCube tool, you can also control the following properties for the ViewCube tool:

- Size
- Position
- Default orientation
- Compass display

Using the Compass

The compass is displayed below the ViewCube tool and indicates which direction North is defined for the model. You can click a cardinal direction letter on the compass to rotate the model, or you can click and drag one of the cardinal direction letters or the compass ring to interactively rotate the model around the center of the view.



To control the position of the ViewCube tool

- 1 Right-click the ViewCube tool, and click Properties.
- 2 In the ViewCube Properties dialog box, under Application Options, select one of the available positions from the On-screen Position drop-down list.
- 3 Click OK.

To control the size of the ViewCube tool

- 1 Right-click the ViewCube tool, and click Properties.
- 2 In the ViewCube Properties dialog box, under Application Options, select a size from the ViewCube Size drop-down list.
- 3 Click OK.

To control the inactive opacity of the ViewCube tool

- 1 Right-click the ViewCube tool, and click Properties.
- 2 In the ViewCube Properties dialog box, under Application Options, select an option from the Inactive Opacity drop-down list.
- 3 Click OK.

Autodesk® ViewCube® navigation tool provides visual feedback of the current orientation of a model. You can use the ViewCube tool to adjust the viewpoint of the model.

Displaying the ViewCube Compass

To display the compass below ViewCube

Right-click the ViewCube, and click Show Compass. The compass reflects the current orientation of the view. For more information, see [Relocating and Mirroring a Project](#) on page 1300.

- 1 Right-click ViewCube and click Options.
- 2 In the Options dialog, under Compass, select Show the Compass with the ViewCube (current project only).
The compass is displayed below the ViewCube and indicates the direction of North for the model.
- 3 Click OK.

ViewCube Menu

Use the ViewCube menu to restore and define the Home view of a model, switch between view projection modes, and change the interactive behavior and appearance of the ViewCube.

The ViewCube menu has the following options:

- **Go Home.** Restores the Home view saved with the model.
- **Orthographic.** Switches the current view to orthographic projection.
- **Perspective.** Switches the current view to perspective projection.
- **Perspective with Ortho Faces.** Switches the current view to perspective projection unless the current view aligns with a face view defined on the ViewCube.
- **Lock to Selection.** Uses the selected objects to define the center of the view when a view orientation change occurs with the ViewCube.

NOTE If you click Home on the ViewCube, the view returns to the Home view even if Lock to Current Selection is selected.

- **Set Current View as Home.** Defines the Home view of the model based on the current view.
- **Set Current View as Front.** Defines the Front view of the model based on the current view.
- **Reset Front.** Resets the Front view of the model to its default orientation.
- **Options.** Displays the dialog which allows you to adjust the appearance and behavior of the ViewCube.
- **Help.** Launches the online Help system and displays the topic for the ViewCube.

Show or Hide the ViewCube

In a 3D view, click View tab ► Windows panel ► User Interface drop-down ► ViewCube.

Alternatively, click  ► Options. Click the ViewCube tab, deselect Show the ViewCube, and click OK.

Reorient the View of a Model with the ViewCube

ViewCube is used to reorient the current view of a model. You can reorient the view of a model with the ViewCube by clicking pre-defined areas to set a preset view current, click and drag to freely change the view angle of the model, and define and restore the Home view.

Reorient the Current View

The ViewCube provides twenty-six defined areas you can click to change the current view of a model. The twenty-six defined areas are categorized into three groups: corner, edge, and face. Of the twenty-six defined areas, six of the areas represent standard orthogonal views of a model: top, bottom, front, back, left, and right. Orthogonal views are set by clicking one of the faces on the ViewCube.

NOTE When the cursor is over one of the clickable areas of the ViewCube, the cursor changes to an arrow with a small cube to indicate the cursor is over the ViewCube. In addition to the cursor changing, a tooltip is also displayed. The tooltip describes the action that can be performed based on the location of the cursor over the ViewCube.

You use the other twenty defined areas to access angled views of a model. Clicking one of the corners on the ViewCube reorients the current view of the model to a three-quarter view, based on a viewpoint defined by three sides of the model. Clicking one of the edges reorients the view of the model to a half view based on two sides of the model.



You can also click and drag the ViewCube to reorient the view of a model to a custom viewpoint other than one of the twenty-six predefined viewpoints that are available. As you drag, the mouse pointer changes to indicate that you are reorienting the current view of the model. If you drag the ViewCube close to one of the preset orientations and it is set to snap to the closest view, the ViewCube rotates to the closest preset orientation.

The outline of the ViewCube helps you identify the view orientation. When a view is oriented to one of the twenty-six pre-defined ViewCube orientations, the ViewCube is outlined in a solid continuous line. When a view is not constrained to one of the twenty-six pre-defined orientations, its outline is displayed as dashed.



Pre-defined orientation left, free-form orientation right.

Roll a Face View

When you view a model from one of the face views, two roll arrow buttons are displayed near the ViewCube. Use the roll arrows to rotate the current view 90 degrees clockwise or counterclockwise around the center of the view.

Switch to an Adjacent Face

When the ViewCube is active while viewing a model from one of the face views, four orthogonal triangles are displayed near the ViewCube. You use these triangles to switch to one of the adjacent face views.

Front View

You can define the Front view of a model to specify the direction of the face views on the ViewCube. Along with the Front view, the Up direction of a model is also used to specify the direction of the face views on the ViewCube.

To reorient the current view to a preset orientation

- Click one of the faces, edges or corners on the ViewCube.

To view an adjacent face

NOTE Make sure a face view is current.

- Click one of the triangles displayed near the edges of the ViewCube.



To interactively reorient the view

- Click the ViewCube, hold down the left mouse button on your pointing device and drag to orbit the model.
Drag in the direction that you want to orbit the model.

To use animated transitions when reorienting a view to a preset orientation

- 1 Right-click the ViewCube, and click Options.
- 2 In the Options dialog, under When Clicking on the ViewCube, click Use Animated Transition when Switching Views.
When checked, transitions from one view to another appear animated when clicking a pre-defined area on the ViewCube.
- 3 Click OK.

To automatically fit the model after a view orientation

- 1 Right-click the ViewCube, and click Options.
- 2 In the Options dialog, under When Clicking on the ViewCube, click Fit-to-View On View Change.
When checked, clicking on a pre-defined area of the ViewCube reorients the model and fits the model to the window.
- 3 Click OK.

To roll a face view

NOTE Make sure a face view is displayed.

- Click one of the roll arrows displayed above and to the right of the ViewCube.
The left roll arrow rotates the view 90 degrees in a counterclockwise, while the right roll arrow rotates the view 90 degrees in a clockwise.

To define the Front view

- Right-click on the ViewCube and click Set Front to, and select (Current View).

NOTE The Front view can only be set to the current view or to an existing elevation view in the project.

To restore the Front view

- Right-click on the ViewCube and click Reset Front.

Home View

The Home view is a special view stored with a model that makes it easy to return to a known or familiar view. You can define any view of the model as the Home view. The saved Home view can be applied to the current view by clicking the Home button near the ViewCube or from the ViewCube menu.

To define the Home view

- Right-click the ViewCube and click Set Current View as Home.

To reorient the model to the Home view

Use one of the following methods:

- Click the Home button () located near the ViewCube.
- Right-click the ViewCube and click Go Home.

Examine Individual Objects with the ViewCube

You can lock the ViewCube to one or more selected objects. This is accomplished by clicking the Lock to Selection option from the ViewCube shortcut menu. Locking a selection of objects to the ViewCube specifies the center of the current view and the distance from center for the view based on the selected objects. Lock to Selection is enabled until it is unchecked from the ViewCube shortcut menu or by clicking the Lock to Selection icon (next to the Home view icon).

Selecting and deselecting objects after Lock to Selection is enabled has no effect on the center or distance from the center of the view when a view orientation change occurs with the ViewCube tool. Zooming to the extents of a model will not occur when Lock to Selection is enabled, even if the ViewCube tool is set to zoom to extents after each view orientation change.

To lock to the current selection

- Right-click the ViewCube and click Lock to Selection.
If Lock to Selection is checked when a view orientation change occurs, the ViewCube uses the selected objects to calculate the center of the view and zooms to the extents of the selected objects. When

unchecked, the ViewCube uses the selected objects to calculate the center of the view and zooms to the extents of the model.

To examine an individual object with the ViewCube

- 1 In the model, select one or more objects to define the center point of the view.
- 2 Click one of the preset locations on the ViewCube, or click and drag the ViewCube to reorient the view of the model.

The ViewCube reorients the view of the model based on the center point of the selected objects.

Navigation Bar

The navigation bar provides access to navigation tools, including Autodesk® ViewCube® and SteeringWheels. The navigation bar displays in the drawing area, along one of the sides of the current model's window. The navigation bar is activated by default.

The navigation tools are organized into separate areas of the navigation bar and provide access to tools based on the currently active view (2D or 3D). You launch navigation tools by clicking one of the buttons on the navigation bar or selecting a tool from the drop-down at the bottom of the navigation bar.

To activate or deactivate the Navigation Bar, click View tab ► Windows panel ► User Interface drop-down, and select or clear Navigation Bar.



The following navigation tools are available from the navigation bar:

- **ViewCube.** Indicates the current orientation of a model and is used to reorient the current view a model.
- **SteeringWheels.** Collection of wheels that offer rapid switching between specialized navigation tools.
- **Pan.** Moves the view parallel to the screen.
- **Zoom tools.** Set of navigation tools for increasing or decreasing the magnification of the current view of a model.

Navigation Bar Customize Menu

Options on the navigation bar customize menu allow you to select tools and reposition the navigation bar in the view.

Customize Menu Drop-Down



Control the Display of Navigation Tools on the Navigation Bar

You can control which navigation tools are displayed on the navigation bar with the Customize menu. The Customize menu is displayed by clicking the Customize button. From the Customize menu, you click the navigation tools that you want displayed on the navigation bar. The position of the navigation tools on the navigation bar is predefined and cannot be changed.

To display a navigation tool on the navigation bar

- 1 On the navigation bar, click Customize.
- 2 On the Customize menu, click the navigation tool you want to display on the navigation bar.
A check mark next to a navigation tool's name indicates when it displays on the navigation bar.

To remove a tool from the navigation bar do one of the following:

- Right-click the tool you want to remove, and click Remove from Navigation Bar.
- On the navigation bar, click Customize. On the Customize menu, click the tool you want to remove.

Reposition and Reorient the Navigation Bar

The position and orientation of the navigation bar can be adjusted by linking it to the ViewCube tool, docking it when the ViewCube tool is not displayed, or freely positioning it along one of the edges of the current window. When linked to the ViewCube tool, the navigation bar is positioned above or below the ViewCube tool and in a vertical orientation. When not linked or docked, the navigation bar can be freely aligned along one of the edges of the current model's window.

You specify how the navigation bar can be repositioned from the Customize menu. When not linked to the ViewCube tool or docked, a grip handle is displayed. Drag the grip handle on the navigation bar to reposition it along one of the sides of the current model's window.

If the side of the window that the navigation bar is aligned to is not long enough to show the entire navigation bar, it is truncated to fit. When truncated, a More Controls button is displayed and replaces the Customize button. When you click the More Controls button, a menu is displayed that contains the navigation tools that are not currently being displayed.

To reposition the navigation bar and ViewCube

- 1 On the navigation bar, click Customize.
- 2 Click Customize menu ► Docking Positions ► Link to ViewCube.
When Link to ViewCube is checked, both the navigation bar and ViewCube are repositioned together around the current window. When ViewCube is not displayed, the navigation bar is docked in the same location in which ViewCube would be instead.
- 3 Click Customize.

- 4 Click Customize menu ► Docking Positions ► an available docking position.
The navigation bar and ViewCube are repositioned.

To link the position of the navigation bar to ViewCube

- 1 On the navigation bar, click Customize.
- 2 Click Customize menu ► Docking Positions ► Link to ViewCube.
When Link to ViewCube is checked, both the navigation bar and ViewCube are repositioned together around the current window.

Link the Navigation Bar and ViewCube

When the navigation bar is linked to the ViewCube, you can freely reposition the navigation bar along the edge of the current window.

- 1 On the navigation bar, click Customize.
- 2 Click Customize menu ► Docking Positions ► Link to ViewCube.
The grip handle for the navigation bar is displayed along the top of the navigation bar.
- 3 Click the grip handle and drag the navigation bar along the edge of the window where you want it displayed. Release the button on the pointing device to orient the navigation bar along the edge of the window.
Dragging the navigation bar to the top or bottom of the window orients it horizontally, dragging it to the left or right side of the window orients it vertically.
- 4 Drag the navigation bar along the window's edge to adjust its position along the window's edge.

SteeringWheels

SteeringWheels are tracking menus (that follow your cursor) from which you can access different 2D and 3D navigation tools from a single tool.

Overview of Steering Wheels

SteeringWheels, also known as wheels, can save you time by combining many of the common navigation tools into a single interface. Wheels are specific to the context from which a model is being viewed.

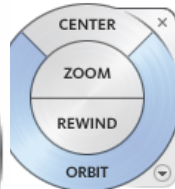
2D Steering Wheel



Full Navigation Wheel

View Object Wheel (Basic Wheel)

Tour Building Wheel (Basic Wheel)



Mini View Object Wheel

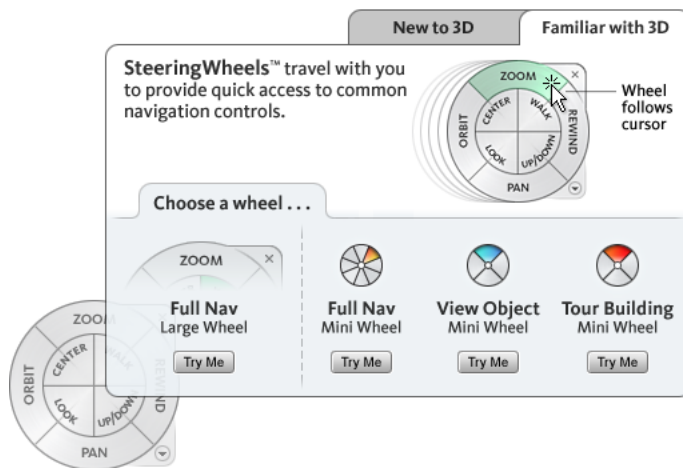
Mini Tour Building Wheel

Mini Full Navigation Wheel



First Contact Balloon

When a SteeringWheel is displayed the first time and a 3D view is current, the First Contact balloon for the wheels is displayed. The First Contact balloon serves as an introduction to the purpose of the wheels and shows how to use them.



Display and Use Wheels

Pressing and dragging on a wedge of a wheel is the primary mode of interaction. After a wheel is displayed, click one of the wedges and hold down the button on the pointing device to activate the navigation tool. Drag to reorient the current view. Releasing the button returns you to the wheel.

Appearance of the Wheels

You can control the appearance of the wheels by switching between the different styles of wheels that are available, or by adjusting the size and opacity. Wheels (except the 2D Navigation wheel) are available in two different styles: big and mini.

The size of a wheel controls how large or small the wedges and labels appear on the wheel; the opacity level controls the visibility of the objects in the model behind the wheel.

Wheel Tooltips, Tool Messages, and Tool Cursor Text

Tooltips are displayed for each button on a wheel as the cursor is moved over them. The tooltips appear below the wheel and identify what action will be performed if the wedge or button is clicked.

Similar to tooltips, tool messages and cursor text are displayed when you use one of the navigation tools from a wheel. Tool messages are displayed when a navigation tool is active; they provide basic instructions about using the tool. Tool cursor text displays the name of the active navigation tool near the cursor. Disabling tool messages and cursor text only affects the messages that are displayed when using the mini wheels or the big Full Navigation wheel.

Use one of the following methods to display a wheel:

To display the currently selected SteeringWheel style:

On the Navigation Bar, click  or .

To display a selected SteeringWheel style:


On the Navigation Bar, click the arrow below the SteeringWheel, and select a SteeringWheel style from the shortcut menu.

To close a wheel

Use one of the following methods to close a wheel:

- Press the Esc.
- Click the small x in the upper right-hand corner of the wheel.

- Right-click on the wheel and click Close Wheel.
- Press *F8*.

NOTE For the following procedures, you can also click  ► Options to access the Options dialog.

To change the size of the wheels

- 1 Display a wheel.
- 2 Right-click on the wheel, and click Options.
- 3 In the Options dialog, click the SteeringWheels tab, under Big Wheel Appearance/Mini Wheel Appearance, for Size, select Small, Normal, or Large.
- 4 Click OK.

To change the opacity of the wheels

- 1 Display a wheel.
- 2 Right-click on the wheel, and click Options.
- 3 In the Options dialog, click the SteeringWheels tab, under Big Wheel Appearance/Mini Wheel Appearance, select the level of transparency.
Select 90% to display SteeringWheels at the greatest opacity. The default setting is 50%.
- 4 Click OK.

To enable tooltips for wheels

- 1 Display a wheel.
- 2 Right-click on the wheel, and click Options.
- 3 In the Options dialog, on the SteeringWheels tab, click Show tooltips.
Tooltips are displayed for each wedge and buttons on a wheel when the cursor hovers over the wheel.
- 4 Click OK.

To enable cursor text for wheels

- 1 Display a wheel.
- 2 Right-click on the wheel, and click Options.
- 3 In the Options dialog, on the SteeringWheels tab, click Show tool cursor text.
Text labels are displayed while selected tools are being used.
- 4 Click OK.

To enable messages for wheels

- 1 Display a wheel.
- 2 Right-click on the wheel, and click Options.
- 3 In the Options dialog, on the SteeringWheels tab, click Show tool messages.
Messages are displayed when you use the navigation tools.

- 4 Click OK.

Wheel Menu

Use the Wheel menu to switch between the big and mini wheels that are available, go to the Home view, change the preferences of the current wheel, and control the behavior of the orbit, look, and walk 3D navigation tools. The menu items available on the Wheel menu are dependent on the current wheel and program.

The Wheel menu has the following options:

- **Mini View Object Wheel.** Displays the mini View Object wheel.
- **Mini Tour Building Wheel.** Displays the mini Tour Building wheel.
- **Mini Full Navigation Wheel.** Displays the mini Full Navigation wheel.

- **Full Navigation Wheel.** Displays the big Full Navigation wheel.
- **Basic Wheels.** Displays the big View Object or Tour Building wheel.

- **Go Home.** Goes to the Home view saved with the model.
- **Fit to Window.** Resizes and centers the current view to display all objects.

- **Restore Original Center.** Restores the center point of the view to the extents of the model.

- **Orient to View.** Orients the camera to match the view angle of the selected view (a plan, elevation, section, or 3D view).
- **Orient to a Plane.** Adapts the view according to a specific plane.
- **Save View.** Saves the current view orientation with a unique name.

NOTE Save View only allows you to save a 3D view with a unique name when you are viewing the default 3D view. If you are viewing a previously saved orthographic 3D view or a perspective (camera) 3D view, the view is simply saved with the new orientation and you are not prompted to supply a unique name.

- **Increase/Decrease Focal Length.** Acts as a zoom lens on the model, because it changes the focal length of the camera in a perspective view.
- **Move Crop Boundary.** Moves the position of the crop boundary around in a perspective view.
- **Re-center Crop Boundary.** Repositions the crop boundary to the center of the perspective view.

- **Help.** Launches the online Help system and displays the topic about the wheels.
- **Properties.** Displays the dialog box where you can adjust the preferences for the wheels.

- **Close Wheel.** Closes the wheel.

Navigation Wheels

Wheels are available in two sizes: big and mini. The big wheel is larger than the cursor. A label is on each wedge in the wheel. The mini wheel is about the same size as the cursor. Labels are not displayed on the wheel wedges. The 2D Navigation wheel is only available in a big version.

2D Navigation Wheel

With this wheel you can access basic 2D navigation tools; it is particularly useful when you do not have a pointing device with a scroll wheel. The wheel includes the Pan and Zoom tools.



The 2D Navigation wheel wedges have the following options:

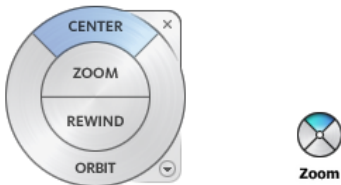
- **Pan.** Repositions the current view by panning.
- **Zoom.** Adjusts the magnification of the current view.

NOTE Pan and Zoom in a 2D steering wheel pan or zoom the page space. In all other wheels, Pan and Zoom moves the camera.

- **Rewind.** Restores the most recent view orientation. You can move backward or forward by clicking and dragging left or right.

View Object Wheels

With the View Object wheels (big and mini), you can view individual objects or features in a model. The big View Object wheel is optimized for new 3D users while the mini View Object wheel is optimized for experienced 3D users.



To switch to the big View Objects wheel

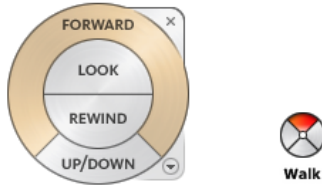
- Right-click on the wheel and click Basic Wheels ➤ View Object Wheel.

To switch to the mini View Objects wheel

- Right-click on the wheel and click Mini View Object Wheel.

Tour Building Wheels

With the Tour Building wheels (big and mini), you can move through a model, such as a building, an assembly line, ship, or oil rig. You can also walk through and navigate around a model. The big Tour Building wheel is optimized for new 3D users while the mini Tour Building wheel is optimized for experienced 3D users.



Big Tour Building Wheel

The big Tour Building wheel wedges have the following options:

- **Forward.** Adjusts the distance between the current point of view and the defined pivot point of the model. Clicking once moves forward half the distance as far as the object you clicked.
- **Look.** Swivels the current view.
- **Rewind.** Restores the most recent view. You can move backward or forward by clicking and dragging left or right.
- **Up/DownTool.** Slides the current view of a model along the Z axis of the model.

Mini Tour Building Wheel

The mini Tour Building wheel wedges have the following options:

- **Walk (Top wedge).** Simulates walking through a model.
- **Rewind (Right wedge).** Restores the most recent view. You can move backward or forward by clicking and dragging left or right.
- **Up/Down (Bottom wedge).** Slides the current view of a model along the Z axis of the model.
- **Look (Left wedge).** Swivels the current view.

NOTE When the mini wheel is displayed, you can press and hold the middle mouse button to pan, scroll the wheel button to zoom in and out, and hold the SHIFT key while pressing and holding the middle mouse button to orbit the model.

To switch to the big Tour Building wheel

- Right-click the wheel, and click Basic Wheels ► Tour Building Wheel.
- Right-click the wheel, and click Basic Tour Building Wheel.

To switch to the mini Tour Building wheel

- Right-click the wheel, and click Mini Tour Building Wheel.

Full Navigation Wheels

The Full Navigation wheels (big and mini) combine the 3D navigation tools found on the View Object and Tour Building wheels. You can view individual objects, and walk through and around a model. The big and mini Full Navigation wheels are optimized for experienced 3D users.



NOTE When one of the Full Navigation wheels is displayed, you can press and hold the middle mouse button to pan, scroll the wheel button to zoom in and out, and hold the SHIFT key while pressing and holding the middle mouse button to orbit the model.

To switch to the big Full Navigation wheel

- Right-click on the wheel and click Full Navigation Wheel.

To switch to the mini Full Navigation wheel

- Right-click on the wheel and click Mini Full Navigation Wheel.

Navigation Tools

Each wheel is divided into different wedges. Each wedge contains a navigation tool that you can use to reorient the current view of a model. Which navigation tools are available depends on which wheel is active.

Each wheel is divided into different wedges. Each wedge contains a navigation tool that you can use to reorient the current view of a model. Which navigation tools are available depends on which wheel is active.

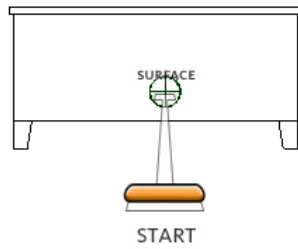
Center Tool

With the Center tool, you can define the center of the current view of a model. To define the center, you drag the cursor over your model. A sphere is displayed in addition to the cursor. The sphere indicates that the point below the cursor in the model will be the center of the current view when you release the mouse button, the model is centered on the sphere.

Forward Tool

You use the Forward tool to change the magnification of the model by increasing or decreasing the distance between the current point of view and the pivot point. The distance that you can move forward or backward is limited by the position of the pivot point.

NOTE In orthographic views, the Forward tool is limited to the distance between the current position and the pivot point. In perspective views, it is not limited, so you can move the cursor through the pivot point.



To adjust the distance between the current point of view and the pivot point you use the Drag Distance indicator. The Drag Distance indicator has two marks on it that show the start and destination distances from the current point of view. The current traveled distance is shown by the orange position indicator. Slide the indicator forward or backwards to decrease or increase the distance towards the pivot point.

To reorient a view by moving towards or away from the model

- 1 Display the big Tour Building wheel.
- 2 Click and hold down the Forward wedge.
The Drag Distance indicator is displayed.

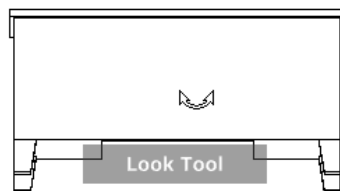
NOTE If you click the Forward wedge once, the model moves forward 50% of the distance between the current location and the pivot point.

- 3 Drag the cursor up or down to change the distance from which you view the model.
- 4 Release the button on your pointing device to return to the wheel.

Look Tool

With the Look tool, you can rotate the current view vertically and horizontally. When rotating the view, your line of sight rotates about the current eye position, like turning your head. The Look tool can be compared to you standing in a fixed location, and looking up or down while turning your head left or right.

When using the Look tool, you adjust the view of the model by dragging the cursor. As you drag, the cursor changes to the Look cursor and the model rotates around the location of the current view.



In addition to using the Look tool to look around a model, you can also use the tool to pan the current view to a specific face on the model. Press and hold the *SHIFT* key before selecting the Look tool on one of the Full Navigation wheels.

Walking through a Model

When using the Look tool from the big Full Navigation wheel, you can walk through a model by using the arrow keys on the keyboard. Use the Options dialog for the SteeringWheels to adjust the walk speed.

Invert Vertical Axis

When you drag the cursor upward, the target point of the view raises; dragging the cursor downward lowers the target point of the view. Use the Options dialog for the SteeringWheels to invert the vertical axis for the Look tool.

To look around a view with the Look tool

- 1 Display one of the Full Navigation wheels or the mini Tour Building wheel.
- 2 Click and hold down the Look wedge.
The cursor changes to the Look cursor.
- 3 Drag the pointing device to change the direction in which you are looking.
- 4 Release the button on your pointing device to return to the wheel.

To look at a face in the model with the Look tool

- 1 Display one of the Full Navigation wheels.
- 2 Press and hold down the *SHIFT* key.
- 3 Click and hold down the Look wedge.
The cursor changes to the Look At cursor.
- 4 Drag over the objects in the model until the face highlights that you want to look at.
- 5 Release the button on your pointing device to return to the wheel.

To look around and walk through a model with the Look tool

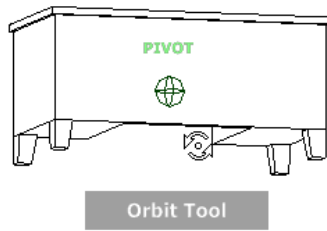
- 1 Display the big Full Navigation wheel.
- 2 Click and hold down the Look wedge.
The cursor changes to the Look cursor.
- 3 Drag to change the direction in which you are looking.
- 4 While holding down the button on your pointing device, press the arrow keys to walk in the model.
- 5 Release the button on your pointing device to return to the wheel.
- 6 Click Close to exit the wheel.

To invert the vertical axis for the Look tool

- 1 Display a wheel.
- 2 Right-click the wheel, and click Options.
- 3 In the Options dialog, for Look Tool Behavior select Invert Vertical Axis.
Dragging downward and upward lowers and raises the target point of the current view.
- 4 Click OK.

Orbit Tool

You use the Orbit tool to change the orientation of a model. The cursor changes to the Orbit cursor. As you drag the cursor, the model rotates around a pivot point while the view remains fixed.



Specify the Pivot Point

The pivot point is the base point used when rotating the model with the Orbit tool. You can specify the pivot point in the following ways:

- **Default pivot point.** When you first open a model, the target point of the current view is used as the pivot point for orbiting the model.
- **Select objects.** You can select objects before the Orbit tool is used to calculate the pivot point. The pivot point is calculated based on the center of the extents of the selected objects.
- **Center tool.** You can specify a point on the model to use as the pivot point for orbiting with the *Center tool*.
- **CTRL+Click and drag.** Press and hold down the *Ctrl* key before clicking the Orbit wedge or while the Orbit tool is active; then drag to the point on the model you want to use as the pivot point. This option is only available when using the big and mini Full Navigation wheels or the mini View Object wheel.

NOTE While the Orbit tool is active, you can press and hold the *Ctrl* key at anytime to move the pivot point used by the Orbit tool.

Maintain Up Direction

You can control how the model orbits around the pivot point by choosing to maintain the up direction of the model. When the up direction is maintained, orbiting is constrained along the *XY* axis and in the *Z* direction. If you drag horizontally, the camera moves parallel to the *XY* plane. If you drag vertically, the camera moves along the *Z* axis.

If the up direction is not maintained, you can roll the model using the roll ring which is centered around the pivot point. Use the Options dialog for the SteeringWheels to control whether the up direction is maintained or not for the Orbit tool.

To orbit a model with the Orbit tool

- 1 Display one of the View Object or Full Navigation wheels.
- 2 Click and hold down the Orbit wedge.
The cursor changes to the Orbit cursor.
- 3 Drag to rotate the model.

NOTE Use the Center tool to re-center the model in the current view, if you are using one of the Full Navigation or View Object wheels.

- 4 Release the button on your pointing device to return to the wheel.

To orbit around an object with the Orbit tool

- 1 Press *Esc* to make sure no tools are active and to clear any previously selected objects.
- 2 Select the objects in the model for which you want to define the pivot point.
- 3 Display one of the View Object or Full Navigation wheels.
- 4 Click and hold down the Orbit wedge.
The cursor changes to the Orbit cursor.
- 5 Drag to rotate the model.
- 6 Release the button on your pointing device to return to the wheel.

To maintain the up direction for the Orbit tool

- 1 Display the mini View Object wheel or one of the Full Navigation wheels.
- 2 Right-click the wheel, and click Options.
- 3 In the Options dialog, select Keep Scene Upright for Orbit Tool.
- 4 Click OK.
Orbiting the model is constrained along the *XY* plane and *Z* directions.

To roll the model around the pivot point with the Orbit tool

- 1 Display the mini View Object Wheel or one of the Full Navigation wheels.
- 2 Right-click the wheel, and click Options.
- 3 In the Options dialog, clear the check mark from Keep Scene Upright for Orbit Tool.
- 4 Click OK.
- 5 Click and hold the Orbit wedge.
The cursor changes to the Orbit cursor.
- 6 Press and hold the *Shift* key to display the roll ring. Drag to roll the model.
- 7 Release the button on your pointing device to return to the wheel.

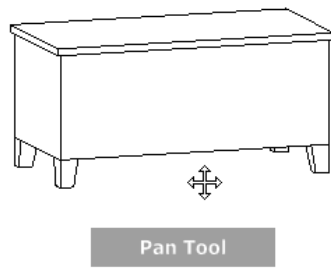
To start the Orbit tool with the middle mouse button

- 1 Display one of the wheels other than the big View Object or Tour Building wheels.
- 2 Press and hold down the *Shift* key.
- 3 Press and hold down the scroll wheel or middle button on your pointing device and drag to orbit the model.
- 4 Release the button on your pointing device to return to the wheel.

Pan Tool

When the pan tool is active, the Pan cursor (a four-sided arrow) is displayed. Dragging the pointing device moves the model in the same direction. For example, dragging upward moves the model up while dragging downward moves the model down.

In a 3D context, primarily when using 3D SteeringWheels, pan dollies the camera left and right. In a 2D context, pan scrolls the view. If you are using pan with an active view on a sheet, pan scrolls the sheet view, not the active view on the sheet.



TIP If the cursor reaches the edge of the screen, you can continue panning by dragging further to force it to wrap around the screen.

To pan the view with the Pan tool

- 1 Display the 2D Navigation wheel, one of the Full Navigation wheels, or the mini View Object wheel.
- 2 Click and hold the Pan wedge.
The cursor changes to the Pan cursor.
- 3 Drag to reposition the model.
- 4 Release the button on your pointing device to return to the wheel.

To start the Pan tool with the middle button

- 1 Display the 2D Navigation wheel, the Full Navigation wheel, or one of the mini wheels.
- 2 Press and hold down the scroll wheel or middle button.
The cursor changes to the Pan cursor.
- 3 Drag to reposition the model.
- 4 Release the wheel or button on your pointing device to return to the wheel.

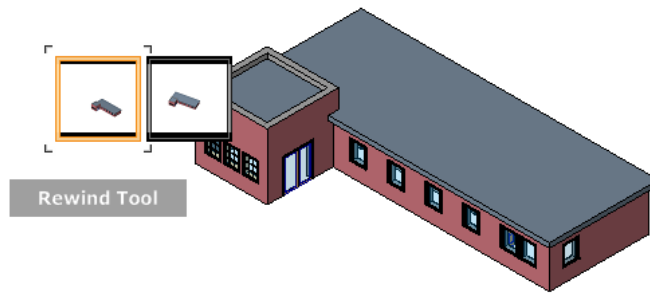
Rewind Tool

As you use the navigation tools to reorient the view of a model, the previous view is saved to the navigation history. The navigation history holds a representation of the previous views of the model along with a thumbnail. A separate navigation history is maintained for each window; it is not maintained after the window is closed. Rewind navigation history is view-specific.

With the Rewind tool, you can retrieve previous views from the navigation history. From the navigation history, you can restore a previous view or scroll through all of the saved views.

When you hold down the button on the pointing device over the Rewind tool on the wheel, the Rewind History panel is displayed. You can scroll through the navigation history. To restore one of the previous views in the navigation history, drag the bracket to the left in the Rewind History panel.

NOTE Rewind history is not saved between sessions.



To restore the previous view

- 1 Display a wheel.
- 2 Click the Rewind wedge.

To restore a previous view with the Rewind History panel

- 1 Display a wheel.
- 2 Click and hold the Rewind wedge.
The Rewind History panel is displayed.

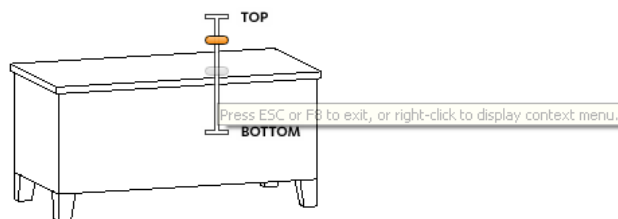
- 3 While holding down the button on your pointing device, drag to the left or to the right to restore a previous view.

Dragging to the left restores an older previous view. Dragging to the right restores a view that is newer than the one you are currently viewing. You must have previously used the Rewind tool to see views available on the right. The current position in the navigation history is indicated by the orange box that is dragged along the Rewind History panel.

Up/Down Tool

Unlike the Pan tool, you use the Up/Down tool to adjust the height of the current viewpoint along the model's Z axis. To adjust the vertical elevation of the current view, you drag up or down. As you drag, the current elevation and the allowed range of motion is displayed on a graphical element called the Vertical Distance indicator.

The Vertical Distance indicator has two marks that show the highest (Top) and lowest (Bottom) elevation the view can have. While changing the elevation with the Vertical Distance indicator, the current elevation is shown by the bright orange indicator, while the previous elevation is shown by the dim orange indicator.



To change the elevation of a view

- 1 Display one of the Full Navigation wheels or the Tour Building wheels.
- 2 Click and hold down the Up/Down wedge.

The Vertical Distance indicator is displayed.

- 3 Drag up or down to change the elevation of the view.
- 4 Release the button on your pointing device to return to the wheel.

Walk Tool

With the Walk tool, you can navigate through a model as if you were walking through it. Once you start the Walk tool, the Center Circle icon is displayed near the center of the view and the cursor changes to display a series of arrows. To walk through the model, you drag in the direction in which you want to move in.

Constrain the Walk Angle

When walking through a model, you can constrain the movement angle to the ground plane. If the Move parallel to ground plane option is enabled, you can freely walk around while maintaining a constant camera viewpoint elevation; if the walk angle is not constrained, you will “fly” in the direction you are looking. Use the Options dialog for the SteeringWheels to constrain the movement angle to the ground plane for the Walk tool.

Movement Speed

As you walk or “fly” through a model, you can control the movement speed. Movement speed is controlled by the distance in which the cursor is moved from the Center Circle icon and the current movement speed setting. You can adjust the movement speed setting permanently and temporarily as you use the Walk tool. To permanently adjust the movement speed, use the Options dialog for the SteeringWheels or the < and > keys when the Walk tool is active. To temporarily increase movement speed, press and hold the + (plus) key while using the Walk tool.

Change the Elevation

As you use the Walk tool, you can adjust the camera elevation by holding down the *SHIFT* key. This temporarily activates the Up/Down tool. With the Up/Down tool active, drag up or down to adjust the elevation of the camera. You can also use the *UP ARROW* and *DOWN ARROW* keys as you walk to adjust the height of the view.

To use the Walk tool to move through the model

- 1 Display one of the Full Navigation wheels or the mini Tour Building wheel.
- 2 Click and hold down the Walk wedge.
The cursor changes to the Walk cursor and the Center Circle icon is displayed.
- 3 Drag in the direction you want to walk.

NOTE While walking, press and hold down the + (plus) key to temporarily increase your movement speed.

- 4 Release the button on your pointing device to return to the wheel.

To change the movement speed for the Walk tool

- 1 Display a wheel.
- 2 Right-click the wheel, and click Options.
- 3 In the Options dialog, under Walk Tool, drag the Speed Factor slider to the left to decrease the walking speed or to the right to increase the walking speed.

- 4 Click OK.

To constrain the Walk tool to the ground plane

- 1 Display a wheel.
- 2 Right-click the wheel, and click Options.
- 3 In the Options dialog, under Walk Tool, select Move parallel to Ground Plane.
- 4 Click OK.
Movement when walking is done parallel to the ground plane of the model.

To adjust the height of the current view from the Walk tool

- 1 Display one of the Full Navigation wheels or the mini Tour Building wheel.
- 2 Click and hold down the Walk wedge.
The cursor changes to the Walk cursor and the Center Circle icon is displayed.
- 3 Do one of the following:
 - Press and hold down the *SHIFT* key to enable the Up/Down tool; drag up or down.
 - Press and hold down the *UP ARROW* or *DOWN ARROW* key.
- 4 Release the button on your pointing device to return to the wheel.

Zoom Tool

You use the Zoom tool to change the zoom magnification of a model. The following mouse click and key combinations are available to control how the Zoom tool behaves:

- **Click.** If you click the Zoom tool on a wheel, the current view is zoomed in by a factor of 25 percent. If you are using the Full Navigation wheel, incremental zoom must be enabled in the Options dialog for the SteeringWheels.
- **SHIFT+click.** If you hold down the *SHIFT* key before you click the Zoom tool on a wheel, the current view is zoomed out by a factor of 25 percent. Zooming is performed from the current location of the cursor, and not the current pivot point.

NOTE When you start the Zoom tool from the Full Navigation wheel, incremental zooming must be enabled in the Options dialog for the SteeringWheels in order to use *CTRL*+click and *SHIFT*+click.

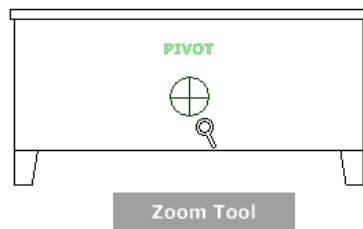
- **CTRL+click.** If you hold down the *CTRL* key before you click the Zoom tool on a wheel, the current view is zoomed in by a factor of 25 percent. Zooming is performed from the current pivot point, and not the location of the cursor.
- **Click and drag.** If you click the Zoom tool and hold down the button on your pointing device, you can adjust the magnification of the model by dragging up and down.
- **CTRL+click and drag.** When using the Full Navigation wheels or the mini View Object wheel, you can control the target point used by the Zoom tool. By holding down the *Ctrl* key, the Zoom tool uses the location of the previous pivot point defined by the Zoom, Orbit, or Center tool.
- **SHIFT+click and drag.** When using the Full Navigation wheels or the mini View Object wheel, you can zoom in to an area of the model by dragging a rectangular window around the area you want to fit in

the window. Hold down the *Shift* key and then click and drag a window around the area in which you want to zoom.

NOTE If you hold down the *Ctrl* key along with the *Shift* key, you can zoom in to an area of a model using a center-based window instead of one defined by opposite corners.

- **Mouse wheel.** When a wheel is displayed, scroll the mouse wheel up or down to zoom the view of the model in or out.

NOTE When you use the Zoom tool from the Full Navigation wheel or the View Object wheel, the point in the view where you click to zoom becomes the Center point for future Orbit operations until you either use the Zoom tool again or use the Center tool. If you press *Ctrl* before you click the Zoom wedge, the Center point does not change.



Zoom Constraints

When changing the magnification of a model with the Zoom tool, you cannot zoom in any further than the focus point or out past the extents of the model. The direction you can zoom in and out is controlled by the center point set by the Center tool.

NOTE Unlike the Zoom tool on the big View Object wheel, the Zoom tool on the mini View Object wheel and the Full Navigation wheels are not constrained.

To zoom the view with a single click

You must have enabled incremental zoom when using the Full Navigation wheels. The setting can be changed from the Options dialog for the SteeringWheels.

- 1 Do the following to make sure this option is selected:
 - Display the Full Navigation wheel.
 - Right-click on the wheel and click Options.
 - In the Options dialog, under Zoom Tool, select Zoom in one increment with each mouse click.
 - Click OK.
- 2 Display the 2D Navigation wheel, one of the Full Navigation wheels, or the mini View Object wheel.
- 3 Click the Zoom wedge.

The magnification of the model is increased and you are zoomed in closer to the model. If you hold down the *SHIFT* key while clicking the Zoom wedge, the model is zoomed out; you can hold down the *CTRL* key to zoom in.

To zoom a view in and out by dragging

- 1 Display the 2D Navigation wheel, one of the Full Navigation wheels, or the mini View Object wheel.
- 2 Click and hold down the Zoom wedge.
The cursor changes to the Zoom cursor.
- 3 Drag vertically to zoom in or out.
- 4 Release the button on your pointing device to return to the wheel.

To zoom in to an area of the model by specifying window

- 1 Display one of the Full Navigation wheels or the mini View Object wheel.
- 2 Press and hold down the *SHIFT* key.
- 3 Click and hold down the Zoom wedge.
The cursor changes to the Zoom cursor.
- 4 Drag the pointing device to define the opposite corner of the window that defines the area in which you want to zoom.


NOTE Holding down the *CTRL* key while defining the second point of the window determines if the first point of the window is used as the corner or center of the window being dragged. When the *CTRL* key is held down, the first point defines the center of the window.

- 5 Release the button on your pointing device to return to the wheel.

To zoom in and out by scrolling the mouse wheel when a SteeringWheel is displayed

- 1 Display one of the wheels other than the big Tour Building wheel.
- 2 Scroll the wheel forward or backward to zoom in or out.
- 3 Release the button on your pointing device to return to the wheel.

Saving a 3D View Orientation as a Project View

- 1 If SteeringWheels are not displayed in the drawing area, click  on the Navigation Bar.
- 2 Right-click the SteeringWheels, and click Save View.
- 3 Enter a name for the new 3D view, and click OK.

NOTE You are only prompted to enter a name for the view if you are saving the default 3D view (named in the Project Browser {3D}). If you are saving a 3D view other than the default 3D view, the view is saved using the current name.

The new view displays in the Project Browser under 3D Views.

View Settings

Related topic

- [Detail Level](#) on page 511

Zooming Project Views

The Zoom tool changes the viewable area in the window.

The following Zoom options are available on the Navigation Bar:

- Zoom in Region
- Zoom Out (2X)
- Zoom to Fit
- Zoom All to Fit
- Zoom Sheet Size
- Previous Pan/Zoom
- Next Pan/Zoom

If the Navigation Bar is hidden in your view, click View tab ► Windows panel ► User Interface drop-down ► Navigation Bar.

You can also zoom project views using the SteeringWheels. See [Navigating Views](#) on page 217.

Maintaining Line Thickness when Zooming

The Thin Lines tool maintains the true thickness of lines relative to the zoom of the view. Typically, when you zoom in on a model in a small scale view, element lines appear much thicker than they actually are.

When you activate the Thin Lines tool, it affects all views but does not affect printing or print preview.

To activate the tool, click View tab ► Graphics panel ► Thin Lines.

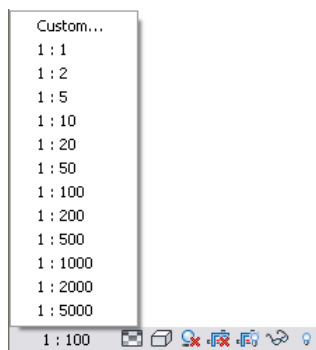
View Scale

The view scale is the proportional system used to represent objects in a drawing. You can assign a different scale to each view in a project. You can also create custom view scales.

To assign a view scale

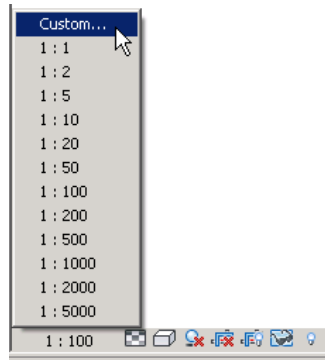
Use one of the following methods:

- In the Project Browser, right-click the view, and click Properties. In the Instance Properties dialog, for View Scale, select a value.
- Select a scale from the View Control Bar.



To create a custom view scale

1 On the View Control Bar, click the view scale, and select Custom.



2 In the Custom Scale dialog, enter a value for Ratio.

3 (Optional) Select Display Name, and enter a custom name for the scale.

4 Click OK.

NOTE Custom view scales cannot be applied to other views in the project.

Related topics

- [Setting Detail Level Scale Values](#) on page 512
- [View Properties](#) on page 259

Detail Levels and Display of Structural Components

The display of structural components differs based on the detail level of the view. For example, structural framing appears as sticks in coarse detail level, but has much more detail at medium or fine detail level. Detail Level is a view instance parameter; therefore every view can have a different setting for this parameter.

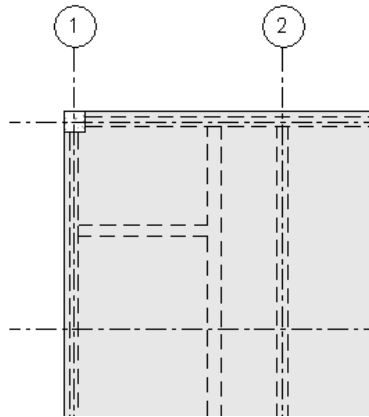
Detail Level is also view-scale-dependent. For information on setting scales with detail level and the Detail Level tool, see [Detail Level](#) on page 511.

Display of Hidden Lines of Structural Concrete Components

Revit Architecture provides the ability to control the display of structural concrete components that are in a hidden state in a view. The display of invisible lines of walls, floors, framing, columns, and foundation elements are controlled by the following view parameters:

- **Discipline**
Discipline must be set to Structural for invisible lines to be represented as hidden.
- **Model Graphics Style**
By setting Model Graphics to either Hidden or to Shading with Edges, invisible lines are represented as hidden.

Plan of structural floor and beams framed into concrete walls



Showing Hidden Element Lines

Model and detail elements that are obscured by other elements can be displayed using the Show Hidden Lines tool. First, select the element on which you want the hidden lines to display. Next, select the obscured element that has the lines you want to bring through. You can use the Show Hidden Lines tool on all elements that have the Hidden Lines subcategory. The Remove Hidden Lines tool is the inverse of the Show Hidden Lines tool.

- 1 Click Modify tab ► Edit Linework panel ► Show Hidden drop-down ► Show Hidden Lines.
- 2 Place the cursor on an element that is hiding another element, and click to select it.
For example, select a filled region that is overlapping a wall.
- 3 Place the cursor on the element with lines to be shown, and click to select it.
The lines of this element display in a hidden line style through the overlapping element. To change the hidden line style of the element, use the Object Styles tool.
- 4 To reverse the effects of this tool, click Modify tab ► Edit Linework panel ► Show Hidden drop-down ► Remove Hidden Lines.
- 5 Select the element that will hide the other element.
- 6 Select the other element to be hidden.

Section, Elevation, and Callout View Tag Setup

You can define the look of view tags used for sections, elevations, and callouts by editing their properties.

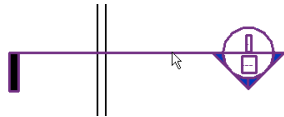
Editing Type Properties for View Tags

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Callout Tags, Elevation Tags, or Section Tags.
- 2 In the Type Properties dialog, edit type properties as necessary.

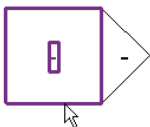
Selecting View Tags

Each view tag has several components. If you want to modify a view tag's element properties or make other changes, you must be sure to select the entire view tag. If you select only a portion of it, you may not be setting properties for or changing the correct object.

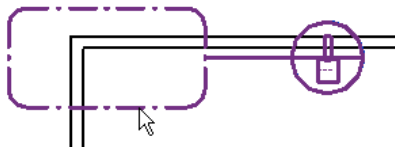
- To select a section tag, click the section line.



- To select an elevation tag, click the square part of the tag.



- To select a callout tag, click the dotted line (bubble) that defines the callout area.



To see element properties, right-click the selected view tag, and click Element Properties.

Hiding Elevation Tags

You can set the view scale at which elevation tags are hidden in project views. Each elevation tag instance can have a different view scale at which it is hidden.

To hide elevation tags

- 1 In the drawing area, select the triangle on the elevation tag.
- 2 Click Modify Elevations tab ► Element panel ► Element Properties.
- 3 Select a value for the Hide at Scales Coarser Than parameter.
- 4 Click OK.

Callout Tag Properties

You can set the following parameters for callout tags. See also [Callout Tags](#) on page 151.

Name	Description
Callout Head	The head used for the callout.
Corner Radius	Sets the angle of the corners of the callout.

Elevation Tag Properties

You can set the following parameters for elevation tags.

Name	Description
Shape	Specifies the shape of the elevation symbol.
Text Position	Specifies the text position for the elevation view.
Arrow Angle	Sets the thickness of the arrowhead.
Filled	Specifies whether the arrowhead is filled in.
Show View Name	Shows the elevation name with the arrowhead.
View Name Position	Aligns the view name with the elevation view arrowhead.
Reference Label Position	Aligns the reference label with the elevation view arrowhead.
Line Weight	Sets the line weight of the elevation symbol. You can change the definition of the line weight value using the Line Weights on page 495 tool.
Color	Sets the color of the symbol.
Line Pattern	Sets a line pattern for the elevation symbol. You can use a preset line pattern or define your own. See Line Patterns on page 496 for more information.
Text Font	Specifies the typeface for the elevation symbol.
Text Size	Specifies the size of the text with respect to the scale of the drawing.
Width	Specifies the width of the interior elevation symbol.

Section Tag Properties

You can set the following parameters for section tags.

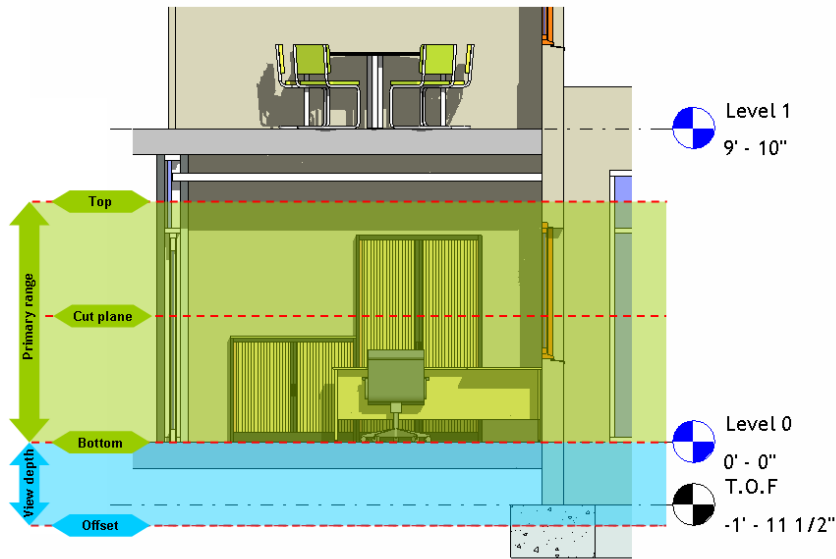
Name	Description
Section Head	Specifies the shape of the section head.
Section Tail	Specifies the shape of the section tail.
Broken Section Display Style	Specifies the line pattern of a segmented section. For more information, see Segmented Section View on page 140.

View Range

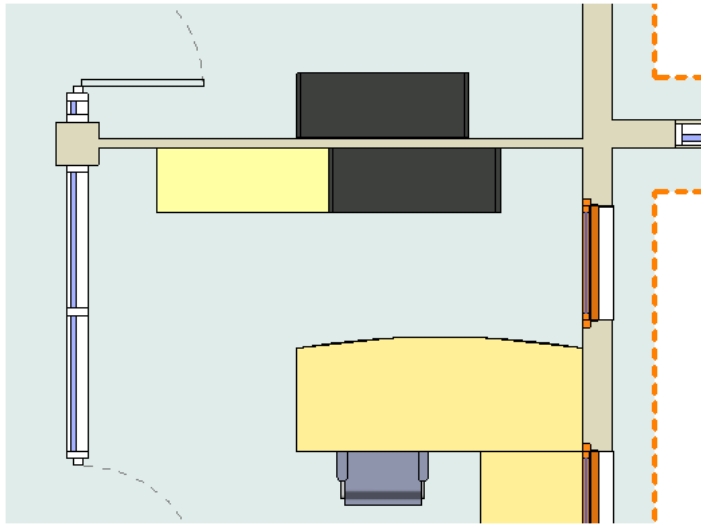
Every plan and RCP view has a view property called View Range, also known as a visible range. The view range is a set of horizontal planes that control object visibility and display in the view. The horizontal planes are Top, Cut Plane, and Bottom. The top and bottom clip planes represent the topmost and bottommost portion of the view range. The cut plane is a plane that determines at what height certain elements in the view are shown cut. These 3 planes define the primary range of the view range.

View depth is an additional plane outside of the primary range. You can set the level of view depth to show elements below the bottom clip plane. By default, it is coincident with the bottom.

The following image shows the view range of a plan view from an elevation view standpoint.



The following image shows the actual plan view with this view range.



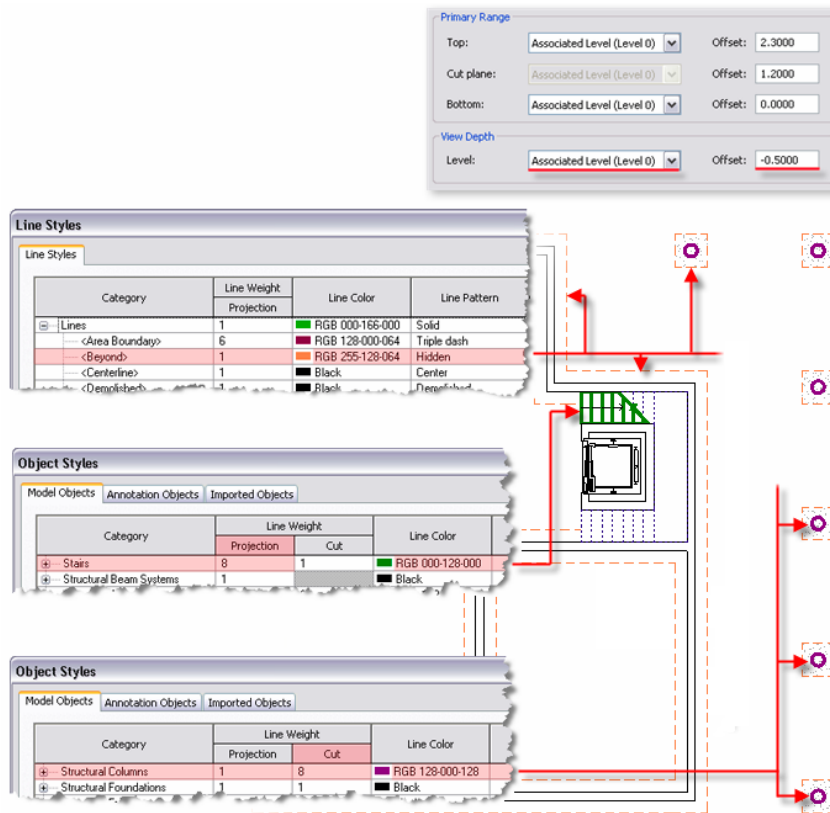
Elements outside of the view range do not display in the view. The exception to this is if you set the view underlay to a level outside the view range. For more information on the Underlay view property, see [View Properties](#) on page 259.

How are elements drawn with respect to the view range?

- Elements within the boundaries of the primary range that are not cut are drawn in the element's projection line style.
- Elements that are cut are drawn in the element's cut line style.

NOTE Not all elements can display as cut. To determine which elements can display as cut, see [Managing Family Visibility and Detail Level](#) on page 513.

- Elements that are within the view depth are drawn in the beyond line style.



You can change the display of cut and projection line styles through the [Object Styles](#) tool. You can change the display of the beyond line style through the [Line Styles](#) tool.

Additional View Range Rules

- Model elements located outside of the view range generally are not shown in the view. The exceptions are floors, stairs, ramps, and components that stay or are mounted on the floor (like furniture). These are shown even when slightly below the view range. In addition, fascia, gutters, and edge slabs are shown when their bottoms are within a tolerance of the primary view range bottom. Floors located outside the view range use an adjusted range that is 4 feet (approximately 1.22 meters) below the bottom of the primary range. Floors are drawn with the Beyond line style if the floor exists within this adjusted range.
- Elements that are strictly below the cut plane, but are at least partially within the view range, are shown as viewed from above. Components display according to Family Element Visibility Settings for Plan/RCP. See [Managing Family Visibility and Detail Level](#) on page 513
- Walls shorter than 6 feet (approximately 1.83 meters) are not cut, even if they intersect the cut plane. The 6 feet are measured from the top of the bounding box to the bottom of the primary view range. For example, if you create a wall with a sloped top face, when the top of the wall is 6 feet away from the bottom of the primary view range, the wall is cut at the cut plane. When the top of the wall is less than 6 feet, the entire wall shows as projection even where it intersects the cut plane. This behavior always occurs when the Top Constraint property for the wall is specified as Unconnected.
- There are a few categories for which an element located above the cut plane but partially below the top clip is shown in plan. These categories include windows, casework, and generic model. These objects are shown as viewed from above.

- Visibility in RCP views is similar to plan views with the exception that objects are presented as viewed from below and mirrored.

Modifying the View Range

- 1 Open a plan or RCP view.
- 2 Click View tab ► Graphics panel ► View Properties.
- 3 In the Instance Properties dialog, locate the View Range parameter, and click Edit.
- 4 In the View Range dialog, modify view range properties as necessary. See [View Range Properties](#) on page 250.

In the View Range dialog, levels used to define the visible range are absolute to the current level of the view. For example, if you are in the Level 2 floor plan of a multi-story building and you select Level 4 as the top, Revit Architecture keeps Level 4 as the top, even if you add levels between Level 2 and Level 4. If you were to delete Level 4, then the clip plane would revert back to the default level with which the view is associated. In this example, it would revert to Associated Level (Level 2). Values, such as Level Above and Level Below, always have a specific level name associated with them. For example, if you are setting the view range for Level 1, the Level Above value would read Level Above (Level 2).
- 5 Click Apply to view changes.
- 6 Click OK.

View Range Properties

Parameter names, values, and descriptions for view ranges. Values are modifiable.

Name	Description
Top	Sets the upper boundary of the primary range. The upper boundary is defined as a level and an offset from that level. Elements display as defined by their object styles . Elements above the offset value do not display.
Cut plane	Sets a height at which elements in a plan view are cut, such that building components below the cut plane display in projection, and others that intersect it display as cut. Building components that display as cut include walls, roofs, ceilings, floors, and stairs. A cut plane does not cut components, such as desks, tables, and beds.
Bottom	Sets the level of the Primary Range's lower boundary. If you access View Range while viewing the lowest level of your project and set this property to level below, you must specify a value for Offset, and you must set View Depth to a level below it.
View Depth	Sets a vertical range for the visibility of elements between specified levels. In a floor plan, it should be below the cut plane. In a reflected ceiling plan (RCP), it should be above. For example, if you are designing a multi-story building, you might have a floor plan for the 10th floor that had a depth to the first level. Specifying view depth lets you display visible objects below the current level; such objects include stairs, balconies, and objects visible through holes in a floor.

Model Graphics Styles

You can specify many different graphic styles for a project view. Model graphics styles are grouped into models graphics and graphic display options.

Model graphics options are

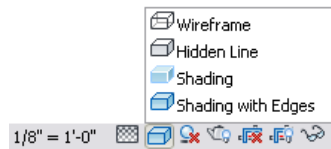
- Wireframe
- Hidden line
- Shading
- Shading with edges

Graphic display options are


- Shadows
- Silhouette edges

Specifying a Model Graphics Style

On the View Control Bar at the bottom of the drawing area, click the Model Graphics Style icon, and select an option.



To save a view with an applied model graphics style

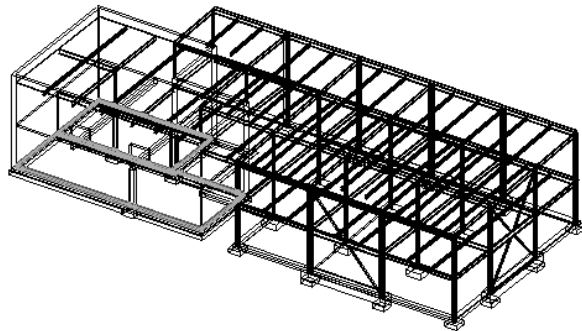
In a 3D view, click  on the Navigation Bar. SteeringWheels display in the drawing area. Right-click SteeringWheels, and click Save View. Enter a name for the new 3D view, and click OK.

NOTE If the Navigation Bar is hidden in your view, click View tab ► Windows panel ► User Interface drop-down ► Navigation Bar.

The new view appears in the Project Browser under 3D Views.

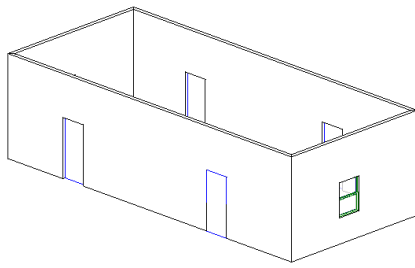
Wireframe Model Graphics Style

The Wireframe tool displays the image of the model with all edges and lines drawn, but with no surfaces drawn. This tool affects the current view only.



Hidden Line Model Graphics Style

Hidden Line mode displays the image with all edges and lines drawn except those obstructed by surfaces. This tool affects the current view only.

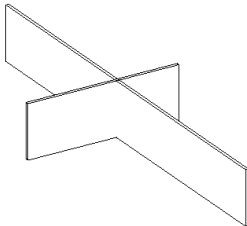


Displaying Intersecting Geometry with Hidden Lines

If the model includes intersected geometry (for example, an extrusion passing through a wall surface), Revit Architecture does not create new edges along the lines of the intersection. This may result in incorrect hidden line removal during export. If you attempt to export a view of the design with hidden lines turned on, you may see unexpected results when you open the view in another CAD application. See [Hidden Line Model Graphics Style](#) on page 252.

To see all visible lines, Revit Architecture recommends that you first create an opening in one surface before passing another surface through it. See [Defining Wall Shapes or Openings](#) on page 662.


Intersecting geometry in hidden line mode (no edges are created at the intersecting surfaces)



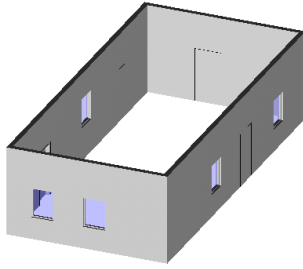
Shading Model Graphics Style

The Shading tool displays the image with all surfaces shaded according to their material color settings and project light locations. A default light source provides illumination for the shaded elements. The number of colors that can display for shading depend on the number of colors you have configured to display in Windows. This tool affects the current view only.

Hardware graphics on your computer may render different levels of shading. Turn on the hardware graphics

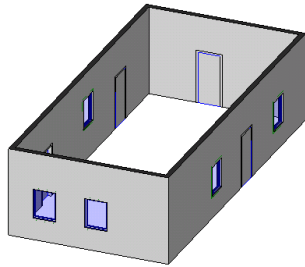
by setting options in the Options dialog. Click  ► Options.

Shaded image



Shading with Edges Model Graphics Style

The Shading with Edges tool displays the image in shaded mode, but with all non-occluded edges drawn as well. A default light source provides illumination for the shaded elements. This tool affects the current view only.




Setting up Shadow Studies

You can include shadow studies as part of your presentation views. Shadows are available for 2D and 3D model views.

To set up shadow studies, you can vary shadow and sun intensity. You can also define settings for sunlight that produces the shadows.

Casting Shadows

- 1 On the View Control Bar, click  (Shadows Off/On) ► Graphic Display Options.
- 2 Under Sun and Shadows, select Cast Shadows.
- 3 If enabled, use the sliders or enter values to vary sun and shadow intensity.
Shadow intensity controls the darkness of the shadows. Sun intensity changes the intensity of ambient color. Valid values are between 0 and 100.
- 4 Click OK to apply changes.

For information about sun and shadow settings, see [Defining the Sunlight Source for Shadows](#) on page 253. For information about silhouette edges, see [Applying or Removing a Line Style for a Silhouette Edge](#) on page 254.

Defining the Sunlight Source for Shadows

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Sun and Shadow Settings.


NOTE You can also access the Sun and Shadow Settings dialog from the Graphic Display Options dialog when shadows are enabled.

The Sun and Shadow Settings dialog includes predefined sunlight settings. You can select one of these or define a new one.

2 To create a new sunlight setting, click Duplicate, and enter a name.

3 To define the sunlight setting based on a specific location:

- Select By Date, Time, and Place.

- For Place, click .

- On the Place tab of the Manage Place and Locations dialog, select a city or specify a latitude and longitude. Click OK.

See [Specifying the Project Location](#) on page 448. See also [Rotating a View to True North](#) on page 449.

- Enter a date and time for the location.

4 To define sunlight by view:

- Select Directly.

- To orient the sunlight along a true north-south trajectory, do not select Relative to view.

- To orient the sunlight along the orientation of the view, select Relative to view.

- Enter the appropriate azimuth and altitude values.

5 To enable shadows on a ground plane, select Ground Plane at Level and select the level at which you want the shadows to display on the ground plane. Revit casts shadows on the specified level in 2D and 3D views. When you clear Ground Plane at Level, Revit casts shadows on the toposurface.

NOTE This option does not affect shadows in rendered images.

6 To test new sun and shadow settings, click Apply.

7 When you are finished with the sun and shadow settings, click OK.

Related topics

- [Casting Shadows](#) on page 253

- [Applying or Removing a Line Style for a Silhouette Edge](#) on page 254

Applying or Removing a Line Style for a Silhouette Edge


Revit Architecture can automatically apply a line style to silhouette edges. Silhouette edges are view-specific.

After you have applied silhouette edges to the model, there may be edges you do not want to display in silhouette. You can remove these lines as necessary.

To apply a line style to a silhouette edge:

1 On the View Control Bar, click  (Model Graphics Style) ► Hidden Line, or Shading with Edges.

Silhouette edges are not available for Wireframe or Shading model graphic styles.

- 2 On the View Control Bar, click  (Shadows Off/On) ► Graphic Display Options.
- 3 In the Graphic Display Options dialog, in the Edges panel, select a Silhouette style (for example, Wide Lines).
- 4 Click OK.

To remove a line style from a silhouette edge:

- 1 Click Modify tab ► Edit Linework panel ► Linework.
- 2 Click Linework tab ► Element panel, and from the Type Selector, select <Not Silhouette>.
- 3 Select the edges in silhouette, and the silhouette is removed.

For more information about the Linework tool, see [Changing the Line Style of Elements](#) on page 398.

Finding Referring Views

The Find Referring Views tool locates all views where the view annotation symbol is visible. For example, if you activate this tool for an elevation view, the Go to View dialog opens and lists all views where the elevation symbol is currently visible.

You can activate this tool from the Project Browser or in the drawing area.

Finding a View Symbol

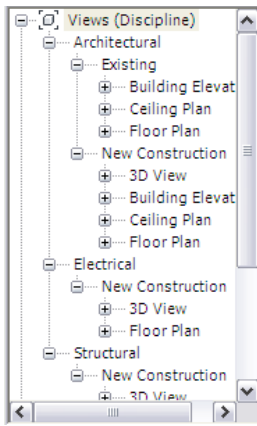
- 1 In the Project Browser, right-click the view for which you want to locate view annotation symbols.
You can also open the view, and right-click in the drawing area.
- 2 Select Find Referring Views.
- 3 In the Go To View dialog, select a view.
- 4 Click Open View.
The view opens with the view symbol selected.

Managing Views

The following topics describe different ways to manage project views to simplify your workflow and help to manage your building project.

Customizing Project View Organization in the Project Browser

You can sort views and sheets in the Project Browser using any of the property values for the view or sheet. For example, the following image shows views in the Project Browser organized by discipline, then by phase, and then by view type. The top level of the Views branch also shows the name of the sort group currently applied (in this case, Discipline).



In addition to sorting views, you can also limit the views that display in the Project Browser by applying a filter. This is useful when you have a project with a large number of views or sheets, and you only want to view a specific set in the Project Browser.

The properties that you can choose from when creating a sort group or applying a filter to the Project Browser include project parameters and shared parameters. For more information about project and shared parameters, see [Project Parameters](#) on page 458.

By default, the Project Browser displays all views (by view type) and all sheets (by sheet number and sheet name).

Sorting Views or Sheets in the Project Browser

- 1 Click View tab ► Windows panel ► User Interface drop-down ► Browser Organization.
- 2 In the Browser Organization dialog, click the Views tab to apply a sort to project views, or click the Sheets tab to apply a sort to sheets.
- 3 Select a sort group.

To view the properties of an existing sort group, select it, and click Edit.

For information on creating a sort group or editing an existing sort group, see [Creating a Project Browser Sort Group](#) on page 256 and [Editing a Project Browser Sort Group](#) on page 257.

- 4 Click Apply, then click OK.

Creating a Project Browser Sort Group

- 1 Click View tab ► Windows panel ► User Interface drop-down ► Browser Organization.
- 2 In the Browser Organization dialog, click the Views tab to create a sort group for project views, or click the Sheets tab to create a sort group for sheets.
- 3 Click New.
- 4 Enter a name for the sort group, and click OK.
- 5 In the Browser Organization Properties dialog, click the Folders tab.
- 6 For the first Group By list, select the view or sheet property to group by.

NOTE Values for the selected property must be defined for each view or sheet for the sort to work correctly. To edit view or sheet properties, in the Project Browser, right-click the view or sheet name, and select Properties.

- 7 If you want only the first few characters of the property value to be considered, select Leading characters, and specify a value.

- 8 Optionally, select 2 additional groupings.
- 9 In the Sort By list, select the order for views or sheets to display in the lowest level grouping, and select ascending or descending order.
- 10 Click OK.

Editing a Project Browser Sort Group

- 1 Click View tab ► Windows panel ► User Interface drop-down ► Browser Organization.
- 2 In the Browser Organization dialog, click the Views tab to edit a sort group for project views, or click the Sheets tab to edit a sort group for sheets.
- 3 Select a sort group.
- 4 To rename the sort group, click Rename.
- 5 To edit the sort group properties, click Edit. In the Browser Organization Properties dialog, make the necessary changes.
- 6 Click OK.

Adding a Filter to a Project Browser Sort Group

- 1 Click View tab ► Windows panel ► User Interface drop-down ► Browser Organization.
- 2 In the Browser Organization dialog, click the Views tab to apply a filter to project views, or click the Sheets tab to apply a filter to sheets.
- 3 Select a sort group, and click Edit.
- 4 In the Browser Organization Properties dialog, click the Filters tab.
- 5 Select the following:
 - a The view or sheet property as the filter.
 - b The filter operator.
 - c The filter operator value.

For example, to show only those project views associated with Level 1, you can create a filter by Associated Level, Equal to, Level 1.

- 6 Optionally, add 2 additional filters.
- 7 Click OK.

Editing a Project Browser Filter

- 1 Click View tab ► Windows panel ► User Interface drop-down ► Browser Organization.
- 2 In the Browser Organization dialog, click the Views tab to edit a filter that is in a project views sort group, or click the Sheets tab to edit a filter that is in a sheets sort group.
- 3 Select a sort group, and click Edit.
- 4 In the Browser Organization Properties dialog, click the Filters tab.
- 5 Make the necessary changes, and click OK.

Using View Lists

A view list is a schedule of the views in a project. In a view list, you can sort and group views by type, level, sheet, or other parameters. If desired, you can include view lists on sheets. (See [Schedules on Sheets](#) on page 1062.)

View lists can help you to do the following:

- Manage views in a project
- Track the status of views
- Ensure that important views display on sheets in the construction document set
- Ensure that views are using consistent and appropriate settings

You can use a view list to see and modify parameters for multiple views at once. For example, suppose you include the Detail Level and Scale parameters in a view list. From the view list, you can change the detail levels of selected views to coarse, medium, or fine, or change view scales to use consistent settings. You can also change the view name or view title that displays on sheets. By using a view list in this way, you can identify and correct inconsistent view settings from one location.

View List				
View Name	Sheet Number	Sheet Name	Detail Level	Scale Value
Building Section	A4	Sections	Medium	96
Cap Flashing	A5	Details	Fine	4
Changing Station	A6	Interiors	Coarse	96
Clearstory Plan			Coarse	96
Clearstory Plan			Coarse	96
Computer Cabinet	A6	Interiors	Coarse	96
Cubbies	A6	Interiors	Medium	96
East Elevation	A3	Elevations	Fine	96
Elevation of Floor			Fine	8
Entry Elevation	A3	Elevations	Coarse	96
Floor Plan	A2	Plans/Schedules	Medium	96
From Parking	T	Title Sheet	Medium	0
Half Height View	A6	Interiors	Medium	16

Related topic

- [Drawing Lists](#) on page 1066

Creating a View List

- 1 In a project, click View tab ► Create panel ► Schedules drop-down ► View List.
- 2 On the Fields tab of the View List Properties dialog, select the fields to include in the view list.
See [Selecting Fields for a Schedule](#) on page 176.
- 3 (Optional) To create user-defined fields, click Add Parameter.
For further instructions, see [Shared Parameters](#) on page 451.
- 4 Specify the remaining schedule properties using the Filter, Sorting/Grouping, Formatting, and Appearance tabs. See [Specifying Schedule Properties](#) on page 176.
By default, all project views are included in the view list. Use the Filter tab to omit views from the list based on their properties.
- 5 Click OK.

The resulting view list displays in the drawing area. In the Project Browser, it displays under Schedules/Quantities.

Adding a View List to a Sheet

To add a view list to a sheet, use the procedure for adding a schedule to a sheet. See [Adding a Schedule to a Sheet](#) on page 1063.

When you add a view list to a sheet, you can perform the same functions as for schedules on sheets, including the following:

- Formatting the view list
- Splitting the view list
- Adjusting the width of columns
- Displaying column headings vertically instead of horizontally

For instructions, see [Schedules on Sheets](#) on page 1062.

Renaming Views

Revit Architecture uses default names for project views. You can change view names at any time to better reflect their content or to simplify project management.

To rename a view from the Project Browser

- 1 In the Project Browser, right-click the view name, and click Rename.
- 2 In the Rename View dialog, enter a new name for the view, and click OK.

To rename a view using view properties

- 1 Access view properties, using either of the following methods:
 - In the Project Browser, right-click the view name, and click Properties.
 - In the drawing area of the view, right-click, and click View Properties.
- 2 In the Instance Properties dialog for the view, under Identity Data, for View Name, enter a new name for the view.
- 3 Click OK.

View Properties

The following properties are common to most view types.

Name	Description
View Scale	Changes the scale of the view as it appears on the drawing sheet. Select a scale value from the list.
Scale Value	Defines a custom scale value. This property is enabled when Custom is selected for View Scale.
Display Model	Hides the model in detail view. The Normal setting displays all elements normally. It is intended for all non-detail views. The Do Not Display setting shows only detail-view-specific elements. These elements include lines, regions, dimensions, text, and symbols. Elements in the model do not display. The As Underlay setting displays all detail-view-specific elements, while model elements are dimmed. You can use the underlay model elements as references for tracing lines, dimensioning, and aligning.

Name	Description
Detail Level	<p>Applies a detail level setting to the view scale: coarse, medium, or fine. This setting overrides the automatic detail level setting for the view. When you apply a detail level to a view, you enable the visibility of certain types of geometry:</p> <ul style="list-style-type: none"> ■ The compound structure of walls, floors, and roofs displays at medium and fine detail levels. ■ Family geometry changes depending on the detail levels. ■ Structural framing changes depending on detail level. At coarse levels, it appears as lines. At medium and fine levels, it displays with more geometry.
Visibility/Graphics Overrides	Click Edit to access the Visibility/Graphics dialog.
Model Graphics Style	Changes the display to Hidden Line, Wireframe, Shading, or Shading with Edges. See Model Graphics Styles on page 250.
Graphic Display Options	Click Edit to access the Graphic Display Options dialog, which controls shadows and silhouette lines. See Model Graphics Styles on page 250.
Underlay	<p>Displays another slice of the model under the current plan view. That slice of the model can be from above or below the current level. The underlay appears dimmed and is visible even in hidden line. The underlay is useful to understand the relation of components on different floors. Normally, you would turn off the underlay before exporting or printing the view. You set an underlay by specifying a level. The slice of the model between that level and the next level up displays. Three of the underlay options (Current Level, Level Above, and Level Below) are relative to the current level. All other choices are absolute. See Halftone/Underlay on page 497.</p> <p>TIP A level that is actually higher than the current level can be the underlay view. For example, the basement level could have Level 2 as its underlay.</p>
Underlay Orientation	Controls the display of the underlay in Hidden Line mode. If the value is specified as Plan, then the underlay displays as if you are viewing it from above, like a plan view. If the value is specified as Reflected Ceiling Plan, then the underlay displays as if you are viewing it from below, like a reflected ceiling plan.
Orientation	Switches the orientation of the project in the view between Project North and True North. See Project Location and Orientation on page 448.
Wall Join Display	Sets the default behavior for cleaning wall joins. If you set this property to Clean All Wall Joins, then Revit Architecture automatically cleans all wall joins. If you set this property to Clean Same Type Wall Joins, Revit Architecture only cleans wall joins of the same wall type. If you join different wall types, Revit Architecture does not clean them. You can override this setting using the Edit Wall Joins tool.
Discipline	Specify the discipline for the project view, Architectural, Structural, or Coordination. The discipline specified determines the organization of views in the Project Browser. Coordination combines Architectural and Structural. Select Structural to hide non-load-bearing walls from the view.
Color Scheme Location	In a floor plan view or section view, select Background to apply the color scheme to the background of the view (the floors of a floor plan, or the background walls of a section). Select Foreground to apply the color scheme to all model elements in the view. See Applying a Color Scheme on page 1022.

Name	Description
Color Scheme	In a floor plan view or section view, the color scheme to use for rooms and areas. See Color Schemes on page 1019.
View Name	The name of the active view. The view name displays in the Project Browser and in the title bar of the view. It also displays as the name of the viewport on a sheet, unless you define a value for the Title on Sheet parameter.
Title on Sheet	The name of the view as it appears on the sheet; it supersedes any value in the View Name property. This parameter is not available for sheet views.
Referencing Sheet	See the description for Referencing Detail that follows. From the example, the referencing sheet is A101.
Referencing Detail	This value comes from the referencing view that is placed on a sheet. For example, you create a section in a plan view. You place that plan view as the first detail on a sheet numbered A101. The referencing detail number for the section view is 1.
Default View Template	Identifies the default view template for the view. See View Templates on page 507.
Crop View	Select the Crop View check box to enable a crop boundary around the model. Select the boundary and resize it using the drag controls. As you resize the boundary, the visibility of the model changes. To turn off the boundary and maintain the cropping, clear the Crop Region Visible check box. See Crop Regions on page 211.
Crop Region Visible	Shows or hides the crop region. View cropping is not available in sheet and schedule views.
Annotation Crop	Shows or hides the annotation crop when crop regions are visible in the project view.
View Range	Within the view properties of any plan view, you can set the View Range. With View Range, you can control the specific geometric planes that define the boundaries of each view. These boundaries are set by defining the exact cut plane as well as the top and bottom clip planes.
Associated Level	The level associated with the plan view. This is a read-only property.
Scope Box	If you draw a scope box in a view, you can associate the view's crop region with that scope box, so the crop region is visible and matches the scope box extents. This property is available for plan, elevation, and section views. When you select a scope box value for this property, the Crop Region and Crop Region Visible properties become read-only.
Phase Filter	The specific phase filter applied to the view.
Phase	The specific phase of the view. Along with the Phase Filter, it determines which model components (phase-wise) are visible in the view and how they appear graphically. When you create new model components in a view, these components assume the view phase as their creation phase.

Using Dimensions and Constraints

6

Dimensions are view-specific elements that show sizes and distances in a project. There are 2 types of dimensions: temporary and permanent.

Constraints are non-view specific elements that can function independently of dimensions. Constraint elements appear in all views in which their references are visible; dimensions are view specific. You can modify and delete constraints independently of dimensions or remove them when you delete dimensions.

Dimensions

Dimensions are view-specific elements that show sizes and distances in a project. There are 2 types of dimensions: temporary and permanent.

Revit Architecture places temporary dimensions as you place components. You create permanent dimensions to define a particular size or distance. Each dimension type can be modified, and the component that is dimensioned updates accordingly.

Temporary and permanent dimensions, by default, use the unit settings specified for the project. For permanent dimensions, you can create custom dimension types that override the default unit settings. See [Creating Custom Dimension Units](#) on page 275.

Temporary Dimensions

As you create or select geometry, Revit Architecture displays temporary dimensions around the component. This is useful for placing the component in the proper place.

Temporary dimensions are created to the nearest perpendicular component and increment by the set value. For example, if you set the snap to 6 cm, the dimension increments in values of 6 cm as you move the component to place it. For information on changing the dimension snap value, see [Setting Snap Increments](#) on page 503.

After you place a component, Revit Architecture displays the temporary dimensions. When you place another component, the temporary dimensions for the previous component disappear to reduce clutter. To view the temporary dimensions of a component, click Modify and select the component. Remember, the temporary dimensions are to the nearest component, so the dimensions you see may be different from the original temporary dimensions. If there are dimensions you want to appear at all times, create permanent dimensions.

You can modify temporary dimensions to reference the components you want by moving the witness lines. You can also specify the display and placement of temporary dimensions. See [Specifying Temporary Dimension Settings](#) on page 507.

Showing Temporary Dimensions When Multiple Elements are Selected

When you select multiple elements in Revit Architecture, temporary dimensions and constraints do not display.


System performance can significantly increase when the temporary dimensions and constraints are not displayed.

To show temporary dimensions and constraints:

- 1 Select multiple elements in the drawing area.
- 2 On the Options Bar, click Activate Dimensions.

NOTE System performance can significantly increase when the temporary dimensions and constraints are not displayed.

Changing Temporary Dimensions to Permanent Dimensions

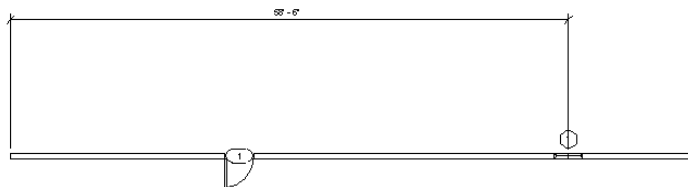
- 1 Select a component in the drawing area.
- 2 Click the dimension symbol  that appears near the temporary dimension. You can then modify the properties of the new dimension and change its type.

Permanent Dimensions

A permanent dimension is a dimension that you specifically place. Permanent dimensions can appear in 2 different states: modifiable and non-modifiable. You can modify a permanent dimension when the geometry that it references is selected.

If the geometry that a permanent dimension references is not selected for modification, the dimension appears at its true size and is not available for modification. This is done to eliminate crowding of dimensions when they are not needed for modification.

Permanent dimension in a non-modifiable state



When dimensioning components such as doors and windows, you can select either the edge of the opening to dimension or you can select the center of the component to dimension.

NOTE Dimensions are like other annotation elements; they are view-specific. They do not appear in all other views automatically.

Placing Permanent Dimensions

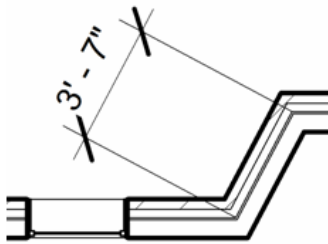
The Dimension tool lets you place permanent dimensions on components in your project or family. You can select from aligned, linear (horizontal or vertical projection of a component), angular, radial, or arc length permanent dimensions.

To view a dimension value after placing it, select one of the components that it references.

Before placing dimensions in Revit Architecture, you may want to edit the properties for dimensions and predefine aligned, linear, angular, radial, and arc length dimensions. For more information, see [Dimension Properties](#) on page 290.

Aligned Dimensions

You can place aligned dimensions between 2 or more parallel references or 2 or more points, such as wall ends.



- 1 Click Annotate tab ► Dimension panel ► Aligned.

Options are Wall centerlines, Wall faces, Center of core, and Faces of core. For example, if you select Prefer wall centerlines, the cursor first snaps to the centerline of a wall when you place it over the wall.

- 2 For Pick, select Individual References.

- 3 Place the cursor at a reference point on an element, such as a wall.

The reference point highlights if you can place the dimension there.

TIP You can cycle through the different reference points for walls by pressing *Tab*. Intersections of internal wall layer boundaries provide references for aligned dimensioning. A gray square reference displays at any intersection of internal wall layers.

- 4 Click to specify the reference.

- 5 Place the cursor on the desired location of the next reference point, and click.

As you move the cursor, a dimension line appears. You can continue to select multiple references, if desired.

- 6 When you have reached the last reference point, move the cursor away from the last component and click.

The permanent aligned dimension appears.

Automatic Aligned Dimensions with Walls

With automatic aligned dimensions, you can place a dimension on a wall with one click, eliminating the need to pick all references. You can dimension an entire wall, a wall with intersecting walls, or a wall with openings.

- 1 Click Annotate tab ► Dimension panel ► Aligned.
 - 2 For Pick, select Entire Walls.
 - 3 Click Options.
 - 4 In the Auto Dimension Options dialog, select:
 - Openings to dimension a wall and its openings. Select Centers or Widths to set the references for the openings.
If you select Centers, the dimension string uses the opening's center as a reference. If you select Widths, the dimension string measures the width of the opening.
 - Intersecting Walls to dimension a wall and its intersecting walls. When you select a wall to place a dimension, a multi-segmented dimension string displays automatically.
 - Intersecting Grids to dimension a wall and its intersecting grids. When you select a wall to place a dimension, the multi-segmented dimension string displays automatically and references the perpendicular grids that intersect the wall centerline.
-
- NOTE** If a grid line is coincident with another wall reference point (for example, the wall end point), then a witness line is not created for the grid. This avoids the creation of zero-length dimension segments.
-
- 5 Click OK to close the Auto Dimension Options dialog.
 - 6 Place the cursor on a wall so that the wall highlights, and click. If desired, continue to highlight other walls to add them to the dimension string.
 - 7 Move the cursor away from the walls so that a dimension line displays.
 - 8 Click to place the dimension.

Aligned Dimensions with Arc Wall Centers

You can place aligned dimensions from the center of arc walls to other walls or lines.

- 1 Click Annotate tab ► Dimension panel ► Aligned.
- 2 Move the cursor over the arc wall until the center mark (+ symbol) displays. You may need to zoom in to see the + symbol.

NOTE By default the arc center mark is invisible. You can dimension to it without displaying it by moving the cursor over the arc until the center mark highlights. Arc center marks are only visible in a plan view.

- 3 Click to start the dimension.
- 4 Place the dimension between the arc wall center and any other component you wish to dimension.

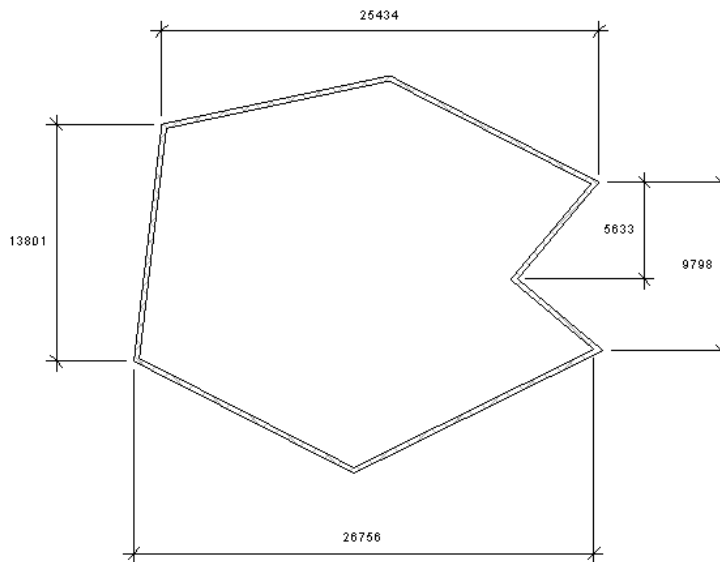
Linear Dimensions

Linear dimensions are placed between selected points. The dimensions are aligned to the horizontal or vertical axis of the view. The selected points are endpoints of elements or the intersection of references (for example, the join of 2 walls).

You can use arc end points as references when placing linear dimensions.

Horizontal and vertical dimensions are available in the project environment only. You cannot create them in the Family Editor.

The following illustration shows horizontal and vertical linear dimensions on an irregular-shaped building.



Placing Linear Dimensions

- 1 Click Annotate tab ► Dimension panel ► Linear.
- 2 Place the cursor at a reference point on an element, such as a wall or a line, or at the intersection of references, such as a join between 2 walls.
The reference point highlights if you can place the dimension there. You can switch through the different reference points of intersections by pressing *Tab*.
- 3 Click to specify the reference.
- 4 Place the cursor on the desired location of the next reference point, and click.
As you move the cursor, a dimension line appears. You can continue to select multiple references, if desired.
- 5 After selecting a second reference point, press *Spacebar* to align the dimension to the vertical or horizontal axis.
- 6 When you have reached the last reference point, move the cursor away from the last element, and click.
The dimension displays.

Related topics

- [Angular Dimensions](#) on page 267
- [Radial Dimensions](#) on page 268
- [Arc Length Dimensions](#) on page 269
- [Baseline and Ordinate Dimensions](#) on page 269

Angular Dimensions

Angular dimensions can be placed on multiple reference points sharing a common intersection. You cannot drag the dimension arc to display a full circle.

- 1 Click Annotate tab ► Dimension panel ► Angular.

2 Place the cursor on a component and click to create a start point for the dimension.

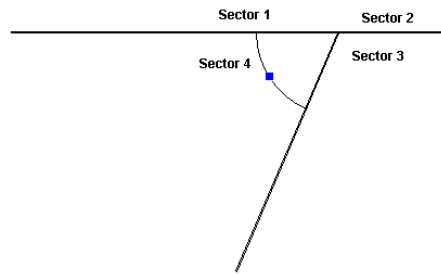
TIP You can switch the reference point for the dimension between a wall face and a wall centerline by pressing *Tab*.

3 Place the cursor on a component not parallel to the first and click.

TIP You can select multiple reference points for the dimension. Each element you are dimensioning must pass through a common point. For example, to create a multiple-reference angular dimension among 4 walls, each of the 4 walls must pass through a common point.

4 Drag the cursor to size the angular dimension. Select the sector where you want the dimension to appear:

Wall join with 4 distinct sectors



5 When sized properly, click to place.

Radial Dimensions

1 Click Annotate tab ► Dimension panel ► Radial.

2 Place the cursor on the arc and click.

A temporary dimension appears.

TIP You can switch the reference point for the dimension between a wall face and a wall centerline by pressing *Tab*.

3 Click again to place the permanent dimension.

Changing Radial Dimension References on Arcs

You can change the reference of an existing radial dimension from one arc to another, provided the new arc is concentric with the original arc.

1 Select a radial dimension.

A blue square drag control appears at the end of the dimension.

2 Drag the control to another arc.

A valid concentric arc highlights when you place the cursor over it.

Arc Length Dimensions

You can dimension arc walls to obtain the overall length of the wall.

1 Click Annotate tab ► Dimension panel ► Arc Length.

2 For Prefer, select a snap option.

For example, select Prefer wall faces to have the cursor snap to the inside or outside wall face. This aids in selecting the radial point.

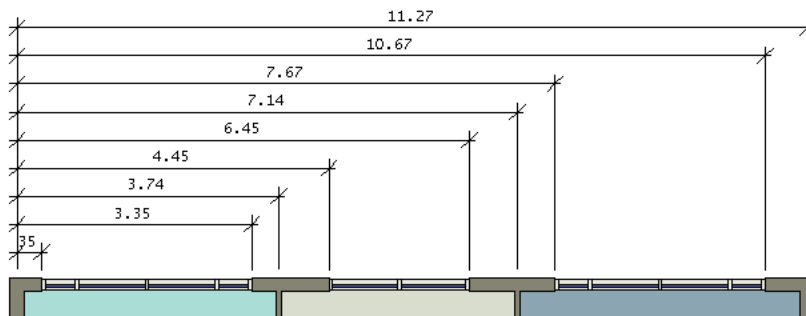
3 Place the cursor on the arc and click to select the radial point.

4 Select the end points of the arc and move the cursor up and away from the arc wall.

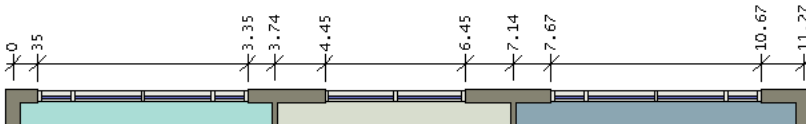
5 Click to place the arc length dimension.

Baseline and Ordinate Dimensions

Baseline dimensions are multiple dimensions measured from the same baseline.



Ordinate dimensions measure the perpendicular distance from an origin point called the datum to an element. These dimensions prevent escalating errors by maintaining accurate offsets of the features from the datum.



You can create baseline and ordinate dimensions for linear dimension styles. Linear dimension styles include aligned, horizontal, and vertical dimensions. To create a baseline or ordinate dimension for these linear dimension styles, you need to edit the Dimension String type parameter. Since this is a type parameter, you may want to create a new baseline or ordinate linear dimension style so that any continuous dimensions in the project are not affected when you edit the parameter.

Baseline and ordinate dimensions export to CAD formats.

IMPORTANT Arc length dimensions are linear dimensions and have parameters (Dimension String Type and Ordinate Dimension Settings) for creating baseline and ordinate dimensions, but these parameters have no effect on arc length dimensions.

Creating a Baseline Linear Dimension Style

1 Click Annotate tab ► Dimension panel ► Aligned or Linear.

These are both linear dimension styles.

2 Click Place Dimensions tab ► Element panel ► Element Properties drop-down ► Type Properties.

- 3 In the Type Properties dialog, click Duplicate.
- 4 In the Name dialog, enter a name for the dimension, such as Baseline Linear-3/32" Arial.
- 5 Click OK.
- 6 In the Type Properties dialog, for the Dimension String Type parameter, select Baseline.
- 7 Click OK 2 times.

The new dimension style displays in the Type Selector.

Creating an Ordinate Linear Dimension Style

- 1 Click Annotate tab ► Dimension panel ► Aligned or Linear.
These are both linear dimension styles.
- 2 Click Place Dimensions tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 In the Type Properties dialog, click Duplicate.
- 4 In the Name dialog, enter a name for the dimension, such as Ordinate Linear-3/32" Arial.
- 5 Click OK.
- 6 In the Type Properties dialog, for the Dimension String Type parameter, select Ordinate.
- 7 Click Edit for the Ordinate Dimension Settings parameter.
- 8 In the Ordinate Dimension Settings dialog, specify settings for the ordinate dimension.


Setting	Description
Text Orientation	Specify where to align the dimension text, with the witness line or the dimension line. This setting is disabled when the Read Convention parameter is Horizontal.
Text Position	Specify the text position, at the end of the witness line or next to the witness line.
Origin Visibility	Specify visibility of the origin witness line for the ordinate dimension (this is the first witness line in the string). Options are: <ul style="list-style-type: none"> ■ None does not show the origin witness line, tick mark, or text (0'-0"). ■ Witness Line with Text shows the origin witness line, tick mark and text (0'-0"). ■ Witness Line only shows the origin witness line and tick mark.
Origin Tick Mark	Specify the tick mark for the dimension origin. This setting is disabled when Origin Visibility is set to None.
Dimension Line Style	Specify the dimension line style. Options are: <ul style="list-style-type: none"> ■ Continuous displays the dimension line as continuous. ■ Segmented segments the dimension line. Specify the length of the segments with the Length of Segment settings.

Setting	Description
	<ul style="list-style-type: none"> ■ None shows no dimension line. When you select the dimension line in the drawing area, a hidden line displays.
Length of Segments	Specify the dimension line segment length. This setting is enabled when Dimension Line Style is Segmented.

9 Click OK 2 times.

The new dimension style displays in the Type Selector.

Placing Baseline Dimensions

- 1 Click Annotate tab ► Dimension panel ► Aligned or Linear.
- 2 In the Type Selector, select a baseline dimension style.
For more information, see [Creating a Baseline Linear Dimension Style](#) on page 269.
- 3 In the drawing area, select the first point for the dimension. This is the origin.
- 4 Continue to select the necessary reference points.
- 5 When you have reached the last reference point, move the cursor away from the last element, and click.
The baseline dimension displays.
- 6 To customize display of the baseline dimension:
 - a In the drawing area, select the dimension.
 - b Click the flip controls () to flip the dimension direction.
 - c Press *Spacebar* to change the baseline dimension stacking. You can use the spacebar to change the baseline dimension stacking before or after placement.

Placing Ordinate Dimensions

- 1 Click Annotate tab ► Dimension panel ► Aligned or Linear.
- 2 In the Type Selector, select an ordinate dimension style.
For more information, see [Creating an Ordinate Linear Dimension Style](#) on page 270.
- 3 In the drawing area, select the first point for the dimension. This is the origin.
- 4 Continue to select the necessary reference points.
- 5 When you have reached the last reference point, move the cursor away from the last element, and click.
The ordinate dimension displays.

Locking Permanent Dimensions

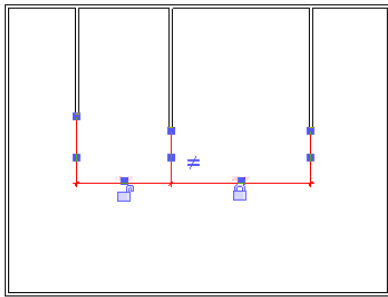
When you place permanent linear or angular dimensions, a lock control appears with the dimension. Locks appear when you select

- A permanent dimension.
- An element constrained by a dimension. An element is constrained if it is referenced by a locked segment or is a reference in an equality dimension.

If the lock is unlocked, the dimension value is modifiable and the element that it references is free to move in any direction. You can click the dimension value and change it.

If the lock is locked, the dimension value is fixed, preventing any change to the distance between its referenced components. You cannot click the dimension value to change it.

Selected dimension with locked and unlocked controls




Clicking on the lock switches it between the locked and unlocked state. Once a dimension is locked, you must unlock it to change its value.

TIP You can also switch the locked and unlocked state of the lock by right-clicking on it and choosing Toggle.

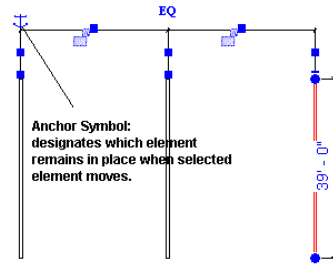
Also see [Applying Constraints with Dimensions](#) on page 300.

Anchoring Elements Referenced in Multi-Segmented Dimensions

In a multi-segmented, equality constrained dimension, you can use the anchor symbol to designate the anchored element. The element that is anchored remains stationary while you move other elements in a dimension.

- 1 Create a multi-segmented dimension. See [Placing Permanent Dimensions](#) on page 265 for information on creating dimensions.
- 2 Click Modify tab ► Selection panel ► Modify.
- 3 In the drawing area select the dimension, and click the Dimension Equality symbol () to make the dimension equally constrained.
- 4 Select any element the dimension references, except the one you want to anchor.
An anchor symbol appears near the dimension.

Equality dimension with selected element shown in red



- 5 Click and hold the anchor symbol. A witness line appears for the anchor.
- 6 Drag the anchor symbol to the element you want to anchor.
- 7 Move any of the unanchored elements referenced in the dimension.
The element accompanied by the anchor does not move.

NOTE If you select the element the anchor is currently attached to, this also moves the position of the anchor.

Distinguishing a Dimension Lock's Related Element

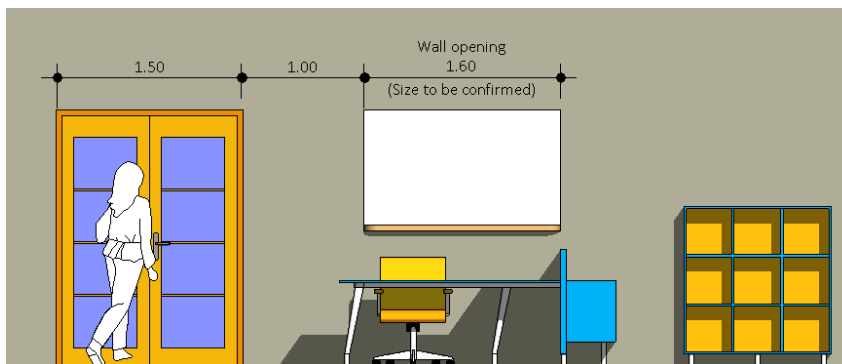
In large-scale projects with many dimensions and alignments, it can be difficult to distinguish which dimension locks refer to which elements.

To determine the element that a lock belongs to:

- 1 In the drawing area, right-click a dimension lock.
- 2 Select Show Related from the shortcut menu.
The appropriate element highlights and a dialog identifies the element.
- 3 Click the arrow buttons to switch between the elements constrained by the lock.

Overriding Dimension Text

You can add supplemental text above, below, to the left or right of a permanent dimension value.



To add supplemental text to a dimension value:

- 1 In the drawing area, select the dimension you want to edit.
- 2 Click the dimension value.
The Dimension Text dialog displays.

3 In the Dimension Value field, select Use Actual Value.

Enter the text you want to display in the Above, Below, Prefix, and/or Suffix text fields.

NOTE You do not need to enter text in all fields, only those you require.

4 Click Apply.

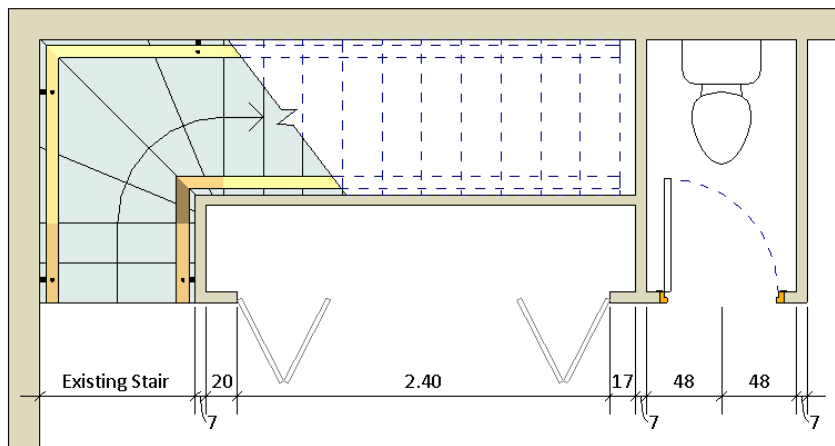
5 Click OK.

Related topics

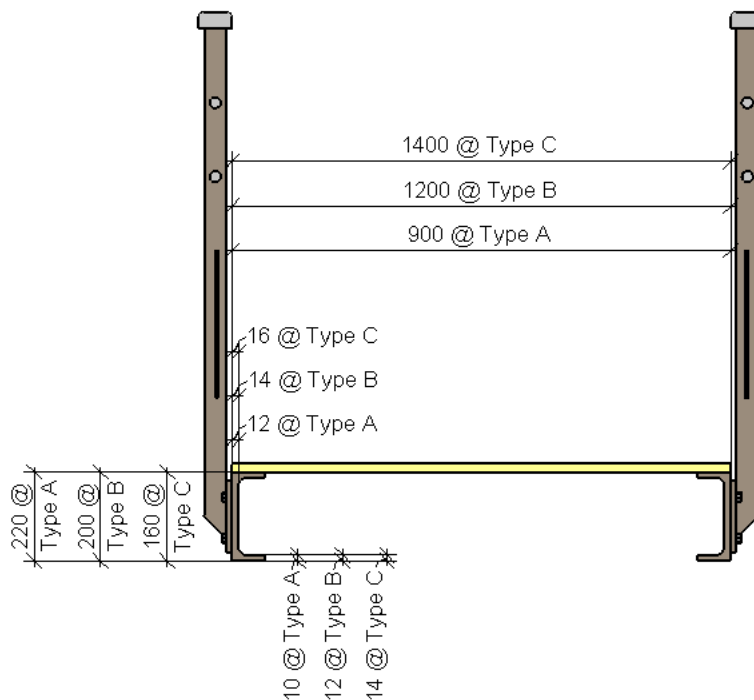
- [Replacing Permanent Dimension Values with Text](#) on page 274
- [Modifying Dimensions](#) on page 286
- [Dimension Properties](#) on page 290

Replacing Permanent Dimension Values with Text

You can replace a permanent dimension value with text, as shown in the following image.



You can also replace a dimension value with variations within a class of element, as shown below.



You cannot replace a permanent dimension value with a numeric value. You will receive a message if you attempt to do so.

To replace permanent dimension values with text:

- 1 In the drawing area, select the dimension you want to edit.
- 2 Click the dimension value.
The Dimension Text dialog displays.
- 3 In the Dimension Value field, select Replace With Text.
- 4 In the text box, enter the text you want to display in place of the dimension value.
- 5 Optionally, enter text in the Above and/or Below text fields.
- 6 Click Apply.
- 7 Click OK.

Related topics

- [Overriding Dimension Text](#) on page 273
- [Modifying Dimensions](#) on page 286
- [Dimension Properties](#) on page 290

Creating Custom Dimension Units

When you create a project, by default Revit Architecture assigns specific units and accuracy to dimension styles based on the project units settings. See [Project Units](#) on page 502.

You can create custom dimension types that override these default settings. For each custom dimension type you create, you can define the unit and accuracy settings. For example, in a project that uses Imperial units, you can create a dimension type that displays a metric unit. You can also create dimension types that

have different rounding options so, for example, you can show dimensions that round to 1/8" in a plan view and 1/32" in a detail view.

To create a custom dimension type:

- 1 Click Annotate tab ► Dimension panel.
- 2 On the Dimensions panel drop-down, click the appropriate dimension tool. For example, if you want to apply custom accuracy to a linear dimension, click Linear Dimension Type.
The Type Properties dialog displays.
- 3 Click Duplicate. Enter a name for the new dimension style, and click OK.
- 4 Find the Units Format parameter and click the button next to it.
- 5 Clear the Use project settings check box.
- 6 For Units, select an appropriate unit.
- 7 For Rounding, select an appropriate value. If you select Custom, enter a value in the Rounding increment text box.
- 8 If applicable, select a Unit suffix.
- 9 Click OK.
- 10 Click OK twice to exit the dimension properties.


Dimensioning to Core in Compound Structures

When constructing a compound wall with inserts, builders often want to know the dimensions of unfinished structural openings for the inserts. You can dimension a structural opening by choosing references on the outer boundary of the core layer in the wall. The structural layer is typically within the core boundary of a wall.

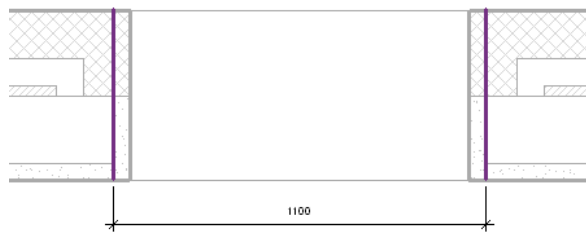
Inserts can be perpendicular or non-perpendicular to the core boundary.

NOTE If you want to dimension to the structural layer of a wall at an insert, be sure that the cut plane offset of the view is set at or lower than the cut plane offset of the insert family.

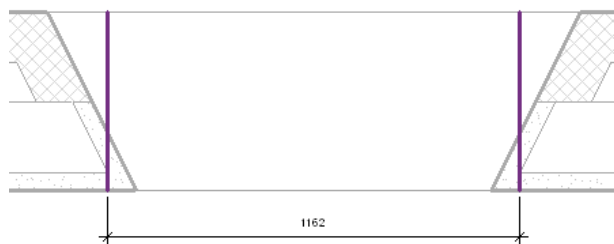
Dimensioning to Core

- 1 Draw a compound wall and place an insert into the wall.
- 2 To view the layers of the wall, set the Detail Level of the view to Medium or Fine. To do this, click  (Detail Level) at the bottom of the drawing area.
- 3 Select the wall and right-click Element Properties.
- 4 In the Instance Properties dialog, click Edit Type to access the wall's type properties.
- 5 Set the Wrapping at Inserts property to Both.
- 6 Click OK twice to exit the dialog.
- 7 On the Options Bar, for Prefer, select Faces of Core.
- 8 Select the outer core boundary as the reference for the dimension.

Dimension references for perpendicular insert



Dimension references for non-perpendicular insert

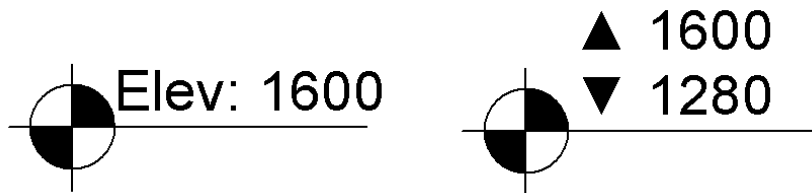


Spot Dimensions

Spot dimensions can be placed as spot elevations, spot coordinates, or spot slopes. Spot elevations can display the elevation of a selected point or the top and bottom elevation of an element. Spot coordinates display the North/South, East/West coordinates of a selected point, and can also display the elevation of the selected point. Spot slopes can display the slope at a specific point on a face or an edge of an element.

Spot Elevations

Spot elevations display the actual elevation of a selected point. Spot elevations can also display the top and/or bottom elevation of elements with a definite thickness. Top and bottom elevations are available for elements in plan views.



You can place spot elevations on non-horizontal surfaces and non-planar edges. You can place them in plan, elevation, and 3D views. Spot elevations are typically used to obtain a point of elevation for ramps, roads, toposurfaces, and stair landings.

Placing a Spot Elevation Dimension

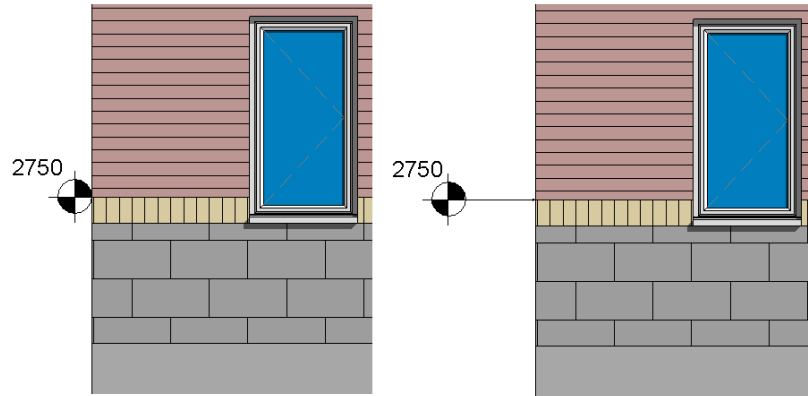
1 Click Annotate tab ► Dimension panel drop-down ► Spot Elevation.

2 In the Type Selector, select the type of spot elevation to place.

3 On the Options Bar:

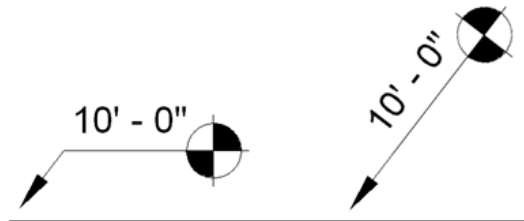
- a Select or clear the Leader option.

The following image shows the same spot elevation without and with a leader.



- b If the Leader option is selected, optionally select the Shoulder option. This adds a bend to the spot elevation leader.

The following image shows a spot elevation with and without a leader shoulder.



- c If you are placing a relative spot elevation, select an option for Relative Base.

- d Select an option for Display Elevations.

NOTE This option is enabled when you place a spot elevation in a plan view.

- Actual (Selected) Elevation displays the elevation of the selected point on the element.
- Top Elevation displays the top elevation of the element.
- Bottom Elevation displays the bottom elevation of the element.
- Top & Bottom Elevation displays the top and bottom elevations of the element.

4 Select an edge of an element, or select a point on a toposurface.

When you move the cursor over an element on which you can place the spot elevation, the value of the spot elevation displays in the drawing area.

5 If you are placing a spot elevation:

- without a leader, click to place it.

- with a leader, move the cursor away from the element, and click to place the spot elevation.
- with a leader and a shoulder, move the cursor away from the element. Click once to place the leader shoulder. Move the cursor again and then click to place the spot elevation.

6 To finish, click **Modify** tab ► **Selection** panel ► **Modify**.

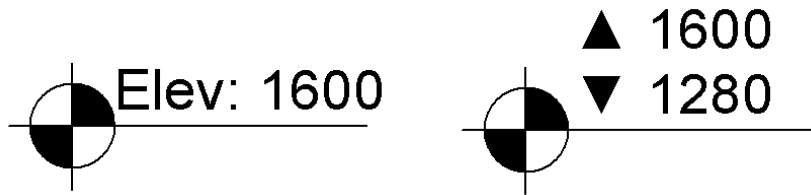
If you select a spot elevation after placing it, you can move it using the drag controls. If you delete an element that is referenced or turn off its visibility, the spot elevation is removed.

Related topics

- [Adding Supplementary Text to Spot Elevation Dimensions](#) on page 279
- [Changing Elevation Reporting](#) on page 279
- [Changing Spot Elevation Arrowhead Style](#) on page 280
- [Dimension Properties](#) on page 290

Adding Supplementary Text to Spot Elevation Dimensions

You can add supplementary text to spot dimensions. By editing the type parameters for the spot elevation, you can add text for the elevation indicator, top indicator, and bottom indicator. This text can appear as a suffix or a prefix to the spot elevation value.



In addition, you can edit the instance parameters for a spot elevation to add supplementary prefix and/or suffix text to the single (or upper) value and the lower value.

The following list shows the order of appearance for text relative to the spot elevation value.

- Single/Upper Value Prefix or Lower Value Prefix (instance parameters)
- Top Indicator or Bottom Indicator when set as Prefix (type parameters)
- Elevation Indicator when set as Prefix (type parameter)
- **Spot elevation value**
- Elevation Indicator when set as Suffix (type parameter)
- Top Indicator or Bottom Indicator when set as Suffix (type parameters)
- Single/Upper Value Suffix or Lower Value Suffix (instance parameters)



For more information, see [Spot Elevation Type Properties](#) on page 293 and [Spot Elevation Instance Properties](#) on page 295.

Changing Elevation Reporting

A spot elevation can report elevations relative to project origin, shared origin, or a specified level.

- 1 Place a spot elevation.
- 2 Select it and right-click Element Properties.
- 3 In the Instance Properties dialog, click Edit Type.
- 4 Specify a value for the Elevation Origin parameter. For more information about the values, see [Spot Elevation Type Properties](#) on page 293.
- 5 If you set the elevation to Relative, click OK, and set the value for the Relative Base instance parameter.

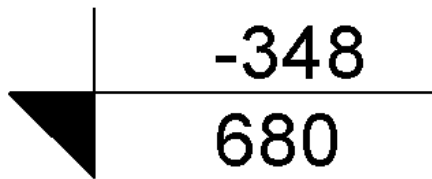
Changing Spot Elevation Arrowhead Style

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Arrowheads.
- 2 For Type, select Filled Elevation Target.
- 3 For Arrow Style, select Elevation Target.
- 4 If desired, select Fill Tick. If you select this option, the arrowhead looks like the filled elevation symbol: . If you do not select this option, the arrowhead is a crosshairs symbol: .
- 5 Click OK.
- 6 Place a spot elevation.
- 7 Select the spot elevation, right-click Element Properties, and click Edit Type.
- 8 For Type, select Target Leader.
- 9 For Leader Arrowhead, select Filled Elevation Target.

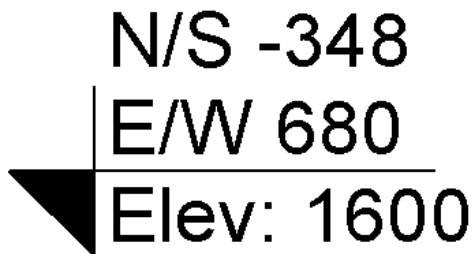
NOTE The Filled Elevation Target type is available for other annotations, such as text note leaders.

Spot Coordinates

Spot coordinates report the North/South and East/West coordinates of points in a project.



You can also display the elevation of the selected point and indicator text in addition to the coordinates.



Coordinates are reported with respect to the shared coordinate system. See [Shared Positioning](#) on page 1296.

Spot coordinates can be placed on floors, walls, toposurfaces, and boundary lines. You can also place spot coordinates on non-horizontal surfaces and non-planar edges. When you display the elevation of the selected point in addition to the spot coordinates, you can place the spot coordinate in the same locations you can place a spot elevation.

To place spot coordinates:

- 1 Click Annotate tab ► Dimension panel drop-down ► Spot Coordinate.
- 2 In the Type Selector, select the type of spot coordinate to place.
- 3 On the Options Bar, select or clear the Leader option. If the Leader option is selected, optionally select the Shoulder option. This adds a bend to the spot elevation leader.
- 4 If you want the elevation to display in addition to the spot coordinates:
 - a Right-click Element Properties.
 - b In the Instance Properties dialog, click Edit Type.
 - c Under Text, select the Include Elevation option.
- 5 Select an edge of an element or a point on a toposurface.

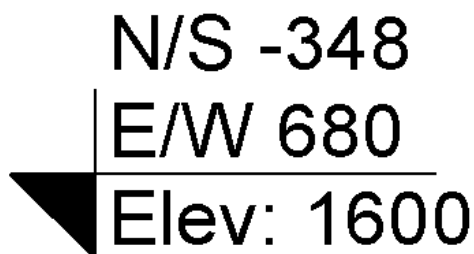
When you move the cursor over an element on which you can place the spot coordinate, the spot coordinate value appears in the drawing area.
- 6 If you are placing a spot coordinate:
 - without a leader, click to place it.
 - with a leader, move the cursor away from the element, and click to place the spot coordinate.
 - with a leader and a shoulder, move the cursor away from the element. Click once to place the leader shoulder. Move the cursor again and then click to place the spot coordinate.
- 7 To finish, click Modify tab ► Selection panel ► Modify.

If you select a spot coordinate after placing it, you can move it using the drag controls. If you delete an element that is referenced or turn off its visibility, the spot coordinate is removed.

To modify the appearance of the spot elevation, select it and right-click Element Properties. For more information, see [Dimension Properties](#) on page 290.

Adding Supplementary Text to Spot Coordinate Dimensions

You can add supplementary text to spot dimensions. By editing the type parameters for the spot coordinate, you can add text for the North/South indicator, East/West indicator, and elevation indicator. This text can appear as a suffix or a prefix to the spot coordinate values.



In addition, you can edit the instance parameters for a spot coordinate to add supplementary prefix and/or suffix text to the top, bottom, and elevation values.

The following list shows the order of appearance for text relative to the top spot coordinate value.

- Top Value Prefix (instance parameter)
- Indicator when set as Prefix (type parameter)
- **Top spot coordinate value**
- Indicator when set as Suffix (type parameter)
- Top Value Suffix (instance parameter)

The following list shows the order of appearance for text relative to the bottom spot coordinate value.

- Bottom Value Prefix (instance parameter)
- Indicator when set as Prefix (type parameter)
- **Bottom spot coordinate value**
- Indicator when set as Suffix (type parameter)
- Bottom Value Suffix (instance parameter)

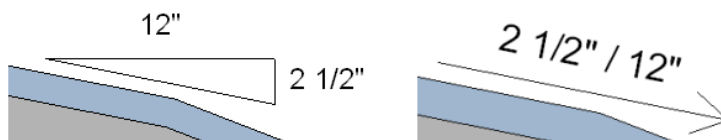
The following list shows the order of appearance for text relative to the elevation spot coordinate value.

- Elevation Value Prefix (instance parameter)
- Elevation Indicator when set as Prefix (type parameter)
- **Elevation spot coordinate value**
- Elevation Indicator when set as Suffix (type parameter)
- Elevation Value Suffix (instance parameter)

For more information, see [Spot Coordinate Type Properties](#) on page 296 and [Spot Coordinate Instance Properties](#) on page 298.

Spot Slopes

A spot slope displays the slope at a specific point on a face or an edge of a model element. You can place spot slopes in plan views, elevation views, and section views. The following illustration show the two spot slope types.



Objects using spot slopes most commonly include roofs, beams, and piping.

Placing a Spot Slope Dimension

- 1 Click Annotate tab ► Dimension panel ► Spot Slope.
- 2 In the Type Selector, select the type of spot slope to place.
- 3 (Optional) Change the following on the Options Bar:
 - a Change the Slope Representation option.

This option is enabled when you are in elevation and section view. You can choose an arrow or triangle option.

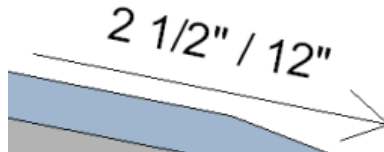
- b** Select or change the Offset from Reference option.

This option allows you to move the spot slope closer or further from the reference.

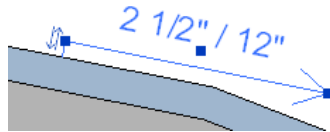
4 Click the edge or slope where you will place the spot slope.

5 Click to place the spot slope, which can be either above or below the slope.


When you move the cursor over an element on which you can place the spot slope, the value of the spot slope displays in the drawing area.

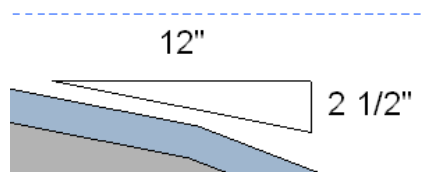


When you click on the spot slope, it looks similar to the following:



6 When you are placing a spot slope, you can also do the following:

- Click the flip controls () to flip the spot slope dimension direction.
- The slope representation has two representations: arrow or triangle. The same information exists in both representations though it displays differently. The triangle is not available for use in plan views. The triangle looks similar to the following:



7 To finish, click Modify tab ► Selection panel ► Modify.

Related topics

- [Spot Dimensions](#) on page 277
- [Dimension Properties](#) on page 290

Listening Dimensions

When you are sketching, you can explicitly enter a value for the sketch line by typing a number after you begin the sketch line. This method is known as listening dimensions.

Typically, listening dimensions specify linear dimensions such as length. For example, the length of a line (when drawing a line), length of a chord (when drawing the second point of a 3-point arc), length of a radius

(when drawing an arc, circle, or polygon). If there is no linear dimension, you can enter an angular dimension, if applicable.

Listening dimensions are not available for some elements, such as splines or rectangles.

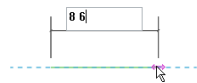
Following is a sample procedure for using listening dimensions to specify the length of a sketch line.

- 1 Begin sketching a line.



NOTE Listening dimensions initially appear in blue or black bold text.

- 2 Type the length value. When you type a number a text box appears, as shown below.
For example, if you need a line that is 8 feet 6 inches long, type the value as: 8 6.



- 3 Press *Enter*.

The sketch line is drawn the specified length.



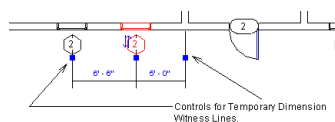
Dimension Witness Lines

You can move witness lines to new references for temporary and permanent dimensions. You can also control the gap between the witness line and the element for permanent dimensions.

Properties for witness lines are included with the type properties for permanent dimensions. See [Permanent Dimension Type Properties](#) on page 290.

Moving the Witness Line for Temporary Dimensions

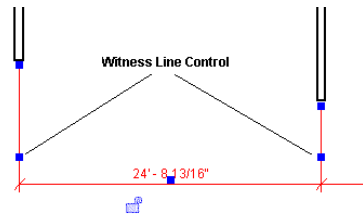
- 1 Select a component.
- 2 Do one of the following:
 - Drag the control (blue square) to a different reference.
 - Right-click the witness line control and select Move Witness Line from the shortcut menu. You can then move the witness line to a new reference.



NOTE Modifications to temporary dimension witness lines are not saved.

Moving the Witness Line for Permanent Dimensions

- 1 Select a permanent dimension.
- 2 Right-click the blue square control in the middle of the witness line, and select Move Witness Line from the shortcut menu.



- 3 Drag the witness line to the element to reference.

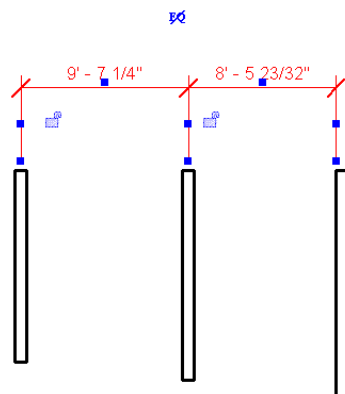
Related topics

- [Moving the Witness Line for Temporary Dimensions](#) on page 284
- [Controlling Witness Line Gaps for Permanent Dimensions](#) on page 285
- [Adding Witness Lines to a Permanent Dimension](#) on page 286
- [Deleting Witness Lines](#) on page 286

Controlling Witness Line Gaps for Permanent Dimensions

By selecting a linear dimension, you can control its distance from the element it is referencing and the reference point for the dimension.

- 1 Create a linear dimension between 2 or more elements (for example, between 2 walls). See [Aligned Dimensions](#) on page 265.
- 2 Select a dimension line.
Blue controls appear on the witness lines.



- 3 Place the cursor on one of the blue square controls at the end of the witness line and drag to resize the gap between the witness line and the element. If desired, select other controls to resize the dimension gap. Parallel dimension lines snap to the same gaps.

TIP As you move the element referenced by the dimension line, the distance of the gap remains constant.

Related topics

- [Moving the Witness Line for Permanent Dimensions](#) on page 285
- [Adding Witness Lines to a Permanent Dimension](#) on page 286
- [Deleting Witness Lines](#) on page 286

Adding Witness Lines to a Permanent Dimension

- 1 Select the dimension.
- 2 Click Modify Dimensions tab ► Witness Lines panel ► Edit Witness Lines.
- 3 Click the element for which you want to add a new witness line.
- 4 When you are finished, click Modify.

Deleting Witness Lines

- 1 Select a permanent dimension.
- 2 Right-click the blue square control in the middle of the witness line, and select Delete Witness Line from the shortcut menu.

Modifying Dimensions

Revit Architecture gives you the capability to customize the look of your dimensions.

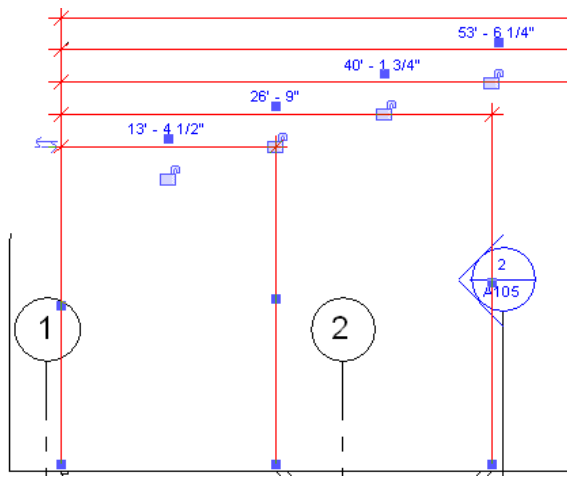
Changing a Dimension Value

- 1 Select a component that the dimension references.
- 2 Click the dimension value.
If the dimension is locked, the lock control appears next to it. Click the lock control to unlock the dimension so you can change it.
- 3 In the edit box, type a new value for the dimension and press *ENTER*.

Moving Dimension Line Text

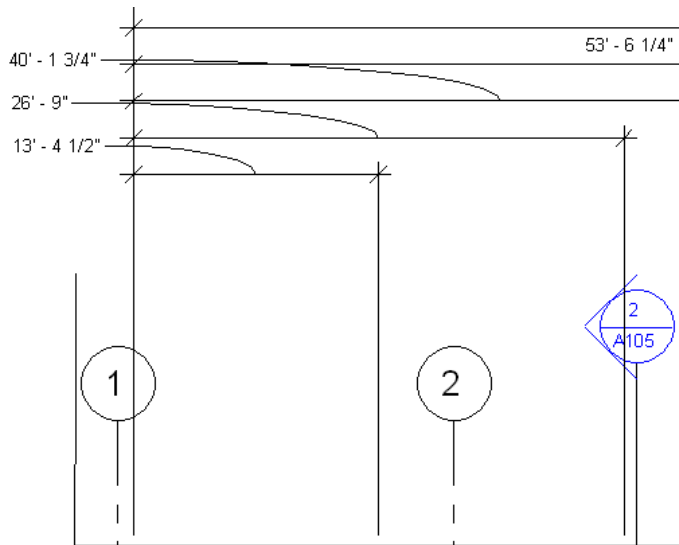
At times in your design, dimensions may appear very close together, making them difficult to read. You can drag text away from the dimension line to improve clarity. Dimension text controls are available only for permanent dimensions.

- 1 Select a dimension.
The witness lines highlight and square blue handles display.



- 2 Place the cursor on the blue handle below the dimension text. Drag the handle away from the dimension.

Revit Architecture moves the text away from the dimension line. If the dimension text crosses the path of one of the witness lines of the dimension, and it does not cross the center of the dimension segment it is on, an arc leader line appears. You can turn off the leader by clearing the Leader option from the Options Bar.



- 3 To return the dimension text to its original position, drag the handle back toward the dimension line, and it snaps to its original position.

Changing the Dimension Line Tick Mark

You can change the tick mark that displays at the ends of the dimension line.

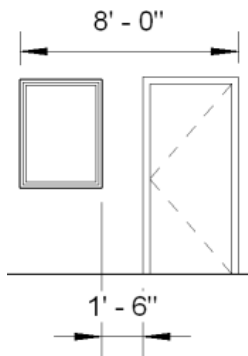
- 1 In the drawing area, select a dimension and right-click Element Properties.
- 2 In the Instance Properties dialog, click Edit Type.
- 3 Select a value for the Tick Mark parameter.
- 4 Click OK.

If you select an arrow tick mark, see [Controlling the Display Behavior of Dimension Arrows](#) on page 288 for information on the behavior of arrow type tick marks.

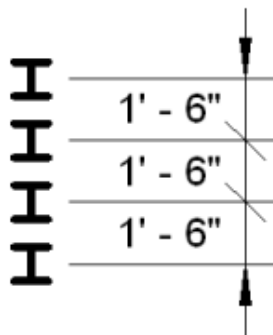
Controlling the Display Behavior of Dimension Arrows

When you select an arrow tick mark for dimension lines, the arrows recognize when a dimension segment is too small to accommodate the arrows on the interior of the dimension line. When this occurs, dimension arrows automatically flip to the exterior of the dimension line. This occurs for linear, angular, and radial dimensions. For radial dimensions, arrows flip when the dimension line (the radius) is shorter than the length of the arrow.

The following image shows 2 dimensions with arrow tick marks. The larger dimension shows how arrows display on the interior of the dimension line when the line is large enough to accommodate them. The smaller dimension shows how dimension arrows flip to the exterior of the dimension line when the line is too small to accommodate them.



In addition, multi-segment dimension lines recognize when adjacent segments are too small for arrows to fit. When this occurs, the ends of the short-segment string flip, and the inner witness lines display the interior tick mark type designated in the dimension properties. In the following image, the dimension arrows flip to the exterior of the dimension line and the witness lines display the designated tick mark (diagonal).



For information on changing the tick mark for a dimension line, see [Changing the Dimension Line Tick Mark](#) on page 287.

To control the display behavior of dimension arrow tick marks:

- 1 In the drawing area, select a dimension and right-click Element Properties.
- 2 In the Instance Properties dialog, click Edit Type.
- 3 Edit the following parameters:
 - Flipped Dimension Line Extension: when dimension arrows flip, this controls the length of the dimension line beyond the flipped arrows. Length is measured from the end of the arrow head.

- **Interior Tick Mark:** designates the tick mark display for inner witness lines when adjacent segments of a dimension line are too small for arrows to fit. When this occurs, the ends of the short-segment string flip, and the inner witness lines display the designated interior tick mark.

NOTE These parameters are only enabled when the tick mark type parameter is set to an arrow type.

4 Click OK.

Rotating Spot Coordinates and Spot Elevations with Components

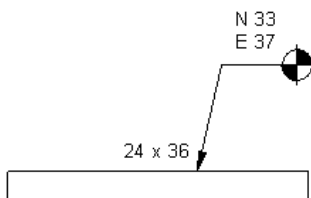
When spot elevations or spot coordinates are applied to line-based host components, they can be set to orient to the component and not the horizontal default. Line-based host components are those elements placed by defining a start point and an end point, such as Structural Walls, Walls, Beams, Braces, and Trusses. The Rotate with Component parameter must be selected to enable this tool.

To set spot coordinates and spot elevations to Rotate with Component:

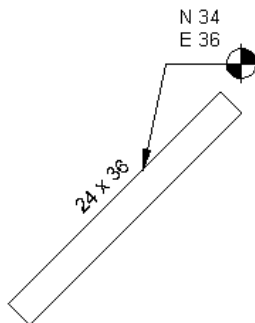
- 1 In the drawing area, select the spot dimension (coordinate or elevation).
- 2 For a spot coordinate, click Modify Spot Coordinates tab ► Element panel ► Element Properties drop-down ► Type Properties.
For a spot elevation, click Modify Spot Elevations tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 In the Type Properties dialog, select Rotate with Component.
- 4 Click OK.

The spot coordinate will not rotate with a component as shown in the images below.

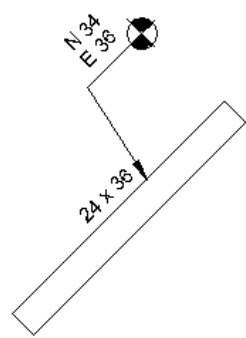
A spot coordinate on a beam.



Rotation at default dimension settings.



Rotation with spot coordinate set to Rotate with Component.



Dimension Properties

You can change many properties of permanent and spot dimensions.

NOTE Permanent dimension type properties include properties for witness lines.

Modifying Permanent or Spot Dimension Properties

- 1 In a project view, select a permanent or spot dimension and right-click Element Properties.
- 2 In the Instance Properties dialog, edit the instance properties.
- 3 Click Edit Type to edit type properties.

NOTE Changes made to type properties affect all permanent dimensions or spot dimensions of that type in the project. You can click Duplicate to create a new permanent or spot dimension type.

- 4 When you are finished, click OK.

Related topics

- [Modifying Dimensions](#) on page 286
- [Dimension Properties](#) on page 290

Permanent Dimension Type Properties

Name	Description
Graphics	
Dimension String Type	<p>Specify the formatting method for a string of dimensions. This parameter is available for linear dimension styles.</p> <p>NOTE Arc length dimensions are linear dimensions and have parameters (Dimension String Type and Ordinate Dimension Settings) for creating baseline and ordinate dimensions, but these parameters have no effect on arc length dimensions.</p> <p>Options include:</p> <ul style="list-style-type: none">■ Continuous places multiple dimensions end to end.■ Baseline places stacked dimensions measured from the same baseline.

Name	Description
	<ul style="list-style-type: none"> ■ Ordinate places a dimension string with values measured from the dimension origin.
Tick Mark	The name of the tick mark style.
Line Weight	Sets the line weight number that designates thickness of the dimension line. You can select from a list of values defined in Revit Architecture or define your own. You can change the definition of the line weights by clicking Manage tab ► Project Settings panel ► Settings drop-down ► Line Weights. See Line Weights on page 495.
Tick Mark Line Weight	Sets the line weight that designates thickness of the tick mark. You can select from a list of values defined in Revit Architecture or define your own.
Dimension Line Extension	Extends the dimension line beyond the intersection of the witness lines to the specified value. When you set this value, this is the size at which the dimension line plots, if you are printing at 100 percent.
Flipped Dimension Line Extension	Controls the extent of the dimension line beyond the flipped arrow if the arrow flips on the ends of the dimension string. This parameter is only enabled when the tick mark type parameter is set to an arrow type. See Changing the Dimension Line Tick Mark on page 287.
Witness Line Control	Switches between the fixed gap functionality and the fixed dimension line functionality.
Witness Line Length	If Witness Line Control is set to Fixed to Dimension Line, this parameter becomes available. Specifies the length of all witness lines in the dimensions. When you set this value, this is the size at which the witness line plots, if you are printing at 100 percent.
Witness Line Gap to Element	If Witness Line Control is set to Gap to Element, this parameter sets the distance between the witness line and element being dimensioned.
Witness Line Extension	Sets the extension of a witness line beyond the tick mark. When you set this value, this is the size at which the witness line plots, if you are printing at 100 percent.
Centerline Symbol	You can select any of the annotations symbols loaded in the project. The centerline symbol appears above the witness lines that reference the centerlines of family instances and walls. If the witness line does not reference a center plane, you cannot place a centerline symbol above it.
Centerline Pattern	Changes the line pattern of the witness lines of the dimension, if the dimension references are the centerlines of family instances and walls. If the references are not at the centerline, this parameter does not affect the witness line pattern.
Centerline Tick Mark	Changes the tick mark at the ends of the centerline of a dimension.
Interior Tick Mark	Designates the tick mark display for inner witness lines when adjacent segments of a dimension line are too small for arrows to fit. When this occurs, the ends of the short-segment string flip, and the inner witness lines display the designated interior tick mark. This parameter is only enabled when the tick mark type parameter is set to an arrow type. See Changing the Dimension Line Tick Mark on page 287.

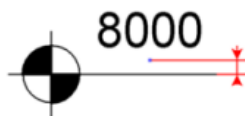
Name	Description
Ordinate Dimension Settings	Specify settings for ordinate dimensions. This parameter is available when the Dimension String Type parameter is set to Ordinate. For more information, see Creating an Ordinate Linear Dimension Style on page 270.
Color	Sets the color of dimension lines. You can select from a list of colors defined in Revit Architecture or define your own. The default value is black.
Dimension Line Snap Distance	To use this parameter, set the Witness Line Control parameter to Fixed to Dimension Line. With these parameters set, additional snapping is available that aids in stacking linear dimensions at even intervals. This value should be greater than the distance between the text and the dimension line, plus the height of the text.
Text	
Width Factor	Specify a ratio to define the elongation of the text string. A value of 1.0 has no elongation.
Underline	Underlines the permanent dimension value and text.
Italic	Applies italic formatting to the permanent dimension value and text.
Bold	Applies bold formatting to the permanent dimension value and text.
Text Size	Specify the size of the typeface for the dimension.
Text Offset	Specify the offset of the text from the dimension line.
Read Convention	Specify the read convention for the dimension text.
Text Font	Sets the Microsoft® True Type fonts for the dimensions.
Text Background	If you set the value to opaque, the dimension text is surrounded by a box that overlaps any geometry or text behind it in the view. If you set the value to transparent, the box disappears and everything not overlapped by the dimension text is visible.
Units Format	Click the button to open the Format dialog. You can then set the format of the units with the dimension. See Setting Project Units on page 502.
Show Opening Height	Place a dimension whose witness lines reference the same insert (window, door, or opening) in a plan view. If you select this parameter, the dimension includes a label that shows the height of the opening for the instance. The value appears below the dimension value you initially placed.
Other	
Center Marks	Shows or hides the radial dimension center mark.
Center Mark Size	Sets the size of the radial dimension center mark. This property is enabled when Center Marks is selected.
Radius Prefix	Shows or hides prefix (R) for radial dimensions.


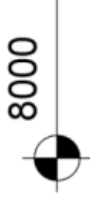
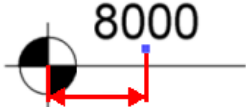
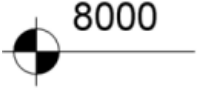
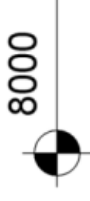
Permanent Dimension Instance Properties

Name	Description
Baseline Offset	Specify an offset value for successive baseline dimensions. This parameter is available when the Dimension String Type type parameter is set to Baseline.
Equality Display (when a dimension has an equality constraint) or Value	<p>All linear and angular continuous dimensions have an Equality Display property. It is set to = by default if there is an equality constraint and to Value by default otherwise. For more information about this property see Changing the EQ Label to the Dimension Value on page 301.</p> <p>NOTE This property is not available when the Dimension String Type type parameter is Baseline or Ordinate.</p>

Spot Elevation Type Properties

Name	Description
Constraints	
Rotate with Component	When selected, the spot elevation rotates with the component.
Graphics	
Leader Arrowhead	Sets the appearance of the leader arrowhead. The value None removes the arrowhead. See Specifying Arrowhead Styles on page 500.
Leader Line Weight	Sets the weight of the leader line. The higher the value, the thicker the line.
Leader Arrowhead Line Weight	Sets the arrowhead line weight. The higher the value, the thicker the arrowhead line.
Color	Click the button to open the color picker. Sets the color of the spot elevation.
Symbol	Changes the look of the symbol head with the spot elevation.
Text	
Width Factor	Specify a ratio to define the elongation of the text string. A value of 1.0 has no elongation.
Underline	Underlines the spot elevation value and text.
Italic	Applies italic formatting to the spot elevation value and text.
Bold	Applies bold formatting to the spot elevation value and text.
Text Size	Sets the size of the elevation text.
Text Offset from Leader	Offsets the text from the leader line.



Name	Description
Text Font	Sets the font for the elevation text.
Text Background	If you set the value to opaque, the dimension text is surrounded by a box that overlaps any geometry or text behind it in the view. If you set the value to transparent, the box disappears and everything not overlapped by the dimension text is visible.
Text Orientation	<p>Changes the position of the text. Specify horizontal</p>  <p>or vertical.</p>  <p>When Rotate with Component is enabled, text orientation is relative to the host element.</p>
Units Format	Click the button to open the Format dialog. Clear the Use Project Settings option and set the appropriate values. See Setting Project Units on page 502.
Text Offset from Symbol	<p>Offsets the text from the symbol. Positive or negative values move the text away from the symbol. Positive values are offsets that move towards the leader and negative values are offsets that move away from the leader.</p> 
Text Orientation	<p>Changes the position of the text. Specify horizontal</p>  <p>or vertical.</p>  <p>When Rotate with Component is enabled, text orientation is relative to the host element.</p>

Name	Description
Text Location	Specify the position of the spot elevation with respect to the leader. Options include Above Leader, Below Leader, or In-line with Leader. When you specify In-line with Leader, the elevation symbol does not display for the spot elevation. In addition, the Text Offset from Leader, Text Offset from Symbol, and Symbol properties are disabled.
Elevation Indicator	A text string you enter with the spot elevation. Can be displayed as a prefix or suffix.
Elevation Origin	If the origin value is set to project, then the elevation reported is with respect to the project origin. If set to shared, then the elevation reported is with respect to the shared origin. If the base value is set to relative, then the elevation reported is with respect to the level in the Relative Base instance parameter. You can change the shared origin by relocating the project. See Relocating and Mirroring a Project on page 1300.
Elevation Indicator as Prefix/Suffix	Specify the placement of the elevation indicator as a prefix or a suffix.
Top Indicator	When you specify the Display Elevations instance parameter to Top & Bottom Elevations or Top Elevation, you can enter text to indicate that this value represents the top elevation of the element. This text can be displayed as either a prefix or a suffix to the elevation value.
Bottom Indicator	When you specify the Display Elevations instance parameter to Top & Bottom Elevations or Bottom Elevation, you can enter text to indicate that this value represents the bottom elevation of the element. This text can be displayed as either a prefix or a suffix to the elevation value.
Top Indicator as Prefix/Suffix	Specify placement of the top indicator as a prefix or a suffix.
Bottom Indicator as Prefix/Suffix	Specify placement of the bottom indicator as a prefix or a suffix.

Spot Elevation Instance Properties

Name	Description
Constraints	
Relative Base	The level from which the elevation is reported. This property can be edited for relative spot elevations, and is a read-only value for project spot elevations.
Graphics	
Leader Shoulder	When Leader is selected, you can add a shoulder (a bend) to the leader line.
Leader	If selected, the spot elevation includes a leader line. When not selected, no leader line appears.
Text	
Display Elevations	Specify the elevation you want to display: <ul style="list-style-type: none"> ■ Actual (Selected) Elevation displays the elevation of the selected point on the element.

Name	Description
	<ul style="list-style-type: none"> ■ Top Elevation displays the top elevation of the element. ■ Bottom Elevation displays the bottom elevation of the element. ■ Top & Bottom Elevation displays the top and bottom elevations of the element. <p>This parameter is enabled when you place a spot elevation in a plan view.</p>
Single/Upper Value	The actual elevation of the selected point or the upper elevation value. This is a read-only value.
Single/Upper Value Prefix	Add prefix text to the single or upper dimension value.
Single/Upper Value Suffix	Add suffix text to the single or upper dimension value.
Lower Value	The actual lower elevation value reported. This is a read-only value.
Lower Value Prefix	Add prefix text to the lower dimension value.
Lower Value Suffix	Add suffix text to the lower dimension value.

Spot Coordinate Type Properties

You can specify various parameters to change the appearance of the spot coordinate.

Name	Description
Constraints	
Rotate with Component	When selected, the spot coordinate rotates with the component.
Graphics	
Leader Arrowhead	Sets the appearance of the leader arrowhead. The value None removes the arrowhead. To define an arrowhead, see Specifying Arrowhead Styles on page 500.
Leader Line Weight	Sets the weight of the leader line. The higher the value, the thicker the line.
Leader Arrowhead Line Weight	Sets the arrowhead line weight. The higher the value, the thicker the arrowhead line.
Color	Sets the color of the spot coordinate. Click the button to open the color picker.
Symbol	Changes the look of the symbol head with the spot coordinate.
Text	
Width Factor	Specify a ratio to define the elongation of the text string. A value of 1.0 has no elongation.
Underline	Underlines the spot coordinate value and text.
Italic	Applies italic formatting to the spot coordinate value and text.
Bold	Applies bold formatting to the spot coordinate value and text.

Name	Description
Text Size	Sets the size of the elevation text.
Text Offset from Leader	Offsets the text from the leader line. <div> </div>
Text Font	Sets the font for the elevation text.
Text Background	Sets the background for the text. With opaque, the background of the text itself covers objects behind it. Transparent allows you to see objects behind the text.
Units Format	Click the button to open the Format dialog. Clear the Use Project Settings option, and set the appropriate values. See Setting Project Units on page 502.
Text Offset from Symbol	Offsets the text away from the symbol. <div> </div> <p>Positive or negative values move the text away from the symbol. Positive values are offsets that move towards the leader and negative values are offsets that move away from the leader.</p>
Text Orientation	Changes the position of the text to read horizontally <div> </div> <p>or vertically.</p> <p>When Rotate with Component is enabled, text orientation is relative to the host element.</p>

Name	Description
Text Location	Specify the position of the spot coordinate with respect to the leader. Options include Above Leader, Below Leader, or In-line with Leader. When you specify In-line with Leader, the elevation symbol does not display for the spot coordinate. In addition, the Text Offset from Leader, Text Offset from Symbol, and Symbol properties are disabled.
Elevation Indicator	A text string you enter with the spot elevation. Can be displayed as a prefix or suffix with the Indicator as Prefix/Suffix parameter.
Coordinate Origin	Indicates that the coordinates are shared. This is a read-only value.
Top Value	Determines which coordinate value is placed on top.
Bottom Value	Determines which coordinate value is placed on the bottom.
North/South Indicator	Lets you specify how to label the north/south direction. For instance, you might enter X.
East/West Indicator	Lets you specify how to label the east/west direction. For instance, you might enter Y.
Include Elevation	Displays the spot elevation in addition to the spot coordinates.
Indicator as Prefix / Suffix	Specifies placement of the North/South, East/West, and Elevation indicators.

Spot Coordinate Instance Properties

Name	Description
Graphics	
Leader Shoulder	When Leader is selected, you can add a shoulder (a bend) to the leader line.
Leader	If selected, the spot coordinate includes a leader line. When not selected, no leader line appears.
Text	
Top Value Prefix	Specify prefix text for the top spot coordinate.
Top Value Suffix	Specify suffix text for the top spot coordinate.
Bottom Value Prefix	Specify prefix text for the bottom spot coordinate.
Bottom Value Suffix	Specify suffix text for the bottom spot coordinate.
Elevation Value Prefix	Specify prefix text for the spot elevation. This parameter is enabled when the Include Elevation type parameter is selected.
Elevation Value Suffix	Specify suffix text for the spot elevation. This parameter is enabled when the Include Elevation type parameter is selected.

Spot Slope Type Properties

You can specify various parameters to change the appearance of the spot slope coordinate.

Name	Description
Constraints	
Rotate with Component	When selected, the spot coordinate rotates with the component.
Graphics	
Leader Arrowhead	Sets the appearance of the leader arrowhead. The value None removes the arrowhead. To define an arrowhead, see Specifying Arrowhead Styles on page 500.
Leader Line Weight	Sets the weight of the leader line. The higher the value, the thicker the line.
Leader Arrowhead Line Weight	Sets the arrowhead line weight. The higher the value, the thicker the arrowhead line.
Color	Sets the color of the spot coordinate. Click the button to open the color picker.
Slope Direction	Sets the direction of the spot slope. Default setting is Down.
Leader Line Length	Sets the leader line length.
Text	
Width Factor	Specify a ratio to define the elongation of the text string. A value of 1.0 has no elongation.
Underline	Underlines the spot coordinate value and text.
Italic	Applies italic formatting to the spot coordinate value and text.
Bold	Applies bold formatting to the spot coordinate value and text.
Text Size	Sets the size of the elevation text.
Text Offset from Leader	Offsets the text from the leader line.
	
Text Font	Sets the font for the elevation text.
Text Background	Sets the background for the text. With opaque, the background of the text itself covers objects behind it. Transparent allows you to see objects behind the text.
Units Format	Click the button to open the Format dialog. Clear the Use Project Settings option, and set the appropriate values. See Setting Project Units on page 502.

Spot Slope Instance Properties

Name	Description
Graphics	
Slope Representation	Lets you set how the spot slope displays when in elevation and section views.
Offset from Reference	Lets you set the offset of the slope representation from its reference.
Text	
Prefix	Specify prefix text for the spot slope.
Suffix	Specify prefix text for the spot slope.

Constraints

Constraints are non-view-specific elements that can function independently of dimensions. Constraint elements appear in all views in which their references are visible; dimensions are view specific. You can modify and delete constraints independently of dimensions or remove them when you delete dimensions.

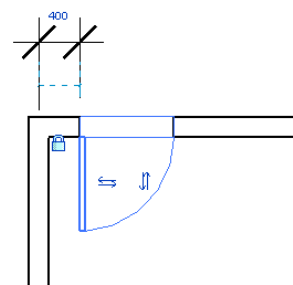
Constraints appear as green dashed lines in project views.

You create constraints by placing dimensions and locking them or by creating equality constraints.

Applying Constraints with Dimensions

When you place permanent dimensions, you can lock those dimensions. When you lock a dimension, you create a constraint. A constraint (dashed blue line) appears when you select its references, as shown in the following image.

Constraint from locked dimensions

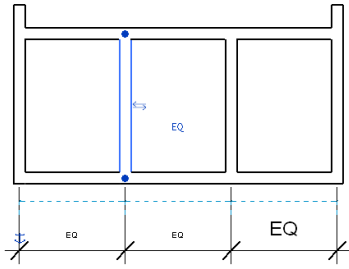


Many dimensions may correspond to the same constraint. For example, if you place a dimension between 2 walls and lock it, you have created a constraint. If you place another dimension between the same 2 walls and lock it, no additional constraint is created.

Also see [Locking Permanent Dimensions](#) on page 272.

Equality Constraints

An equality constraint appears as an EQ symbol near the dimension line when you select a multi-segmented dimension. If you select one of the references for the dimension line (such as a wall), the EQ symbol appears with a dashed blue line at the middle of the references.



The EQ symbol represents an equality constraint element applied to the references for this dimension. The references, which are walls in the graphic, remain at equal distances from one another while this constraint is active. If you select one of the walls and move it, all walls move together at a fixed distance.

Applying an Equality Constraint

- 1 Select a multi-segmented permanent dimension. If you need to place a dimension, see [Permanent Dimensions](#) on page 264.
- 2 Click the EQ symbol so that it no longer has a slash through it.

Changing the EQ Label to the Dimension Value

Multi-segmented dimensions have an EQ label that displays directly above each segment of the dimension line. The label displays when the values for all segments in the dimension are equal, or if the values for the first and last segments of the dimension are equal. If neither of these conditions is satisfied, then the dimension segment cannot display the EQ label and instead displays the value.

You can change the display of the label from EQ to the dimension value.

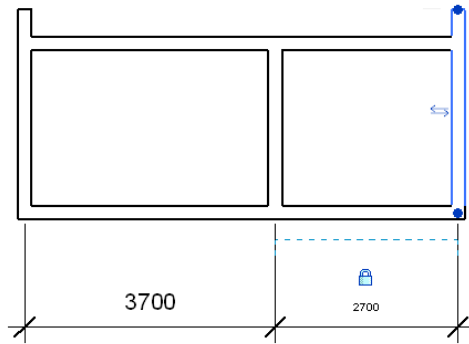
To change the EQ label to the dimension value:

- 1 Select the dimension and right-click Element Properties.
- 2 In the Instance Properties dialog, for Equality Display, select Value.
- 3 Click OK.

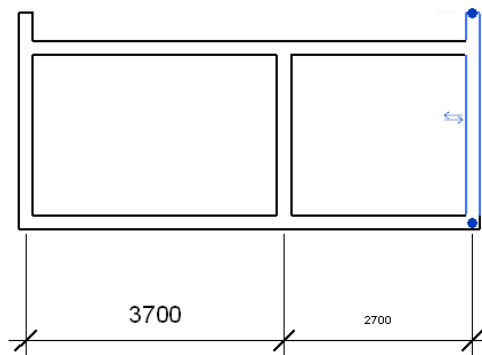
Controlling Visibility of Constraints

- 1 Click View tab ► Graphics panel ► Visibility/Graphics, or use the keyboard shortcut VG.
- 2 Click the Annotation Categories tab.
- 3 Find the Constraints category, and deselect the check box to hide constraints in the view.

The following image shows the constraint (the blue dashed line) visible.



The following image shows the constraint hidden.



For more information, see [Visibility and Graphic Display in Project Views](#) on page 198.

Removing Constraints

- 1 Select a dimension.
- 2 Do any of the following:
 - Click a lock to unlock it.
 - Click the EQ symbol to remove an equality constraint. The EQ symbol appears with a slash through it when the equality constraint is not applied.
 - Delete the dimension that corresponds to the constraint. A warning appears that you are not deleting the actual constraint. Click Unconstrain in the warning dialog to remove the constraint.

Constraints and Worksets

Constraints belong to the worksets of the elements they constrain. In order to add a constraint, the worksets of all the elements that can be moved by the constraint must be editable. See [Making Worksets Editable](#) on page 1263.

Sketching

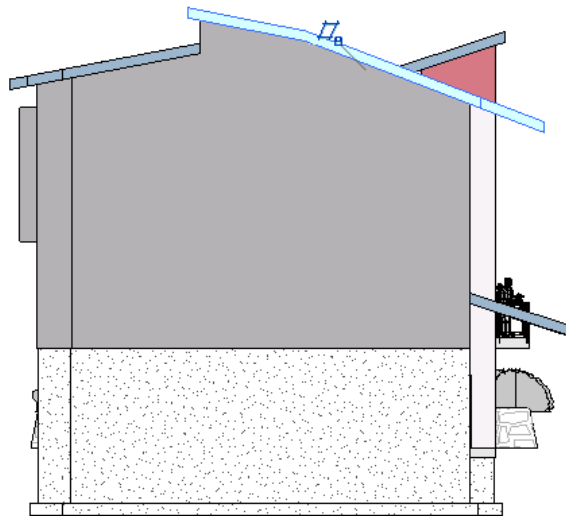
7

To create certain elements in Revit Architecture, such as roofs, floors, stairs, and railings, you draw them by sketching. Sketching is also required to define other types of geometry, such as extrusions, openings, and regions.

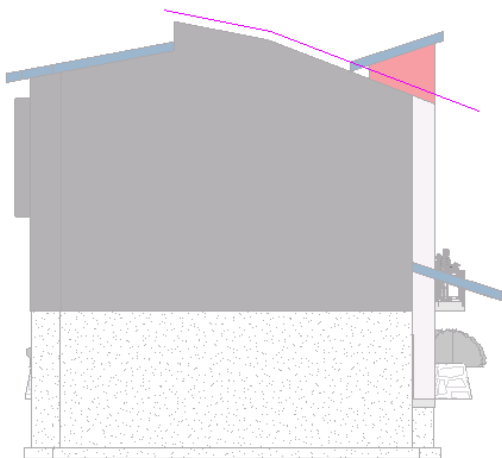
Sketching Terminology

There are several terms specific to the sketching process in Revit Architecture:

- **Sketching** is a process of drawing elements in Revit Architecture.
- **Sketch-based elements** are those elements (for example, floors, ceilings, and extrusions) that are typically created using sketch mode. There are also elements, such as walls, that are sketched but do not require the use of sketch mode.
- **Sketch mode** is an environment in Revit Architecture that allows you to sketch elements whose size or shape cannot be determined automatically, for example when you create (or edit a sketch of) a roof or a floor. When you enter sketch mode, the Ribbon only displays the tools applicable for the type of sketch you are creating or editing.
- All the elements that comprise a sketch-based element (such as a roof) are known as the **sketch**. For example, a sketch-based roof is selected in the following image.



In this example, when you select the roof (created by extrusion), you can click Modify Roofs tab ► Modify Roof panel ► Edit Profile, which opens the sketch (the pink lines in the following image) in sketch mode. (For a roof created by footprint, select the roof and click Modify Roofs tab ► Edit panel ► Edit Footprint.) Here you can edit the individual elements of the sketch. The tools that are available in sketch mode vary depending on the type of element you are editing.









Sketching Elements

You can either draw sketch lines or use a Pick (Walls, Lines, Edges, Faces) option when sketching. Drawing allows you to create the element by clicking and moving the cursor; Pick options allow you to select existing walls, lines, edges or faces. As you sketch, you can use listening dimensions. For more information, see [Listening Dimensions](#) on page 283.

When you add elements whose size or shape cannot be determined automatically, such as a roof, extrusion, or opening, you enter sketch mode. In sketch mode, only the tools available for that sketch are available for use; the tools vary depending on the type of element you are sketching. There are also elements (such as walls) that are sketched but do not require the use of sketch mode.

Common Options for Sketches

Use this option	to
 Draw options (for example,  (Line) or  (Rectangle))	draw sketches.
 Pick options (for example,  (Pick Lines))	select existing walls, lines, or edges. When you use Pick Lines, there is a Lock option (for some elements) on the Options Bar that locks the picked line to the edge. TIP You can use <i>Tab</i> to toggle to available chains.
 Pick Faces	add walls by selecting the face of a mass element or generic component. This option is only available when you are sketching walls or curtain walls.
Chain	connect (chain) line segments when you are sketching so that the last point on the previous line becomes the first point on the next line. You cannot chain closed loops (circles, polygons) or fillets.

Use this option	to
Offset	<p>offset the placement of a sketch line by the value you specify.</p> <p>When you use offset with the Pick Lines option, the element or sketch line is offset from a line specific to an element (for example, the location line in a wall). The new element has the same shape and length as the picked line.</p> <p>If you use offset when you draw a sketch, the element or sketch is offset from the cursor location. You can create an element of any length or shape when draw a sketch with an offset.</p> <p>You can also specify the offset location line for walls by selecting an option from the Location Line drop-down.</p> <hr/> <p>NOTE If you draw with the chain option turned on, the newly created lines are also chained. Therefore, you can create a shape similar to an existing shape by tracing it with an offset.</p>
Radius	<p>preset a value for the radius. This option is available for walls or lines when you draw a rectangle, circle, arc, or polygon.</p> <p>Use a radius to:</p> <ul style="list-style-type: none"> ■ specify a fixed radius for a circle, a circle in which a polygon is inscribed (or around which it is circumscribed), an arc from center and endpoint, or a tangent arc. The preset radius puts constraints on the element or sketch so that fewer clicks are required to complete it. With a preset radius, you can create a circle with one click or a fillet with 2 clicks. ■ specify a rounding of corners (the radius of the fillet) when joining lines (with or without the chain option), when you draw a rectangle, or when you fillet using the Fillet Arc sketch option.


Using Constraints When Sketching

You can use constraints while you are sketching by pressing *Shift* as you draw. Shift constraints works as follows:

- Constrains straight lines and radii of polygons to horizontal or vertical lines.
- Limits the chords of 3-point arcs, the radii of arcs from center and end points, and the axis of ellipses to multiples of 45 degrees.
- Limits 2-point and 3-point arcs to 90, 180, or 270 degrees.

Sketching a Line

1 Select a tool that allows for a line, for example, click Home tab ► Model panel ► Model Line.

2 Click Place Lines tab (or respective Place <Element> tab or Create <Element> tab) ► Draw panel ►  (Line).

3 On the Options Bar:

- Optionally, select Offset and specify a value.
- Optionally, select Radius and specify a value.

A radius creates fillets at the specified radius between line segments, allowing you to create a rounded chain of lines. A line must be joined to the end of another line for a fillet to display. If a line is connected to more than one line, a fillet cannot be created.

The following image shows line segments sketched without Radius selected and line segments sketched with Radius selected.



NOTE If you specify a radius, the Offset option is overridden.


4 Click in the drawing area to specify the start point of the line.

5 Move the cursor and click to specify the end point of the line.

NOTE You can also use listening dimensions to specify the length of the line. See [Listening Dimensions](#) on page 283.

Sketching a Rectangle

1 Select a tool that allows for a rectangle, for example, click Home tab ► Model panel ► Model Line.

2 Click Place Lines tab (or respective Place <Element> tab or Create <Element> tab) ► Draw panel ►  (Rectangle).

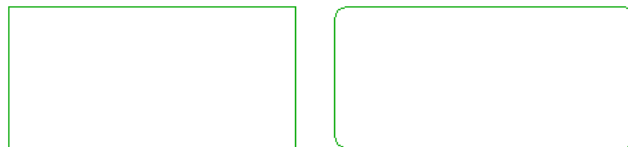
3 On the Options Bar:

a Optionally, select Offset and specify a value.

b Optionally, select Radius and specify a value.

Specifying a radius creates fillets at the corners of the rectangle.

The following image shows a rectangle sketched without Radius selected and a rectangle sketched with Radius selected.




NOTE If you specify a radius, the Offset option is overridden.

4 Click in the drawing area to specify the first corner of the rectangle.

5 Move the cursor and click to specify the diagonal corner of the rectangle.

Sketching a Circle

1 Select a tool that allows for a circle, for example, click Home tab ► Model panel ► Model Line.

2 Click Place Lines tab (or respective Place <Element> tab or Create <Element> tab) ► Draw panel ►  (Circle).

3 On the Options Bar:

a Optionally, select Offset and specify a value.

- b** Optionally, select Radius and specify a value. If you specify a radius, placing a circle in the drawing area requires only 1 click.

NOTE If you specify a radius, the Offset option is overridden.

- 4** Click in the drawing area to place the circle. If you have not already specified a radius, move the cursor and click to complete the circle.

NOTE You can also use listening dimensions to enter a value for the radius. After you click in the drawing area to place the circle, type the value of the radius and press *Enter*.

Sketching an Inscribed Polygon

- 1** Select a tool that allows for an inscribed polygon, such as Wall, Model Line, or Detail Line.

For example, click Home tab ► Model panel ► Model Line.

For an inscribed polygon, the radius of the circle is measured to a vertex between sides of the polygon.

- 2** Click Place Lines tab (or respective Place <Element> tab or Create <Element> tab) ► Draw

panel ►  (Inscribed Polygon).

- 3** On the Options Bar:

- a** Enter the number of sides for the polygon.
- b** Optionally, select Offset and specify a value.
- c** Optionally, select Radius and specify a value.

NOTE If you specify a radius, the Offset option is overridden.

- 4** Click in the drawing area to specify the start point.
- 5** If you have not already specified a radius, move the cursor and click to complete the inscribed polygon.

NOTE You can also use listening dimensions to enter a value for the radius. After you click in the drawing area to place the inscribed polygon, type the value of the radius and press *Enter*.


Sketching a Circumscribed Polygon

- 1** Select a tool that allows for a circumscribed polygon, such as Wall, Model Line, or Detail Line.

For example, click Home tab ► Model panel ► Model Line.

For a circumscribed polygon, the radius of the circle is measured to a side of the polygon.

- 2** Click Place Lines tab (or respective Place <Element> tab or Create <Element> tab) ► Draw

panel ►  (Circumscribed Polygon).

- 3** On the Options Bar:

- a** Enter the number of sides for the polygon.

- b Optionally, select Offset and specify a value.
- c Optionally, select Radius and specify a value.

NOTE If you specify a radius, the Offset option is overridden.

- 4 Click in the drawing area to specify the start point.
- 5 If you have not already specified a radius, move the cursor and click to complete the circumscribed polygon.

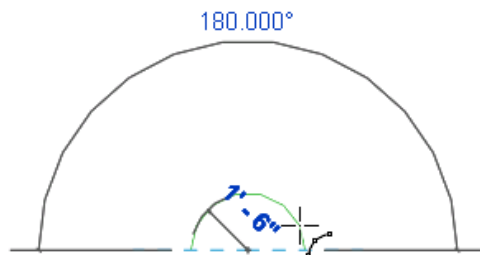
NOTE You can also use listening dimensions to enter a value for the radius. After you click in the drawing area to place the circumscribed polygon, type the value of the radius and press *Enter*.

Sketching Arcs

There are several options for sketching arcs in Revit Architecture:

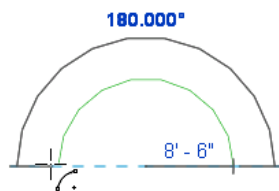
- **Start-End-Radius Arc**

You specify a start-end-radius arc by drawing the chord that connects the 2 ends of the arc, and then you specify the angle or radius with the third point.



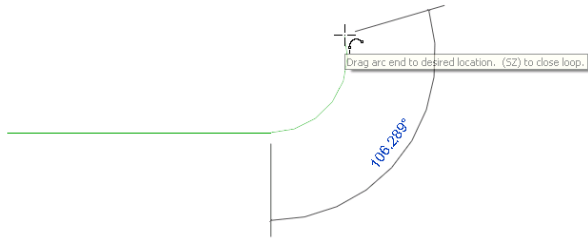
- **Center-ends Arc**

To create an arc from the center and end points, first specify the radius for the arc, and then specify the angle. You cannot specify an arc of more than 180 degrees using this method, although you can modify the arc after you draw it.



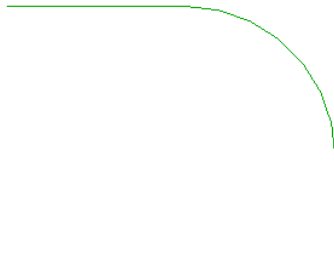
- **Tangent End Arc**

You can create tangent arcs from the end points of existing walls or lines.



■ Fillet Arc

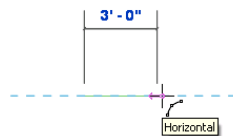
Use fillet arcs when you need to create rounded corners.



For information on constraining arc sketches, see [Using Constraints When Sketching](#) on page 305.

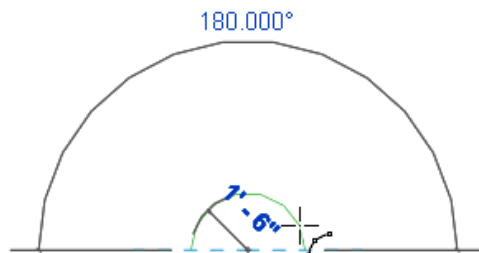
Sketching a Start-End-Radius Arc

- 1 Select a tool that allows for an arc, for example, click Home tab ► Model panel ► Model Line.
- 2 Click Place Lines tab (or respective Place <Element> tab or Create <Element> tab) ► Draw panel ► (Start-End-Radius Arc), and place the cursor in the drawing area.
- 3 Click in the drawing area to specify the start point for the arc.
- 4 Move the cursor and click to specify the length of the chord.



NOTE You can also use listening dimensions to specify the length of the chord. After you click in the drawing area to specify the start point, type a value for the chord and press *Enter*.


- 5 Move the cursor and click to define the arc.

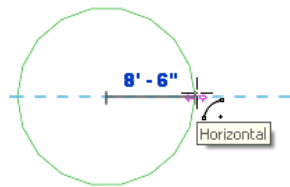


NOTE You can also use listening dimensions to specify the radius of the arc. Type a value for the radius and press *Enter*.

Sketching an Arc from the Center and End Points

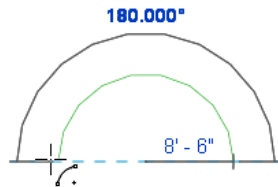
Use this sketching option to create an arc up to 180 degrees. If you move the cursor so the arc exceeds 180 degrees, the arc flips to the other side.

- 1 Select a tool that allows for an arc, for example, click Home tab ► Model panel ► Model Line.
- 2 Click Place Lines tab (or respective Place <Element> tab or Create <Element> tab) ► Draw panel ►  (Center-ends Arc), and place the cursor in the drawing area.
- 3 Click in the drawing area to specify the center of the arc.
- 4 Move the cursor and click to define the arc radius and the start point of the arc.




NOTE You can also use listening dimensions to specify the radius of the arc. Type a value for the radius and press *Enter*.

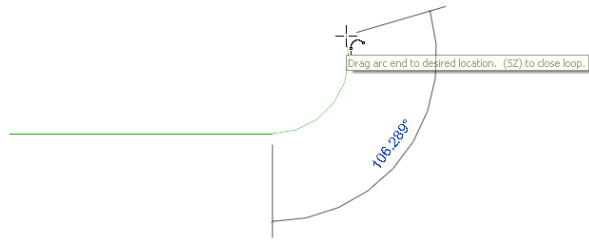
- 5 Move the cursor and click to specify the end point of the arc.



NOTE You can also use listening dimensions to specify the angle of the arc. Type a value for the angle and press *Enter*.


Sketching a Tangent Arc

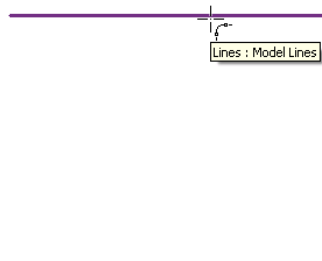
- 1 Select a tool that allows for an arc, for example, click Home tab ► Model panel ► Model Line.
- 2 Click Place Lines tab (or respective Place <Element> tab or Create <Element> tab) ► Draw panel ►  (Tangent End Arc), and place the cursor in the drawing area.
- 3 Click the endpoint of an existing wall or line to specify the start point for the tangent arc.
- 4 Move the cursor and click to specify the end point of the arc.



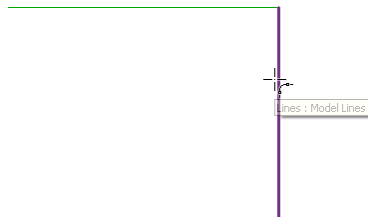
Sketching a Fillet Arc

NOTE You can only fillet elements that are created with the Line (this includes sides of polygons) or Arc sketch options.

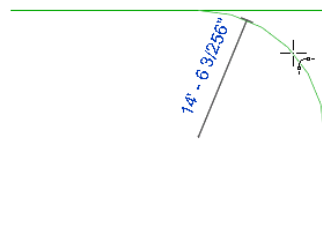
- 1 Select a tool that allows for an arc, for example, click Home tab ► Model panel ► Model Line.
- 2 Click Place Lines tab (or respective Place <Element> tab or Create <Element> tab) ► Draw panel ►  (Fillet Arc), and place the cursor in the drawing area.
- 3 Select the first element to fillet.



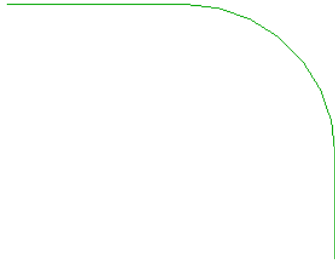
- 4 Select the second element to fillet.



- 5 Move the cursor and click to define the fillet arc.





After you place the fillet, Revit Architecture automatically trims the elements to the fillet.



Sketching Ellipses

Ellipses are available for model lines, detail lines, beams, and sketch-based elements.

Sketching a Full Ellipse

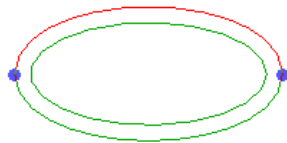
- 1 Select a tool that allows for an ellipse, for example, click Home tab ► Model panel ► Model Line.
- 2 Click Place Lines tab (or respective Place <Element> tab or Create <Element> tab) ► Draw panel ►  (Ellipse) or  (Pick Lines).

NOTE If you select Pick Lines, you can pick the edge or face of another ellipse.

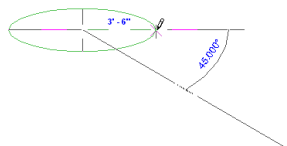
- 3 If you selected Pick Lines, on the Options Bar optionally select Offset and specify a value.

NOTE Offset for an ellipse is only available when you select the Pick Lines option.

When you create a full ellipse with an offset, the result is a spline. For example, if you create a mass element as a full ellipse with an offset and then attempt to create a wall on the face of the mass element, the ellipse is not considered contiguous, as shown in the following image.



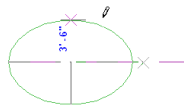
- 4 Click in the drawing area to specify the center of the ellipse.
Snapping is enabled for the ellipse, and a preview ellipse displays.
- 5 Move the cursor away from the center in any direction.
An editable listening dimension displays the radius of the major axis.



- 6 Either click when the desired radius value displays, or type a value and press *Enter*.
- 7 Again, move the cursor away from the center in any direction.



An editable listening dimension displays the radius of the minor axis.

- 8 Either click when the desired radius value displays, or type a value and press *Enter*.



Sketching a Partial Ellipse

- 1 Select a tool that allows for an ellipse, for example, click Home tab ► Model panel ► Model Line.

- 2 Click Place Lines tab (or respective Place <Element> tab or Create <Element> tab) ► Draw panel ►  (Partial Ellipse) or  (Pick Lines).

NOTE If you select Pick Lines, you can pick the edge or face of another ellipse.

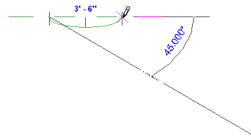
- 3 If you selected Pick Lines, on the Options Bar optionally select Offset and specify a value.

NOTE Offset for an ellipse is only available when you select the Pick Lines option.

- 4 Click in the drawing area.

Snapping is enabled for the partial ellipse, and a preview ellipse displays.

- 5 Move the cursor away from the first point to define the direction and extent of the major axis.



- 6 Either click when the desired value displays, or type a value and press *Enter*.

- 7 Move the cursor to get the desired partial ellipse shape and either click, or type a value and press *Enter*.



Resizing an Ellipse

- 1 Select the ellipse.

- 2 If you created an ellipse for a sketch-based element, click the edit option to enter sketch mode. For example, if you created an elliptical floor, click Modify Floors tab ► Edit panel ► Edit Boundary.

- 3 Optionally, on the Options Bar, select Modification keeps ratio. This allows you to change the radii proportionally.

4 Resize the ellipse:

To resize using	then
temporary dimensions	click the temporary dimension for the axis radius you want to change, enter a new value in the text box, and press <i>Enter</i> .
controls	drag the controls to resize the major and minor axes. For a full ellipse, there are 4 controls (one for each quadrant). For a partial ellipse, there are also 4 controls (one for each quadrant). In addition, there are 2 controls at either end (one for each end of the partial ellipse). You can modify the shape of the ellipse (Drag line end option) or you can resize the axis (Drag axis end option). Place the cursor over the control and press <i>Tab</i> until the desired option displays in the status bar.


5 If necessary, click Finish <Element>.

Rotating an Ellipse

To rotate ellipses, select the ellipse and click Modify <element> tab ► Modify panel ► Rotate. See [Rotating Elements](#) on page 379.

If you need to snap the axis end to another element, you can use the drag controls to rotate the ellipse. Using this method may cause you to inadvertently resize the axis.

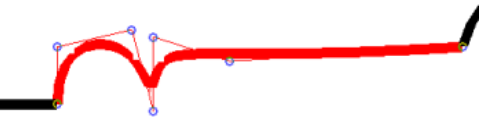
Sketching a Spline

- 1 Select a tool that allows for a spline, for example, click Home tab ► Model panel ► Model Line.
- 2 Click Place Lines tab (or respective Place <Element> tab or Create <Element> tab) ► Draw panel ►  (Spline), and place the cursor in the drawing area.
- 3 Click to specify the start point for the spline.
- 4 Move the cursor and click to specify the next control point on the spline. Repeat as necessary.
- 5 Click Modify to complete the spline.

You cannot create a single closed loop with one spline. However, you can close the loop with a second spline. See [Modifying a Spline](#) on page 808.

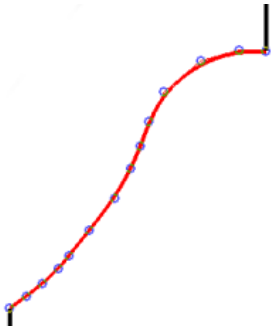
Best Practices for Sketching a Spline

When sketching a spline, try to use the simplest lines (or combination of lines) to achieve the desired results. For example, you may need to create a line that looks similar to the following image.

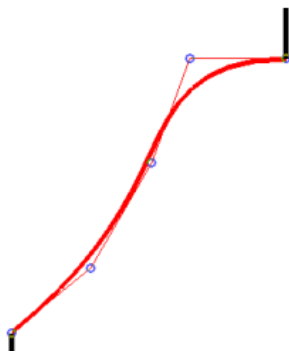


You could create this line using a combination of arcs and lines, or you could use a spline. Lines that are sketched using splines require more processing time, therefore it is recommended to use arc and line combinations instead of splines whenever possible.

When it is necessary to create a line using a spline, you should use as few control points as possible to keep processing time to a minimum. The following image shows a spline that was sketched by choosing many control points (blue dots).



You can create the same spline using fewer control points, as shown.

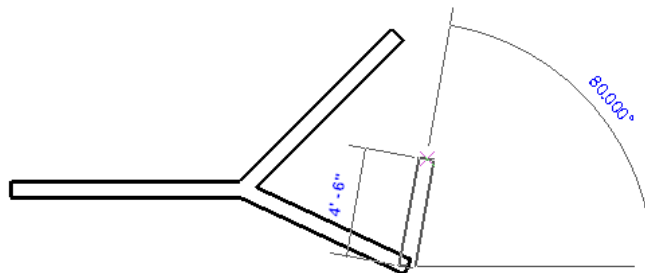


Closing an Open Loop

You can use the Close snap to close valid open loops when sketching. If there is more than one option to close the loop, you can move the cursor or press *Tab* to see other snap options.

To close an open loop:

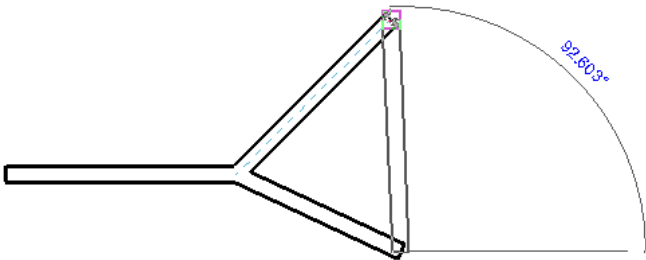
- 1 Begin sketching off of the open loop.



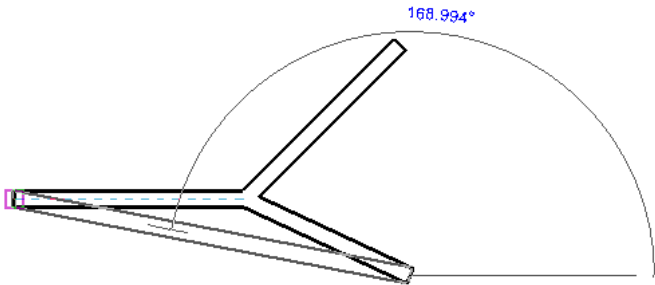
NOTE When sketching, the status bar indicates when there is a valid open loop to close, and lists the keyboard shortcut (SZ).

Enter wall end point. (SZ) to close loop. Space flips orientation.

2 Use the keyboard shortcut SZ, or right-click, click Snap Overrides ► Close. Revit Architecture snaps to close the loop.



If there is more than one option to close the loop, you can move the cursor or press *Tab* to see other close options.



3 Click to complete the loop.

Modifying Sketched Elements

- 1 In the drawing area, select a sketched element.
- 2 If you created the sketch for a sketch-based element, click the edit option to enter sketch mode.
For example, if you sketched a floor, click Modify Floors tab ► Edit panel ► Edit Boundary.

3 Modify the element:

If you want to	then
move an entire element	select all of its sketch lines, and drag it to the desired location. If another element is attached, it updates accordingly.
modify the end of a sketch line	select it, and either drag the end control or edit the dimension. If you are moving the end control of a straight line segment, you can change the angle of the line or change the length of the line. If you move the end control of an arc, you change the number of degrees for the arc angle; if you drag the middle control, you change the radius.

4 If you were in sketch mode, when finished, click Finish <Element>.

Sketching and Work Planes

Each view in Revit Architecture is associated with a work plane. In some views (such as plan, 3D, and drafting) and for views in the Family Editor, the work plane is automatically set. In other views, such as elevation and section views, you need to set the work plane. The work plane is necessary for sketching operations such as creating an extruded roof, and for enabling tools in particular views, such as Rotate and Mirror in a 3D view.

When you set a work plane in a view, it is saved with that view. You can change the work plane as necessary.

When sketching, you can snap to the work plane grid, but you cannot align or dimension to it.

Setting the Work Plane

1 Click Home tab ► Work Plane panel ► Set.

2 In the Work Plane dialog, under Specify a new Work Plane, select one of the following options:

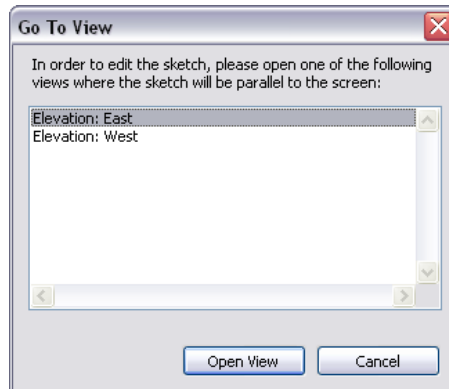
- **Name**—Choose an available work plane from the list, which contains names of levels, grids, and named reference planes.

NOTE The list is active even if you have not selected the Name option. If you choose a name from the list, Revit Architecture automatically selects the Name option.

- **Pick a plane**—Revit Architecture creates a plane coincident to the selected plane. You can select any plane that can be dimensioned, including wall faces, faces in linked Revit models, extrusion faces, levels, grids, and reference planes.
- **Pick a line and use the work plane it was sketched in**—Revit Architecture creates a work plane that is coplanar with the work plane of the selected line.

If the plane you choose is perpendicular to the current view, the Go to View dialog opens, giving you options of which view to open based on your selection.

For example, if you select a north-facing wall, the upper pane in the dialog lets you choose a parallel view (east or west elevation), or in the lower pane you can choose a 3D view, as shown.



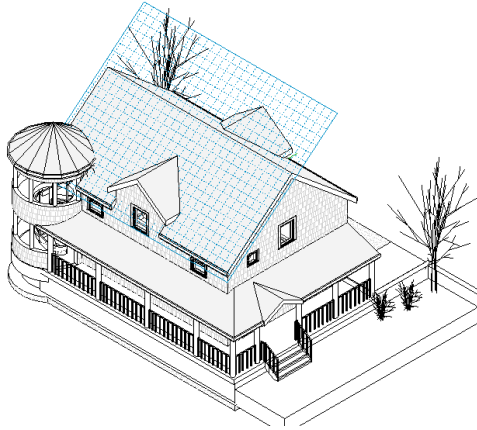
3 Select a view, and click Open View.

Making the Work Plane Visible

Click Home tab ► Work Plane panel ► Show.

The work plane appears as a grid in the view.

Part of a work plane grid



Modifying Work Plane Grid Spacing

- 1 If necessary, click Home tab ► Work Plane panel ► Show, to make the work plane visible.
- 2 Select the work plane.

NOTE Click the edge of the work plane to select it.

- 3 On the Options Bar, for Spacing, enter a value to specify the desired distance between grid lines.

Rotating a Work Plane Grid

When you rotate a work plane grid, the new orientation affects placement of components and affects the rectangle draw option for walls and lines. For example, if you rotate the work plane grid and then place a component, the component is oriented on the same angle as the work plane grid. If you create a chain of walls with the rectangle option, you can create them in the orientation of the work plane grid only.

To rotate a work plane grid, see [Rotating Elements](#) on page 379.

Elements Associated with Work Planes

If you create a family that is work plane-based, or an element that is not level-based (a hosted element), it is associated with a work plane. Work plane association controls how an element moves when its host moves. When an element is created, it inherits the work plane of the view; subsequent changes to the view work plane do not effect the element.

It is important to associate geometry to a work plane in order for geometry to move correctly. For example, you associate an element to its host via the work plane. When the host moves, the element moves as well.

Most elements have a read-only instance parameter called Work Plane, which identifies the current work plane of the element. You can view this property in the Instance Properties dialog. You can change the work plane an element is associated with, or you can dissociate an element from a work plane. Some sketch-based elements, such as stairs, floors, footprint roofs, and ceilings, are sketched on a work plane, but that work plane must be a level. You cannot dissociate these element types from their work plane.

Changing the Work Plane of an Element

- 1 Select a work plane-based element in a view.

- 2 Click Modify <Element> tab ► Work Plane panel ► Edit Work Plane.

NOTE When you use the Edit Work Plane option, the new work plane must be parallel to the existing work plane. If you need to select a work plane that is not parallel to the existing work plane, use the Rehost option. See [Rehosting](#) on page 811.

The Work Plane dialog displays, and the work plane grid for the element displays in the view.

- 3 If desired, click Show to display other views that can show the work plane for the element.

- 4 Select another work plane.

See [Setting the Work Plane](#) on page 317 for details on work plane options.

Disassociating an Element from a Work Plane


- 1 Select a work plane-based element in a view.

This type of element includes any solid geometry in the Family Editor or extruded roofs in a project.

- 2 Click Modify <Element> tab ► Work Plane panel ► Edit Work Plane.

The Work Plane dialog displays, and the work plane grid for the element displays in the view.

- 3 Click Dissociate.

TIP You can also dissociate an element graphically by clicking  (Disassociate Work Plane), which displays near the element when you select it in the view.

When an element is no longer associated with a work plane, the value of its Work Plane parameter (in the Instance Properties dialog) is <not associated>. The element is free to move irrespective of a work plane.

Creating a Work Plane-based Family

You can create a family that is hosted by the active work plane. This can be very useful both in a project environment and within a nested family where you may need a nested sub-component to reside on a particular plane. You can make any non-hosted family a work plane-based family.

For more information about work plane-based families, see [The Families Guide](#) on page 418.

- 1 Open or create a non-hosted family.

NOTE Only non-hosted components can become work plane-based families. Doors and windows, for instance, are hosted by walls and cannot become work plane-based components.

- 2 In the Family Editor, on any tab, click Family Properties panel ► Category and Parameters.

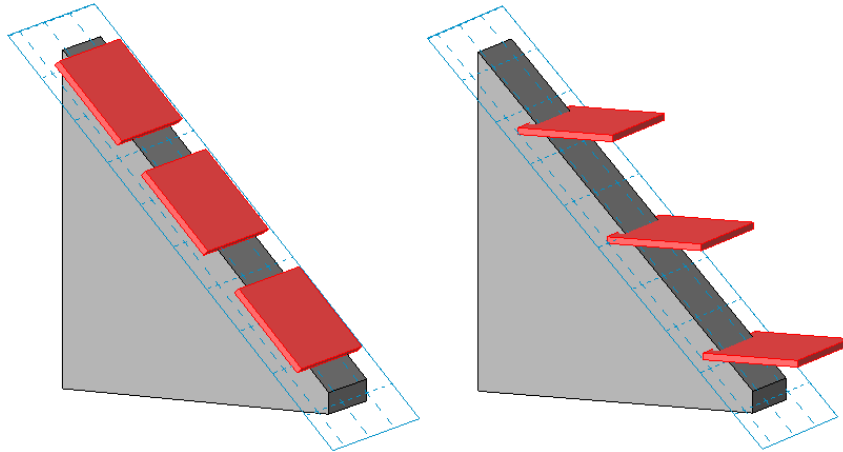
- 3 In the Family Category and Parameters dialog, under Family Parameters, select Work Plane-Based.

- 4 Click OK.

NOTE You can make a family both work plane-based and always vertical. Examples of both are shown below.


In the nested family below, the rectangular extrusion is a work plane-based component. On the left, the extrusion is work plane-based but not always vertical. On the right,

the same extrusion was reloaded into the family after designating it work plane-based and always vertical.



Flip Control for Work Plane-based Families

After you save and load a work plane-based family into the project, you can flip it about its work plane in a view.

Select the family instance in the project, and a Flip Work Plane control displays . Click the Flip Work Plane control to rotate the family instance 180 degrees about the x-axis of the work plane. You can also right-click the instance, and click Flip Work Plane.

Creating Solid and Void Geometry

The tools you use to create solid and void geometry are available only in the Family Editor. For more information, see [Family Editor](#) on page 416.

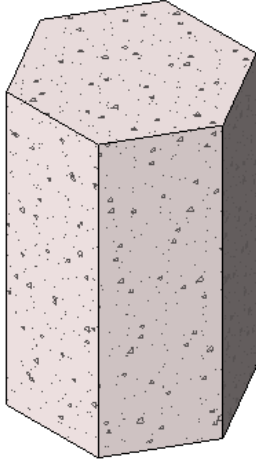
For detailed information about creating families, including tutorials for creating geometry using the Family Editor, see [The Families Guide](#) on page 418.

Creating an Extrusion

For information about using extrusions in families, see [The Families Guide](#) on page 418.

A solid or void extrusion is the easiest form to create. You sketch a 2D profile of the form on a work plane, and then extrude that profile perpendicular to the plane on which you sketched it.

**Sample polygonal concrete
isolated foundation extrusion**



Before you extrude the shape, you can specify its start and end points to increase or decrease the depth of the form. By default, the extrusion start point is 0. The work plane does not need to be either the start or end point of the extrusion – you only use it to sketch on and to set the extrusion direction.

The following procedure is a general method for creating a solid or void extrusion. Steps may vary depending on your design intent.

To create a solid or void extrusion

1 In the Family Editor, on the Create tab ► Forms panel, do one of the following:

- Click Solid drop-down ► Extrusion.
- Click Void drop-down ► Extrusion.

NOTE If necessary, set the work plane before you sketch the extrusion. Click Create tab ► Work Plane panel ► Set.

2 Use the sketching tools to sketch the extrusion profile:

- To create a single solid form, sketch a closed loop.
- To create more than one form, sketch multiple, non-intersecting, closed loops.


3 To extrude the profile from the default start point of 0, on the Options Bar, for Depth, enter a positive or negative extrusion depth.

This value changes the endpoint of the extrusion.

NOTE The extrusion depth is not retained after you create the extrusion. If you need to make multiple extrusions with the same endpoint, sketch the extrusions, select them, and then apply the endpoint.

4 Specify the extrusion properties:

- Click Create Extrusion tab ► Element panel ► Extrusion Properties.
- To extrude the extrusion from a different start point, under Constraints, for Extrusion Start, enter a new point.
- To set the visibility of a solid extrusion, under Graphics, for Visibility/Graphics Overrides, click Edit, and specify the visibility settings.

- To apply a material to a solid extrusion by category, under Materials and Finishes, click in the Material field, click  , and specify a material.
 - To assign a solid extrusion to a subcategory, under Identity Data, for Subcategory, select a subcategory.
 - Click OK.
- 5 Click Create Extrusion Boundary tab ► Extrusion panel ► Finish Extrusion.
Revit Architecture completes the extrusion and returns you to the view in which you started the extrusion.
- 6 To view the extrusion, open a 3D view.
- 7 To resize the extrusion in the 3D view, select it and use grips to edit it.

Editing an Extrusion

For information about using extrusions in families, see [The Families Guide](#) on page 418.

You can modify an extrusion after creating it.

To edit an extrusion

- 1 In the drawing area, select the extrusion.
- 2 If you are in the project environment:
 - a Click Modify <Element> tab ► Family panel ► Edit Family.
 - b Click Yes to open the family for editing.
 - c In the Family Editor, select the extrusion in the drawing area again.
- 3 Click Modify Extrusion tab ► Form panel ► Edit Extrusion.
- 4 If desired, modify the extrusion profile.
- 5 To edit the extrusion properties, click Modify Extrusion > Edit Extrusion tab ► Element panel ► Extrusion Properties, and change the visibility, material, or subcategory of the extrusion.
- 6 To change the extrusion to a solid or a void, under Identity Data, for Solid/Void, select Solid or Void.
- 7 Click OK.
- 8 Click Finish Extrusion.

Extrusion Tips

- The work plane does not have to be either the start or the end of the extrusion depth. It is only used to sketch on and set the extrusion direction to be perpendicular to the plane.
- You can set the depth of the geometry before sketching it. In sketch mode, enter a value in the Depth text box on the Options Bar. This value changes the end point of the extrusion. Depths can be negative values.
- You can modify the depth of the extrusion after creating it by selecting it and then clicking Modify Extrusion ► Element panel ► Element Properties drop-down ► Instance Properties. Specify values for the start and end points. You can also resize the extrusion in a 3D view by selecting it and then dragging it to resize it.

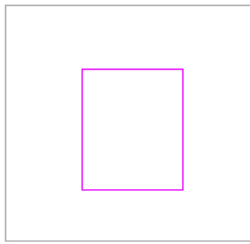
- If specified, Revit Architecture does not retain the end point value during creation of the extrusion. If you need to make multiple extrusions with the same end point, first sketch the extrusions, then select them, and then apply the end point.

Creating a Blend

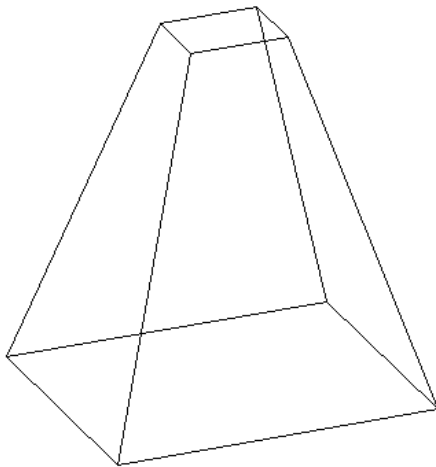
For information about using blends in families, see [The Families Guide](#) on page 418.

The Blend tool blends 2 profiles (boundaries) together. For example, if you sketch a large rectangle and a smaller rectangle on top of it, Revit Architecture blends the 2 shapes together.

Sample base and top boundaries for a blend.



Finished blend



NOTE If you want to dimension a solid blend after you create it, you can dimension from lines at the top of the blend to lines at the base of the blend. You cannot dimension from lines at the base of the blend to lines at the top of the blend.

To create a solid or void blend

1 In the Family Editor, on the Create tab ► Forms panel, do one of the following:

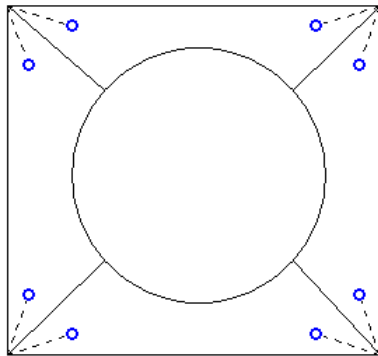
- Click Solid drop-down ► Blend.
- Click Void drop-down ► Blend.

NOTE If necessary, set the work plane before you sketch the blend. Click Create tab ► Work Plane panel ► Set.

- 2 On the Create Blend Base Boundary tab, use the sketching tools to sketch the base boundary of the blend, for example sketch a square.
- 3 To specify the depth of the blend, do either of the following:
 - To specify a depth that is calculated from a default start point of 0, on the Options Bar, for Depth, enter a value.
 - To specify a depth that is calculated from a start point other than 0, on the Create Blend Base Boundary tab ► Element panel, click Blend Properties. Under Constraints, enter new Second End and First End values.

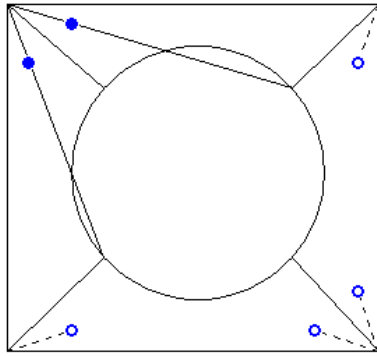
NOTE If specified, Revit Architecture does not retain the end point value during creation of the blend. If you need to make multiple blends with the same end point, first sketch the blends, then select them, and then apply the end point.

- 4 When finished with the base boundary, on the Create Blend Base Boundary tab ► Mode panel, click Edit Top.
- 5 On the Create Blend Top Boundary tab, sketch a boundary for the top of the blend, for example another square.
- 6 If necessary, edit the vertex connections to control the amount of twist in the blend:
 - On the Create Blend Top Boundary tab, click Mode panel ► Edit Vertices.
 - Vertex points become available on one of the blend sketches.




The dotted lines with blue open-dot controls are suggested connections. Each control is a switch between adding and removing connections.

- To display the vertex points on the other blend sketch, on the Edit Vertices tab ► Vertex Connect panel, click Controls on Base or Controls on Top (whichever option is currently unselected).
- Click a control, and the line becomes a solid connection. A filled blue control displays on the connection.



- Click a solid control to remove a connection; the line reverts to a dashed line with an open dot control.
- As you click the controls, some possible edges disappear and other ones appear.
- On the Vertex Connect panel, click Twist Right or Twist Left to twist the selected blend boundary in a clockwise or counter-clockwise direction.

7 Specify the blend properties:

- On the Element panel, click Blend Properties.
- To set the visibility of a solid blend, under Graphics, for Visibility/Graphics Overrides, click Edit, and specify the visibility settings.
- To apply a material to a solid blend by category, under Materials and Finishes, click in the Material field, click , and specify a material.
- To assign a solid blend to a subcategory, under Identity Data, for Subcategory, select a subcategory.
- Click OK.

8 On the Blend panel, click Finish Blend.

9 To view the blend, open a 3D view.

10 To resize the blend in the 3D view, select and use grips to edit it.

Editing a Blend

For information about using blends in families, see [The Families Guide](#) on page 418.

- 1 In the drawing area, select the blend.
- 2 If you are in the project environment:
 - a On the Modify <Element> tab ► Family panel, click Edit Family.
 - b Click Yes to open the family for editing.
 - c In the Family Editor, select the blend in the drawing area again.
- 3 On the Options Bar, enter a value in the Depth text box to change depth of the blend.
- 4 On the Modify Blend tab ► Edit Blend panel, select an editing option:
 - Click Edit Top to edit the top boundary of the blend.

- Click Edit Base to edit the base boundary of the blend.
- 5 To edit other blend properties, on the Edit Top Boundary tab or Edit Base Boundary tab, click Element panel ► Blend Properties, and change the visibility, material, or subcategory of the blend.
- 6 To change the blend to a solid or a void, under Identity Data, for Solid/Void, select Solid or Void.
- 7 Click OK.
- 8 On the Edit Top Boundary tab or Edit Base Boundary tab, click Mode panel ► Edit Vertices, and edit the blend vertices.
- 9 On the Blend panel ► click Finish Blend.

Creating a Revolve

For information about using revolutions in families, see [The Families Guide](#) on page 418.

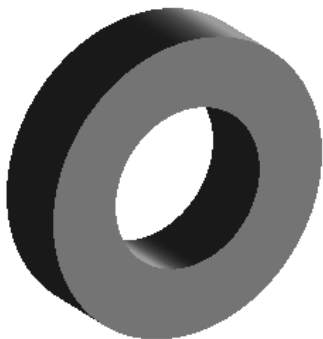
A revolve is a form that you create by revolving a shape around an axis. You can revolve the shape in a circle or any fraction of a circle. If the axis touches the revolve shape, the result is a solid.

**Solid revolved geometry
created near axis**



If you sketch away from the axis, the resulting geometry has a hole in it.

**Revolved geometry created away
from axis**



Use solid revolves to create family geometry like door and furniture knobs, columns, and dome roofs.

The following procedure is a general method for creating revolved geometry. Steps may vary depending on your design intent.

To create a solid or void revolve

1 In the Family Editor, on the Create tab ► Forms panel, do one of the following:

- Click Solid drop-down ► Revolve.
- Click Void drop-down ► Revolve.

NOTE If necessary, set the work plane before you sketch the revolve. Click Create tab ► Work Plane panel ► Set.

2 Place an axis of revolution:


- On the Create Revolve tab ► Draw panel, click Axis Line.
- Specify the start and endpoint of the axis at the desired orientation.

3 Use the sketching tools to sketch a shape to revolve around the axis:

- On the Create Revolve tab ► Draw panel, click Boundary Lines.
- To create a single revolve, sketch a closed loop.
- To create more than one revolve, sketch multiple, non-intersecting, closed loops.

IMPORTANT If the axis touches the revolve shape, the result is a solid. If the axis does not touch the revolve shape, the revolve will have a hole in it.

4 Change the properties of the revolve:

- On the Create Revolve tab ► Element panel, click Revolve Properties.
- To change the start and end points of the geometry to revolve, enter a new Start and End Angle.
- To set the visibility of a solid revolve, under Graphics, for Visibility/Graphics Overrides, click Edit.
- To apply a material to a solid revolve by category, under Materials and Finishes, click in the Material field, and click  to specify a material.
- To assign a solid revolve to a subcategory, under Identity Data, for Subcategory, select a subcategory.
- Click OK.

5 On the Revolve panel, click Finish Revolve.

6 To view the revolve, open a 3D view.

7 To resize the revolve in the 3D view, select and use grips to edit it.

NOTE You cannot drag the start and end faces of a 360-degree revolve.

Editing a Revolve

For information about using revolutions in families, see [The Families Guide](#) on page 418.

- 1 In the drawing area, select the revolve.
- 2 If you are in the project environment:
 - a On the Modify <Element> tab ► Family panel, click Edit Family.
 - b Click Yes to open the family for editing.
 - c In the Family Editor, select the revolve in the drawing area again.
- 3 On the Modify Revolve tab ► Edit panel ► click Edit Sketch.
- 4 If desired, modify the revolve sketch.
- 5 To edit other revolve properties, on the Edit Revolve tab ► Element panel, click Revolve Properties, and change the start and end points, visibility, material, or subcategory.
- 6 To change the revolve to a solid or a void, under Identity Data, for Solid/Void, select Solid or Void.
- 7 Click OK.
- 8 On the Revolve panel, click Finish Revolve.

Creating a Sweep

For information about using sweeps in families, see [The Families Guide](#) on page 418.

A sweep is a tool for creating families that requires you to sketch or apply a profile (shape) and extrude that profile along a path. You might use a sweep to create moldings, railings, or simple pipes.

The following procedure is a general method for creating a sweep. Steps may vary depending on your design intent.

To create a solid or void sweep

- 1 In the Family Editor, on the Create tab ► Forms panel, do one of the following.
 - Click Solid drop-down ► Sweep.
 - Click Void drop-down ► Sweep.


NOTE If necessary, set the work plane before you sketch the sweep. Click Create tab ► Work Plane panel ► Set.

- 2 Specify the sweep path:
 - To sketch a new path for the sweep, on the Create Sweep tab ► Mode panel, click Sketch Path.
The path can either be a single closed or single open path. You cannot have multiple paths. The path can be a combination of straight lines and curves, and it need not be planar.
 - To select an existing line for the sweep, on the Create Sweep tab ► Mode panel, click Pick Path.
You can select edges of other solid geometry, such as extrusions or blends, or you can pick existing sketch lines. Watch the status bar to know what you are picking. This method of picking automatically locks the sketch lines to the geometry you are picking and allows you to sketch the path in multiple work planes, hence allowing for a 3D path.
- 3 Sketch or pick the path, and then on the Path panel, click Finish Path.

4 Load or sketch a profile:

- To load a profile:
 - a Click Modify Profile tab ► Edit panel, and select a profile from the Profile list.
If the profile you need is not already loaded in the project, click Modify Profile tab ► Edit panel ► Load Profile to load the profile.
 - b On the Options Bar, use the X, Y, Angle, and Flip options to adjust the position of the profile.
Enter values for X and Y to specify the offset for the profile.
Enter a value for Angle to specify the angle of the profile. The angle rotates the profile around the profile origin. You can enter negative values to rotate in the opposite direction.
Click Flip to flip the profile.
 - c Click Apply.
 - d Select the path, and zoom in to see the profile.
- To sketch a profile:
 - a Click Modify Profile tab ► Edit panel, verify <By Sketch> is displayed, and then click Edit Profile.
 - b If the Go To View dialog displays, select the view where you want to sketch the profile, and click OK.
For example, if you sketched the path in a plan view, you would choose an elevation view to sketch the profile. The profile sketch can be a single-closed loop or multiple closed loops that do not intersect. Sketch the profile near the intersection of the profile plane and the path.
 - c Sketch the profile. Profiles must be closed loops.
 - d On the Create Profile Sketch tab ► Profile panel, click Finish Profile.

5 Specify the sweep properties:

- On the Create Sweep tab ► Element panel, click Sweep Properties.
- To set the visibility of a solid sweep, under Graphics, for Visibility/Graphics Overrides, click Edit, and specify the visibility settings.
- To apply a material to a solid sweep by category, under Materials and Finishes, click in the Material field, click , and specify a material.
- To assign a solid sweep to a subcategory, under Identity Data, for Subcategory, select a subcategory.
- Click OK.

6 On the Sweep panel, click Finish Sweep.

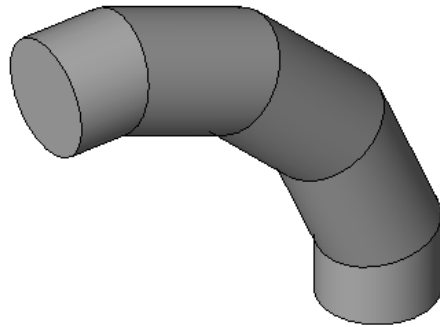
Creating a Segmented Sweep

For information about using sweeps in families, see [The Families Guide](#) on page 418.

Segmented sweeps are useful for creating mechanical duct work elbows. You create a segmented sweep by setting 2 sweep parameters and sketching a path with arcs. The parameters affect only arcs in the path. The minimum number of segments for a sweep is 2.

- 1 In the Family Editor, begin creating a sweep.
- 2 On Create Sweep tab ► Element panel, click Sweep Properties.
- 3 In the Instance Properties dialog, under Other, select the check box for Trajectory Segmentation.
- 4 Enter a value for Maximum Segment Angle. Valid values are between 0 and 360 degrees.
- 5 Sketch or pick a path with arcs.
- 6 Click Finish Path to complete the path.
- 7 Create a profile or use a pre-loaded profile.
- 8 On the Sweep panel, click Finish Sweep to complete the sketch of the sweep.

Sample segmented sweep with 30 degree Maximum Segment Angle.



TIP You can change a segmented sweep to a non-segmented sweep by clearing the check box for Trajectory Segmentation.

Editing a Sweep

For information about using sweeps in families, see [The Families Guide](#) on page 418.

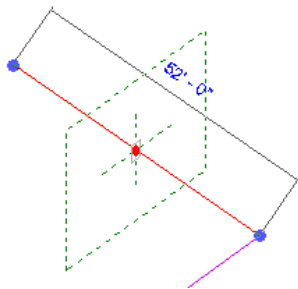
- 1 In the drawing area, select the sweep.
- 2 If you are in the project environment:
 - a On the Modify <Element> tab ► Family panel, click Edit Family.
 - b Click Yes to open the family for editing.
 - c In the Family Editor, select the sweep in the drawing area again.
- 3 On the Modify Sweep tab ► Form panel, click Edit Sweep.
- 4 To modify the sweep path:
 - On the Create Sweep tab ► Mode panel, click Sketch Path.
 - Use the tools on the Edit tab to modify the path.
 - On the Path panel, click Finish Path.
- 5 To modify the sweep profile:
 - On the Create Sweep tab ► Mode panel, click Select Profile.
 - On the Edit panel, use the tools that display to select a new sweep profile or change the sweep profile location. You can edit the existing profile using the tools on the Modify Profile tab.

- 6 To edit other sweep properties, on the Element panel, click Sweep Properties, and change the visibility, material, segmentation, or subcategory of the sweep.
- 7 To change the sweep to a solid or a void, under Identity Data, for Solid/Void, select Solid or Void.
- 8 Click OK.
- 9 On the Sweep panel, click Finish Sweep.

Sweep Tips

When creating a sweep with a tangent arc in the path, be sure the profile is small enough to sweep around the arc without the resulting geometry intersecting itself. An error occurs if the geometry intersects.

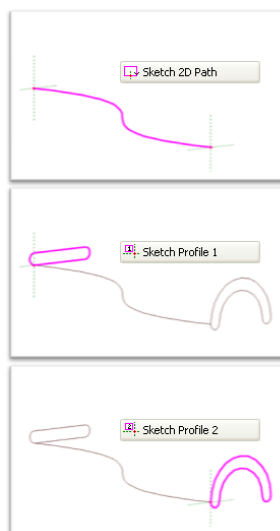
If you create a sweep path by using the Pick Path tool, you can drag the end points of the path lines as you are sketching it.



Creating a Swept Blend

For information about using swept blends in families, see [The Families Guide](#) on page 418.

The Swept Blend tool allows you to create a blend that has 2 different profiles and then sweep it along a path. The shape of a swept blend is determined by the 2D path you either sketch or pick and the 2 profiles you either sketch or load.



The following procedure is a general method for creating a swept blend. Steps may vary depending on your design intent.

To create a solid or void swept blend

1 In the Family Editor, on the Create tab ► Forms panel, do one of the following:

- Click Solid drop-down ► Swept Blend.
- Click Void drop-down ► Swept Blend.

2 Specify the path for the swept blend. Do one of the following on the Create Swept Blend tab ► Mode panel:

- Click Sketch Path to sketch a path for the swept blend.
- Click Pick Path to pick an existing line for the swept blend.

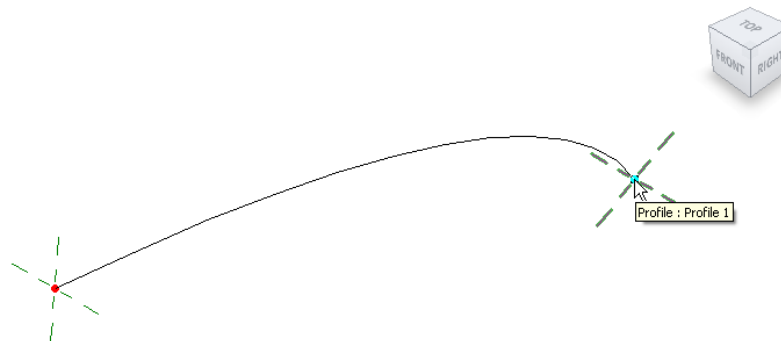
NOTE If necessary, set the work plane before you sketch or pick the path for the swept blend. Click Create tab ► Work Plane panel ► Set.

3 Sketch or pick the path, and then on the Path panel, click Finish Path.

NOTE A swept blend path can only have one segment.

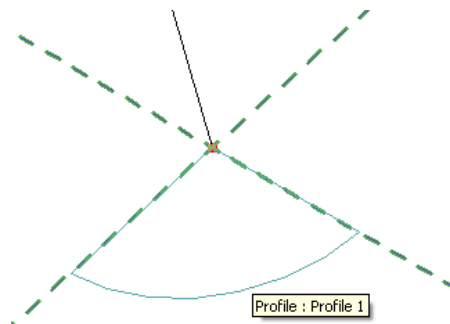
4 Load or sketch Profile 1.

The end point for Profile 1 on the swept blend path is highlighted.



■ To load a profile:

- a Click Modify Profile tab ► Edit panel, and select a profile from the Profile drop-down. If the profile you need is not already loaded in the project, click Load Profile to load the profile.
- b Zoom in to see the profile.



- c Use the X, Y, Angle, and Flip options to adjust the position of the profile. Enter values for X and Y to specify the offset for the profile.

Enter a value for Angle to specify the angle of the profile. The angle rotates the profile around the profile origin. You can enter negative values to rotate in the opposite direction.

Click Flip to flip the profile.

d Click Apply.

■ To sketch a profile:

- a On the Edit panel, verify that <By Sketch> is selected and click Edit Profile.
- b If the Go To View dialog displays, select the view where you want to sketch the profile, and click OK.
- c Use the tools on the Create Profile tab to sketch the profile. Profiles must be closed loops.
- d On the Profile panel, click Finish Profile.


5 Click Swept Blend tab ► Mode panel ► Modify Profile 2.

6 Load or sketch Profile 2 using the steps above.

7 Optionally, edit the vertex connections. By editing vertex connections, you control the amount of twist in the swept blend. You can edit vertex connections in plan or 3D views.

- a On the Swept Blend tab ► Mode panel, click Edit Vertices.
- b On the Edit Vertices tab ► Vertex Connect panel, select Controls on Base or Controls on Top.
- c In the drawing area, click the blue controls to move the vertex connections.
- d On the Vertex Connect panel, click the Twist Right and Twist Left tools to twist the swept blend.

8 Specify the swept blend properties:

- On the Element panel, click Swept Blend Properties.
- To set the visibility of a solid swept blend, under Graphics, for Visibility/Graphics Overrides, click Edit, and specify the visibility settings.
- To apply a material to a solid swept blend, under Materials and Finishes, click in the Material field, click , and specify a material.
- To assign a solid swept blend to a subcategory, under Identity Data, for Subcategory, select a subcategory.
- Click OK.

9 When finished, click Swept Blend panel ► Finish Swept Blend.

Editing a Swept Blend

For information about using swept blends in families, see [The Families Guide](#) on page 418.

1 In the drawing area, select the swept blend.

2 If you are in the project environment:

- a On the Modify Swept Blend tab ► Edit Swept Blend panel, click Edit Family.

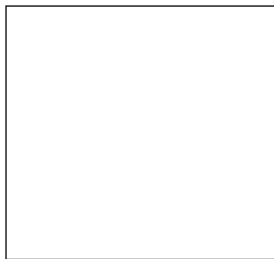
- b** Click Yes to open the family for editing.
 - c** In the Family Editor, select the swept blend in the drawing area again.
- 3** On the Modify Swept Blend tab ► Form panel, click Edit Swept Blend.
- 4** To edit the path:
- a** On the Create Swept Blend tab ► Mode panel, click Sketch Path.
 - b** Use the tools on the Sketch Path tab to modify the path, and click Path panel ► Finish Path.
- 5** To edit the profiles:
- a** On the Swept Blend tab ► Mode panel, click Modify Profile 1 or Modify Profile 2.
 - b** On the Edit panel, select a different loaded profile from the drop-down list, or select <By Sketch> from the list to sketch a new profile.
 - c** If you selected <By Sketch>, click Edit Profile on the Edit panel.
 - d** Sketch the profile and then click Profile panel ► Finish Profile.
- 6** To edit other swept blend properties, click Swept Blend tab ► Element panel ► Swept Blend Properties, and change the visibility, material, or subcategory of the sweep.
- 7** To change the swept blend to a solid or a void, under Identity Data, for Solid/Void, select Solid or Void.
- 8** Click OK.
- 9** On the Swept Blend panel, click Finish Swept Blend.

Cut Geometry

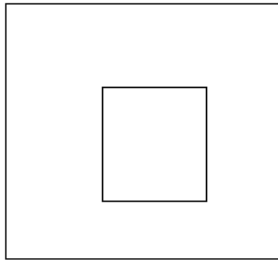
With the Cut Geometry tool, you can pick and choose which geometry gets cut and which does not, regardless of when you created the geometry.

NOTE While this tool and the UnCut Geometry tool are primarily for families, you can use them to embed curtain walls.

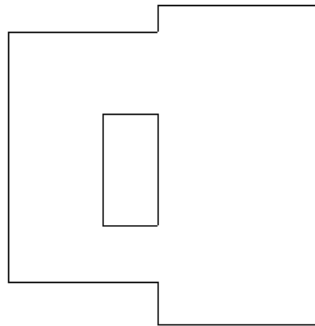
- 1** In the Family Editor, create solid geometry; it can be a single primitive or some joined primitives.



- 2** Create a void through the solid geometry.

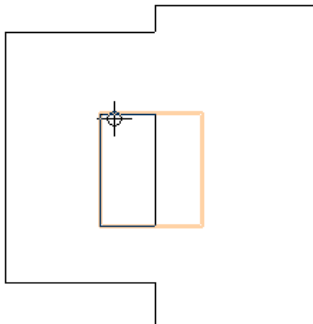


3 Create another solid geometry shape and join it to the existing geometry.

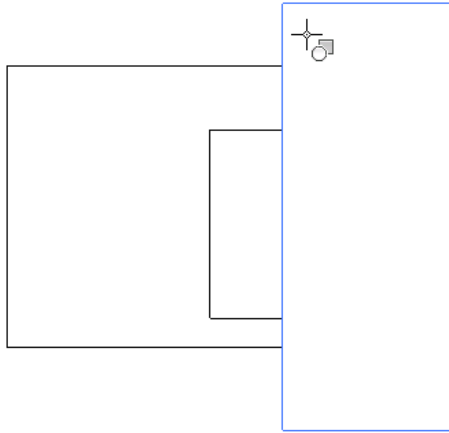


4 Click Modify tab ► Edit Geometry panel ► Cut drop-down ► Cut Geometry and select the void you created.

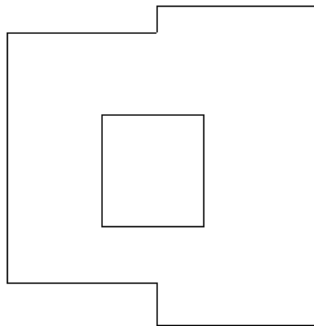
Notice the cursor changes shape.



5 Select the geometry you created in Step 3.



Revit Architecture cuts the selected geometry.



UnCut Geometry

- 1 In the Family Editor, click Modify tab ► Edit Geometry panel ► Cut drop-down ► Uncut Geometry.
- 2 Select the void.
- 3 Select the appropriate solid primitives that you do not want to cut.

NOTE If you select all geometry to not be cut, then the void appears at all times in the view.

Creating 2D Geometry

To create 2D family geometry, you use the Revit Architecture Model and Symbolic lines tools that are available in the Family Editor.

The **Model Line** tool on the Create tab ► Model panel lets you sketch two-dimensional geometry for when you do not need to show solid geometry. For example, you could sketch door panels and hardware as 2D rather than sketch solid extrusions. Model lines are always visible in 3D views. You can control their visibility in plan and elevation views by selecting the lines and clicking Modify Lines tab ► Visibility panel ► Visibility Settings.

The **Symbolic Line** tool on the Detail tab ► Detail panel lets you sketch lines that are meant for symbolic purposes only. For example, you might sketch symbolic lines in an elevation view to represent a door swing.

Symbolic lines are not part of the actual geometry of the family. Symbolic lines are visible parallel to the view in which you sketch them.

You can control symbolic line visibility on cut instances. Select the symbolic line and click Modify Lines tab ► Visibility panel ► Visibility Settings. Select Show only if instance is cut.

In the displayed dialog, you can also control the visibility of lines based on the detail level of the view. For example, if you select Coarse, that means that when you load the family into a project and place it in a view at the Coarse detail level, the symbolic lines are visible.

Adding a Reference Line

In the Family Editor, you can add a reference line in any view and use the same drawing tools and techniques used when adding model lines. When you sketch a reference line, it displays as a single line.

In a view where the model graphics are set to hidden line or wireframe, the sketched line displays as a solid line and the plane extents display with dashed lines.

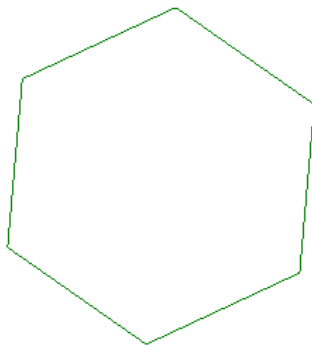
To add a reference line

1 In the Family Editor, on the Create tab ► Datum panel, click Reference Line.

2 Using the drawing tools on the Options Bar, sketch the line.

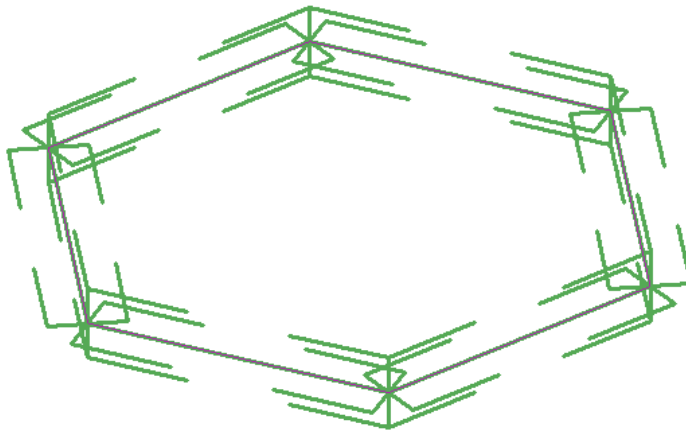
The line displays as a solitary solid line until selected or when highlighted during preselection.

**Example of reference lines
sketched as a polygon**



When selected or highlighted, the associated planes display according to the active view.

Example of reference line chain highlighted in a 3D view



To use reference lines and linear dimensions to control model geometry

- 3** Align the face of a model element to the reference line and lock it.
- 4** Add a dimension line referring to the reference line and label it as an instance or type parameter.
- 5** Flex the model by changing and applying a new value within the Family Types dialog.

Editing Elements

8

This topic describes the tools and techniques that you can use to edit elements in the drawing area.

Selecting Elements

Many of the controls and tools that you use to modify an element in the drawing area are only available when an element is selected.

To help you identify elements and mark them for selection, Revit Architecture includes an automatic highlighting feature. When you move the cursor onto or near an element in the drawing area, the outline of the element is highlighted. (It appears in a heavier line weight.) A description of the element displays on the status bar at the bottom of the Revit window. After a brief delay, the element description also displays within a tool tip just below the cursor.

Wall element before and after highlighting




When an element is highlighted, click to select it. When an element is selected in one view, the selection applies to all other views as well.

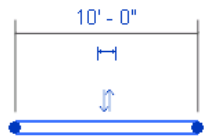
TIP If you have difficulty highlighting a particular element because other elements are in close proximity, press **TAB** to cycle through the elements until the desired element is highlighted. The status bar identifies the currently highlighted element.

When you select an element, the following events occur:

- The element is outlined in the color specified in options. (For information on changing this color, see [Options](#) on page 516.)
- Any element-specific editing controls and dimensions display on or adjacent to the element. See [Controls and Shape Handles](#) on page 349.
- Applicable editing tools are available on the Modify <Element> tab. Many of these tools are also available on the element's shortcut menu.

- The selection count on the status bar () displays the number of elements selected. (See [How Many Elements Are Selected?](#) on page 341.)


Wall after selection



NOTE You can right-click a highlighted element to select it and display its shortcut menu. The element remains highlighted until the menu is closed; the color outline is then visible on the selected element.

Basics for Selecting Elements

Use the following techniques to select elements in the drawing area.

If you want to...	Then do this...
locate the desired element to select	move the cursor over the element in the drawing area. Revit Architecture highlights the element and displays information about it in the status bar and in a tooltip. If several elements are very close to or on top of one another, move the cursor over that area and press <i>TAB</i> until the status bar describes the desired element.
select an element	click the element.
select multiple elements	<i>CTRL</i> + click each element. For more ways to select multiple elements, see Selecting Multiple Elements on page 340.
determine how many elements are currently selected	check the selection count on the status bar(). See How Many Elements Are Selected? on page 341.
select all elements of a particular type	select one element of the desired type, and type <i>SA</i> (for Select All Instances).
select all elements of a certain category (or categories)	draw a pick box around the elements, and click Multi-Select tab ► Filter panel ► Filter. Select the desired categories, and click OK.
deselect an element	<i>SHIFT</i> +click each element to deselect that element from a group of selected elements.
re-select the previously selected elements	press <i>CTRL</i> +left arrow.

Selecting Multiple Elements

To select more than one element, use one of the following methods:

- While pressing *CTRL*, click each of the elements.


- Draw a selection box by placing the cursor on one side of the elements to be selected and dragging it diagonally to form a rectangular boundary.
 - To select only elements that are completely within the boundary of the selection box, drag the cursor from left to right.
 - To select any elements that are wholly or partially within the boundary of the selection box, drag the cursor from right to left.
- Press *TAB* to highlight connected elements, and then click to select. See [Selecting Chains of Walls and Lines](#) on page 342.
- Right-click on a family type name in the Project Browser or a family type in the drawing area, and click Select All Instances. This tool selects all instances of that family type in your project. See [Project Browser](#) on page 93.

NOTE If you are editing a design option, the tool name is Select All Instances in Active Option. It selects all elements of that type in the active option only.

How Many Elements Are Selected?

When you select multiple elements, it can be difficult to determine whether you have selected the intended elements. To verify this and make any needed adjustments, do the following:

- Check the selection count on the status bar.

Revit Architecture indicates the total number of selected elements using: 
- Click the selection count to display the Filter dialog.

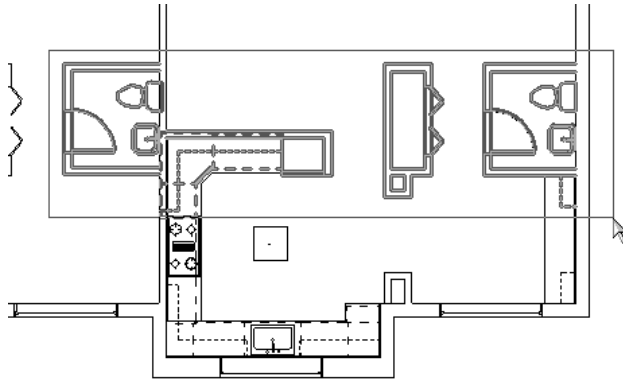
The Filter dialog lists the categories of the selected elements. It also indicates the number of selected elements in each category, and the total number of selected elements. You can clear check boxes to deselect categories of elements. See [Selecting Elements Using a Filter](#) on page 341.

Selecting Elements Using a Filter

When a selection includes elements of different categories, you can use a filter to remove unwanted categories from the selection. For example, if the selection includes walls, doors, windows, and furniture, you can use a filter to omit the furniture from the selection. As a result, only the walls, doors, and windows remain selected.

To select elements using a filter

- 1 Define a selection box around the elements to select. Place the cursor on one side of the elements and drag it diagonally to form a rectangular boundary.



To select only elements that are completely within the boundary of the box, drag the cursor from left to right. To select any elements that are wholly or partially within the boundary of the box, drag the cursor from right to left.

2 Click Multi-Select tab ► Filter panel ► Filter.


The Filter dialog lists all categories of the elements that are currently selected. The Count column indicates the number of selected elements in each category. At the bottom of the dialog, Total Elements displays the total number of elements currently selected.

3 Specify the categories of elements to include in the selection:

- To exclude all elements in a category, clear its check box.
- To include all elements in a category, select its check box.
- To select all categories, click Check All.
- To clear all categories, click Check None.

When you select or clear the check boxes, Total Elements updates to display the new number of selected elements. This total also displays in the selection count on the status bar.

4 Click OK.

The selected elements now include only the categories specified in the filter. The selection count on the status bar () displays the total number of selected elements.

Selecting Chains of Walls and Lines

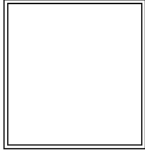
If multiple elements (such as walls, lines, or both) are joined together in a continuous chain, you can select the entire chain. The chain can include different types of elements.

To select a chain of walls or lines

- 1** Highlight any one of the elements in the chain.
- 2** Press *TAB*.
Revit Architecture highlights all elements in the chain.
- 3** Click to select the entire chain.

The following figures show valid chains for selection.

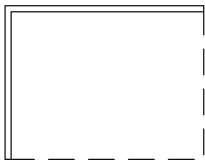
Four walls joined



Four area separation lines joined



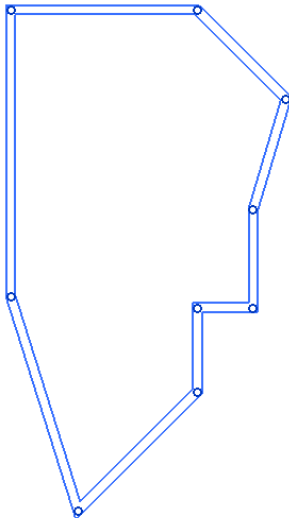
Walls and area separation lines joined



If multiple walls are joined at the same point, the chain continues along the wall that makes the smallest angle with the one currently highlighted. Walls joined at mid-end faces can also be included in a chain selection. See [Creating Walls with Mid-End Faces](#) on page 657.

As shown in the following illustration of a selected chain of walls, drag controls display at the coincident endpoints. You can drag these controls to new locations without unjoining the endpoints. See [Modifying a Selected Chain](#) on page 345.

A selected chain of walls with drag controls



Selecting Part of a Chain

If multiple elements (such as walls, lines, or both) are joined together in a continuous chain, you can select part of the chain.

To select part of a chain

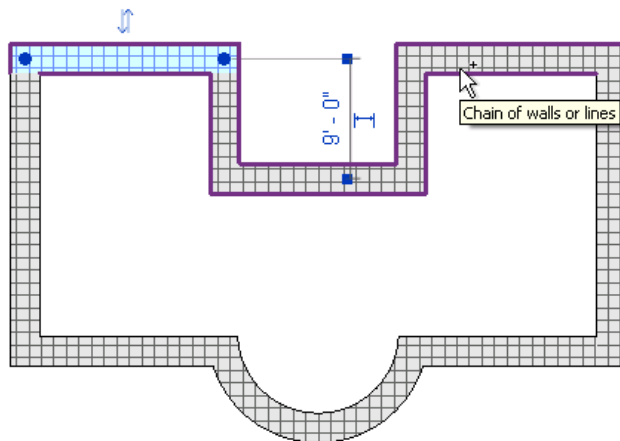
- 1 Select the first desired element in the chain.
- 2 Move the cursor to highlight the last desired element in the chain.
- 3 Press *TAB*.

Revit Architecture highlights all elements in the partial chain between the first and last elements that you selected. (Press *TAB* again to highlight the entire chain. Press it a third time to highlight only the second element.)

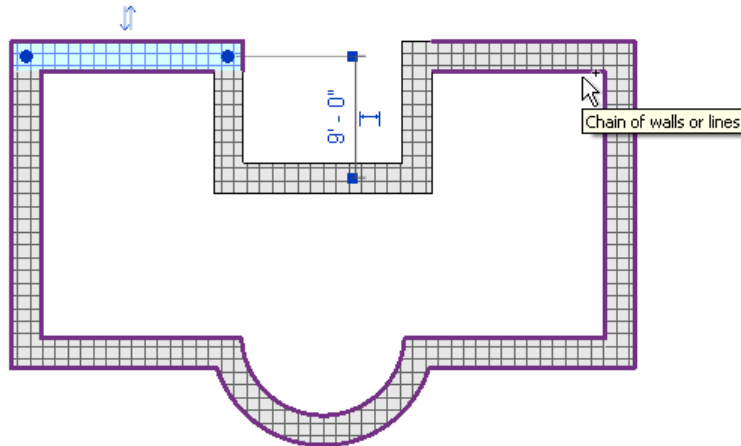
- 4 Click to select the part of the chain that is highlighted.

If the chain is a closed loop, the elements to be highlighted for partial chain selection are determined by the cursor position when you highlight the last desired element. As shown in the following wall layout, if you position the cursor near the left endpoint of the upper-right wall, the partial chain includes the walls along the top of the layout. If you place the cursor on the right side of that wall, the walls on both sides and along the bottom are included in the partial chain.

Highlighted partial chain with cursor near left endpoint of last wall in chain



Highlighted partial chain with cursor near right endpoint of last wall in chain

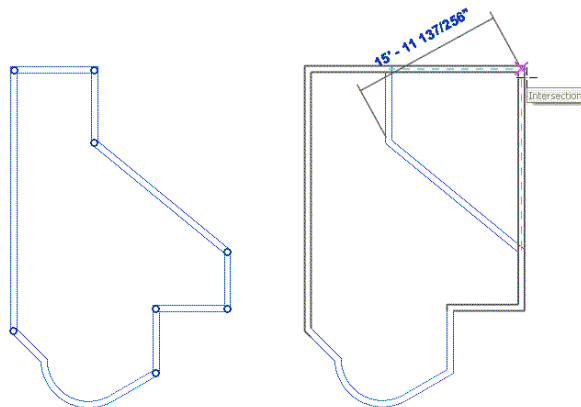


Modifying a Selected Chain

When a chain of walls or lines is selected, you can use the drag controls that display at the coincident endpoints to perform any of the following edits without unjoining elements in the chain:

- To change the layout of the chain, drag a control to a new location.

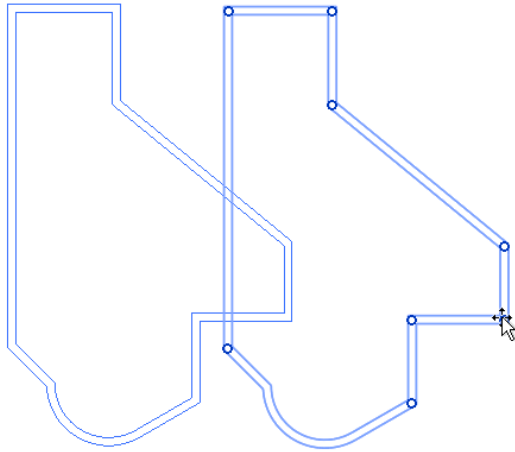
Editing a selected chain of walls.



- To move the entire chain (preserving its layout), while pressing *SHIFT*, drag the chain vertically or horizontally to a new location.

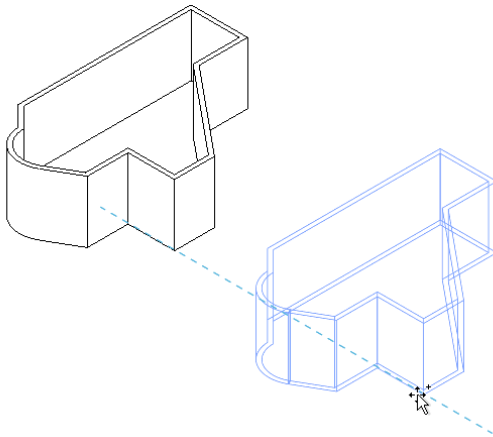
NOTE If the movement is constrained, you can release *Shift* and then move the chain.

Dragging a wall chain to a new location



- To create and place a copy of the chain, while pressing *CTRL*, drag the chain to the desired location.

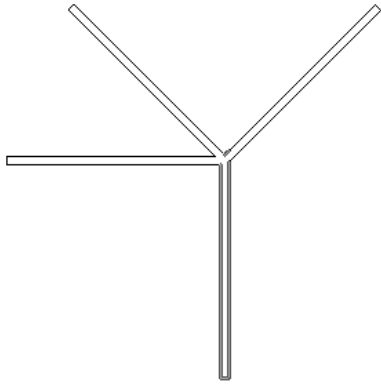
Copying a wall chain in a 3D view



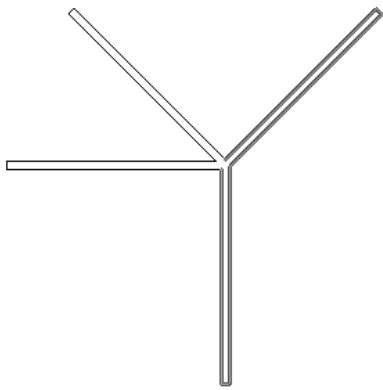
Selecting Walls or Lines Joined at a Point

When multiple walls or lines are joined at a common point, you can use *TAB* to select multiple elements, as follows:

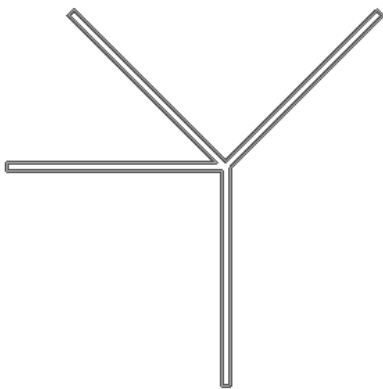
- Place the cursor on or near one wall or line, and click to select it.



- Press *TAB*. Revit Architecture highlights the second wall or line that is closest to the cursor. For example, in the following example, the cursor is positioned on the right side of the lower wall. If you want to select these 2 walls or lines, click to select them.



- Press *TAB* again to highlight all of the connected walls or lines. Then click to select them.



Selecting Multiple Curtain Elements

You can select multiple curtain elements on large curtain hosts using selection tools on the shortcut menu. Curtain hosts include curtain walls, sloped glazing, and curtain systems created by face.

When selecting multiple elements in a curtain wall, use the status bar and the Filter dialog to ensure that you have selected the intended elements. See [Selecting Elements Using a Filter](#) on page 341.

Selecting Panels

You can select curtain panels in multiple ways.

To select all panels on a curtain host element, right-click the host element and click Select Panels on Host. You can then select an individual panel, right-click, and click Select Panels to access the following options for selecting multiple panels:

- Select Panels along Vertical Grid (available for curtain walls only)
- Select Panels along Horizontal Grid (available for curtain walls only)
- Select Panels along Grid 1
- Select Panels along Grid 2
- Select Panels on Face (available for curtain systems created by face only)
- Select Panels on Host

Selecting Mullions

The shortcut menu options for selecting multiple mullions vary depending on whether you access them from the curtain host element or a selected mullion.

If you right-click a curtain wall and click Select Mullions, the following options are available:

- Select Mullions on Vertical Grid. Selects all interior mullions on vertical grids.
- Select Mullions on Horizontal Grid. Selects all interior mullions on horizontal grids.
- Select All Mullions. Selects all mullions on the host.

If you right-click a curtain system or sloped glazings and click Select Mullions, the following options are available:

- Select Mullions on Grid 1. Selects all interior mullions that lie on the grid 1 layout. For more information on grid layouts, see [Type-Driven Curtain Element Layout](#) on page 772.
- Select Mullions on Grid 2. Selects all interior mullions that lie on the grid 2 layout.
- Select All Mullions. Selects all mullions on the host.

If you right-click an individual mullion and click Select Mullions, the following options are available:

- Select Mullions on Gridline. Selects all mullions that lie on the same gridline as the selected mullion.
- Select Mullions Across Gridline. Selects all interior mullions that lie on gridlines opposite the gridline on which the selected mullion lies.
- Select Mullions on Vertical Grid. Selects all vertical mullions.
- Select Mullions on Horizontal Grid. Selects all horizontal mullions.
- Select Inner Mullions. Selects all interior mullions on the same face as the selected mullion.

- **Select Border Mullions.** Selects all border mullions on the same face as the selected mullion.
- **Select Mullions on Host.** Selects all mullions on the host.


Restoring a Selection

To restore a selection (of one or more elements) that you have cleared, while pressing *CTRL*, press the *LEFT ARROW* on the keyboard. Alternatively, you can right-click anywhere in the drawing area, and click **Select Previous** on the shortcut menu.

You can only restore a selection while **Modify** is active. If you switch to a different tool, the selection is cleared.

Removing Elements from a Selection

To deselect an element, while pressing *SHIFT*, click the element. Other selected elements remain selected.

The selection count on the status bar () updates to display the new number of selected items. (See [How Many Elements Are Selected?](#) on page 341.)

Controls and Shape Handles

When you select an element, various controls and handles appear on or near the element. Use these controls to move the element or modify its size or shape. The types of controls that are available depend on the type of element selected and the type of view.

When a control has multiple functions, move the cursor over the control and press *TAB* to toggle between the functions. For example, press *TAB* to display shape handles for most basic wall types when they are highlighted in elevation or 3D views. In plan views, however, this only works for curtain walls. To display shape handles for a basic wall in plan view, select the wall first, and then press *TAB*.

Drag Controls

Drag controls display at the ends of selected elements in plan views. They also display along the ends, bottoms, and tops of selected elements in elevation and 3D views, where they are labeled as shape handles. Drag these controls to resize an element.


When a chain of walls or lines is selected, drag controls display at the coincident endpoints. Drag the controls to change the layout of the chain. See [Selecting Chains of Walls and Lines](#) on page 342.

Revit Architecture uses the following types of drag controls:

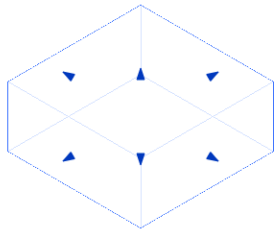
- Dots () display when movement is constrained to a plane, as with walls and lines in plan views. Drag a dot control to lengthen, shorten, or change the orientation of the element.


Drag controls (shown in blue) on a wall in plan



- Single arrows () display as shape handles in elevation and 3D views when movement is constrained to a line, but the outside direction is unambiguous. For example, a massing shape with no dimension constraints displays with single arrows. Single arrow controls on a selected wall in 3D views can also be used to move the wall. Place the cursor over the control and press *TAB* to change the control from a shape handle that lengthens or shortens the wall to a drag control that moves the wall without resizing it.

Drag controls on massing form



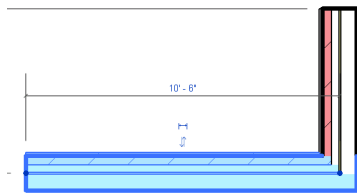
- Double arrows () display when the shape handles are constrained to move along a line. For example, if you add a labeled dimension to a family and make it an instance parameter, it displays with a double arrow after you load it into a project and select it.

TIP You can right-click the wall end controls and use an option on the shortcut menu to allow or disallow wall joins.

Flip Controls

Click a flip control (double arrows) to change the orientation of an element. For example, when you flip a compound wall, you reverse the order of its component layers. Doors with a swing have 2 flip controls: Flip the Instance Facing (which controls whether the door swings in or out) and Flip the Instance Hand (which controls whether the door swings right or left). Flip controls display only when practical.

Flip control for a compound wall



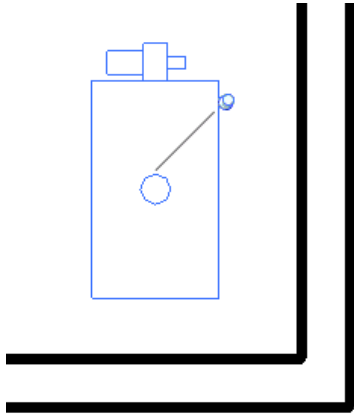
TIP You can also flip a selected element by pressing the *SPACEBAR*.

Pushpin Controls

A pushpin is a user-placed control that provides a quick way to allow or prevent changes to an element's position. After you place a pushpin, you cannot move the element until you unpin it (by clicking the pushpin control). When the element is unpinned, a red X displays on the control. After moving the element, you

can click the control again to pin the element to its new position. For information on placing pushpin controls, see [Preventing Elements from Moving](#) on page 382.

Pushpin control on a locked component



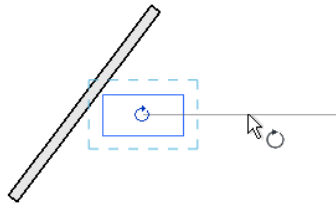
Rotate Controls

Use rotate controls to drag an element or text note to a desired degree of rotation around a central axis.

If desired, drag the center of rotation symbol. The symbol snaps to points and lines of interest, such as walls and the intersections of walls and lines. You can also drag it onto open space.

See [Rotating Elements](#) on page 379.

Rotate control



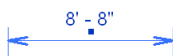
Dimension Text Controls

Dimension text controls are blue squares that display on selected dimension elements that you have added to a drawing. Drag a control to move dimension text away from the dimension line.

NOTE You may need to zoom in to see dimension text controls.

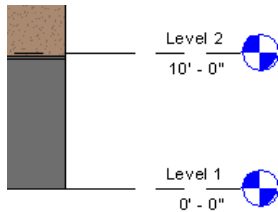
See [Dimension Witness Lines](#) on page 284.

Dimension text control shown in blue



View Controls

Double-click a view control to open a new view associated with an element. For example, when you double-click a view control for level lines, Revit Architecture opens the appropriate floor plan level. When you double-click a view control with a section level, Revit Architecture opens the appropriate section view.



Spacebar

Use the *SPACEBAR* to flip a selected element. You can select multiple elements and flip them all at the same time. Free standing families, such as furniture and columns, rotate 90 degrees each time you press the *SPACEBAR*. Some annotations can be flipped. For example spot slopes, baseline dimensions, and ordinate dimensions can be flipped.

The following general rules apply to using the *SPACEBAR* to flip multiple elements:

- When multiple walls are selected, pressing the *SPACEBAR* flips the orientation of them all.
- For elements such as doors, which can be flipped in 2 directions relative to their host, press the *SPACEBAR* multiple times to cycle through the possible positions.
- If elements constrained to flip in only one direction (such as windows) are selected with elements that can flip in multiple directions (such as doors), then all elements flip along the common direction.


Pressing the *SPACEBAR* does not work in the following cases:

- The selection contains any element that cannot be flipped.
- The selection includes elements that do not share a common flip direction.

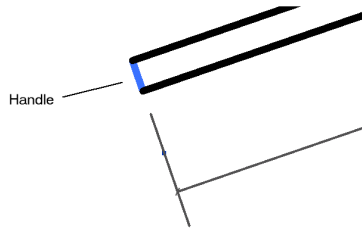
For example, if you select a door and its host wall, you cannot use the *SPACEBAR* to flip the selection.

Shape Handles

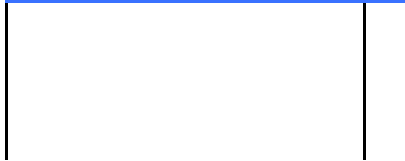
When a wall is selected in a plan view, place the cursor over an end control (blue dot) and press *TAB* to display a shape handle. When a wall is highlighted in an elevation view or a 3D view, press *TAB* to display the entire edge (closest to the cursor) as a shape handle that you can drag to resize the wall. The edge functioning as a shape handle is blue (or the defined selection color) when you drag it. The edge remains selected for further resizing until you press *ESC* or click elsewhere in the drawing area.

NOTE You can change the selection color from blue (the default) to another color using  ► Options. See [Setting Options](#) on page 516.

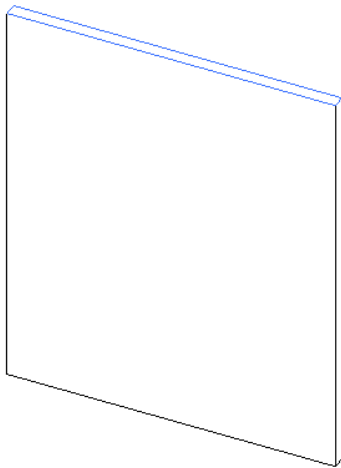
Shape handle (shown in blue) in plan view



Shape handle (shown in blue) in elevation view



Shape handle (shown in blue) for 3D view



Undoing, Redoing, or Canceling an Action

While working in Revit Architecture, you can undo past actions, redo past actions, or cancel a current action.

Undoing an Action

Use the Undo tool to cancel the most recent action or a series of recent actions.

To undo a single action:

- Click (Undo) on the Quick Access toolbar.

Revit Architecture cancels the most recent action.

To undo multiple actions:

- 1 On the Quick Access toolbar, click the drop-down list adjacent to the Undo tool .
- 2 Scroll down to find the action to cancel.

3 Select the action.

Revit Architecture cancels all actions up to and including the selected action.

TIP You can also use the keyboard shortcut *CTRL+Z* to undo actions.

Redoing an Action

The Redo tool reinstates all actions canceled by Undo. After reinstating the actions, the current tool continues.


For example, suppose that you place a door and then cancel the placement with Undo. You then choose to place a window. While the Window tool is active, you click Redo. Revit Architecture reinserts the door and then continues the Window tool.

If the Redo tool is active and you execute an action, the Redo information is lost.

NOTE The Redo tool is available only after you use the Undo tool.

To redo a single action


1 Undo a Revit Architecture action.

2 Click  (Redo) on the Quick Access toolbar.

Revit Architecture reinstates the action that you had previously canceled with Undo.

To redo multiple actions:

1 Undo multiple Revit Architecture actions.

2 On the Quick Access toolbar, click the drop-down list adjacent to the Redo tool .

3 Scroll down to find the action to redo.


4 Select the action.

Revit Architecture reinstates all actions up to and including the selected action.

TIP You can also use the keyboard shortcut *CTRL+Y* to redo actions.

Canceling an Action

To exit an action that you have already started, do any of the following:

- Press *ESC* twice.
- Right-click and select Cancel from the shortcut menu.
- Click  (Modify) on the Quick Access toolbar.

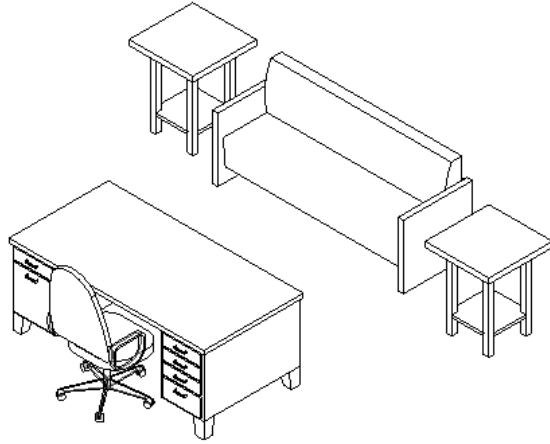
Editing Elements in Groups

You can group elements in a project or family and then place that group many times in a project or family. Grouping elements is useful when you need to create entities that represent repeating layouts or are common to many building projects (for example, hotel rooms, apartments, or repeating floors).

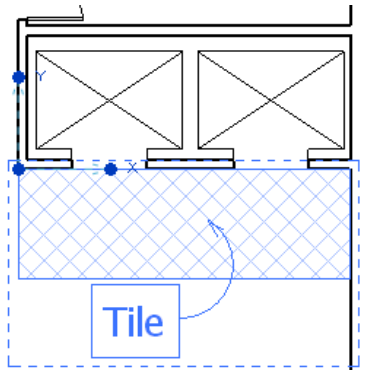
With each instance of a group that you place, there is associativity among them. For example, you create a group with a bed, walls, and window and then place multiple instances of the group in your project. If you modify a wall in one group, it changes for all instances of that group. This makes modifying your building model much easier because you can change several instances of a group in one operation.

You can create the following types of groups:

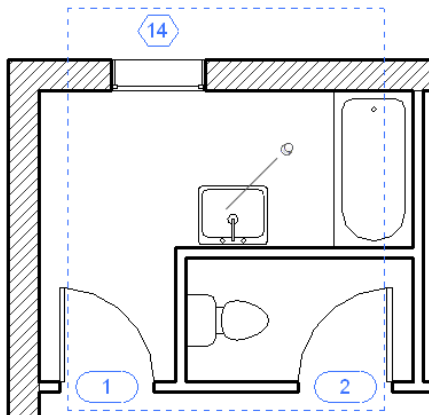
- Model groups, which can contain model elements.



- Detail groups, which can contain view-specific elements (such as text and filled regions).



- Attached detail groups, which can contain view-specific elements that are associated with a specific model group (such as door and window tags).



A group cannot contain both model and view-specific elements. If you select both types of elements and then try to group them, Revit Architecture creates a model group and places the detail elements into an attached detail group for that model group. The result is the same if you select both detail elements and a model group; Revit Architecture creates an attached detail group of the detail elements for that model group.

Restrictions on Grouping

If elements cannot be copied together, they cannot be grouped together. See [Copying Elements to the Clipboard](#) on page 393 for information on copy restrictions.

Creating Groups

You can create a group by selecting elements in a project view, or you can use the group editor. In the group editor you can add elements from the project view, place additional elements in the view which are then automatically added to the group, remove elements, create attached detail groups (for model groups), and view group properties.

You can also create groups from linked Revit models, or you can duplicate and modify an existing group. See [Converting Groups and Linked Revit Models](#) on page 363 and [Duplicating Group Types](#) on page 357.

NOTE You cannot group dimensions, tags, or keynotes without also grouping the elements that they reference. You can group them in an attached detail group for the model group they reference.

Creating a Group by Selecting Elements

- 1 In a project view, select the desired elements or existing groups you want in the group.
- 2 Click Multi-Select tab ► Create panel ► Create Group.

NOTE If you have only selected one element type, the respective Modify <Element> tab displays instead of the Multi-Select tab.

- 3 In the Create Group dialog, enter a name for the group.

NOTE The name of this dialog will vary depending on the types of elements you selected.

- 4 If you want to open the group in the group editor, select the Open in Group Editor option.
The group editor allows you to add or remove elements from a group, attach detail groups (for model groups), and view group properties.
- 5 Click OK.

Creating a Group Using the Group Editor

- 1 Click Home tab ► Model panel ► Model Group drop-down ► Create Group.
Alternatively, you can click Annotate tab ► Detail panel ► Detail Group drop-down ► Create Group.
- 2 In the Create Group dialog, enter a name for the group.
- 3 Select the type of group to create (model or detail), and click OK.
Revit Architecture enters group edit mode. The background color of the drawing area changes when you are in group edit mode.
- 4 If elements exist in the project view and you want to add them to the group, click Edit Group panel ► Add, and then select the elements.

- 5 If you want to add elements to the group that do not already exist in the project view, select an element creation tool from the appropriate tab and place the new element. When you add an element to a view in group edit mode, it is automatically added to the group.

NOTE If you add a view-specific element to a model group (for example, a window tag), the view-specific element is placed in the project view and not in the model group.

- 6 When you are finished adding elements to the group, click Edit Group panel ► Finish.

Related topics

- [Editing Elements in Groups](#) on page 354
- [Loading Groups](#) on page 358
- [Placing Groups](#) on page 358
- [Modifying Groups](#) on page 360

Creating an Attached Detail Group

- 1 In the drawing area, do one of the following:
 - Select model elements and detail elements, simultaneously. Click Multi-Select tab ► Create panel ► Create Group.
 - Select view-specific elements, tags, or dimensions that are associated with an existing model group, and click Modify <Element> tab ► Create panel ► Create Group.
 - Select an existing model group, and click Modify Model Groups tab ► Group panel ► Edit Group. Click Edit Group panel ► Attach Detail.
- 2 In the Create Model Group and Attached Detail Group dialog, enter a name for the model group (if necessary), and enter a name for the attached detail group.
- 3 Click OK.

The attached detail group displays in the Project Browser under the model group that it belongs to.

Related topic

- [Adding or Removing Elements in a Group](#) on page 360

Duplicating Group Types

You can create a new group type by duplicating an existing group. When you duplicate a group, you can edit the new group type without affecting the original group or its instances.

Use one of the following methods to duplicate a group type:

- In the Project Browser, right-click the group name, and click Duplicate. The new group displays in the Project Browser. For example, if your original group was called Group 1, the new group would be Group 2. You can rename the group as necessary.
- Select the group in the drawing area, and click Modify Model Groups tab ► Element panel ► Element Properties drop-down ► Type Properties. In the Type Properties dialog, click Duplicate. Enter a name for the group, and click OK.

Loading Groups

You can load Revit project files (RVT) into a project as a group, and you can load Revit family files (RFA) into the Family Editor as a group. If you have existing Revit group files (RVG), you can also load them into a project or family.

To load a project or family file as a group:

- 1 Click Insert tab ► Load From Library panel ► Load as Group.
- 2 In the Load File as Group dialog, navigate to the Revit project file (RVT), Revit family file (RFA), or Revit group (RVG) you want to load.
- 3 If you are loading an RVT or RVG file, select whether you want to include attached details, levels, or grids.
When you select attached details, detail elements in the file are loaded as attached detail groups.
- 4 Click Open.
The file is loaded as a group, and the group displays in the Project Browser under the Groups branch. You can now place the group in the project or family. See [Placing Groups](#) on page 358.

To reload a group:

- 1 In the Project Browser, expand Groups.
- 2 Right-click the group to reload, and select Reload.
- 3 In the Load File as Group dialog, navigate to the file.
- 4 Optionally, select whether you want to include attached details, levels, or grids.
- 5 Click Open.
If any family types differ between the file you are loading and the host file, the Duplicate Types dialog opens to indicate this.

Placing Groups

To place a model group:

- 1 Click Home tab ► Model panel ► Model Group drop-down ► Place Model Group.
- 2 Click Place Group tab ► Element panel, and select the model group type to place from the Type Selector drop-down.
- 3 Click in the drawing area to place the group.

To place a detail group:

- 1 Click Annotate tab ► Detail panel ► Detail Group drop-down ► Place Detail Group.
- 2 Click Place Group tab ► Element panel, and select the detail group type to place from the Type Selector drop-down.
- 3 Click in the drawing area to place the group.

To place a model or detail group from the Project Browser:

- 1 In the Project Browser, expand the Groups branch.
- 2 Expand the Model or Detail group.
- 3 Drag the model or detail group to place in the drawing area.

Alternatively, right-click a group name in the Project Browser and click Create Instance. Click in the drawing area to place instances of the group. When you are finished placing groups, click Place Group tab ► Select panel ► Modify.

NOTE Attached detail groups cannot be dragged from the Project Browser into the drawing area.

To place an attached detail group:

- 1 Place an instance of a model group that has a detail group associated with it.

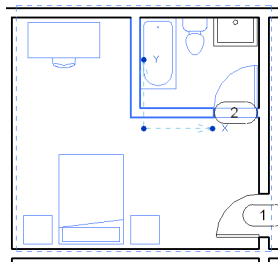
NOTE Attached detail groups can only be placed in the view type in which they were created: plans or section/elevation views. They cannot be placed in 3D views. The instance parameters for attached detail groups indicate the types of views they can be placed in and to which model group they are attached.

- 2 Click Place Group tab ► Select panel ► Modify.
- 3 Select the model group or multiple instances of the same model group.
- 4 Click Modify Model Groups tab ► Group panel ► Attached Detail Groups.
- 5 In the Attached Detail Group Placement dialog, select the detail groups to display, or clear the detail groups to hide in the current view.
- 6 Click OK.

Specifying the Position of a Group by its Origin

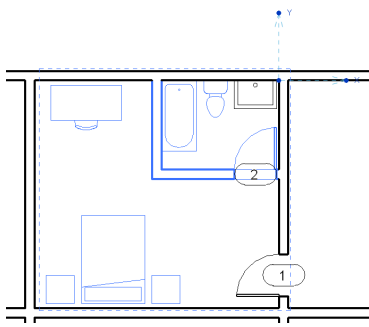
When you are placing, moving, rotating, or pasting groups, the cursor is at the group origin. You can modify the position of the group origin. Once established, the origin position is used for each instance of the group that you place.

- 1 To display the origin, select the group in plan or 3D view. Three drag controls display.



- 2 Drag the center control to move the origin.
 - 3 Drag the end controls to rotate the origin about the z axis.
- Snap points help you place the origin or rotate the end controls.

The following image shows the same group with its origin moved. The origin snaps to the wall.



Modifying Groups

After you create or load a group, you can modify it. You can modify a group within a project (or family) using the group editor, or you can edit the group externally.

The group editor allows you to add elements from the project view, place additional elements in the view which are then automatically added to the group, remove elements, create attached detail groups (for model groups), and view group properties. When you edit a group using the group editor, the background color of the drawing area changes. The background color is ignored when you print from the group editor.

When you edit a group externally, the group opens as a Revit project file (RVT) or a Revit family file (RFA), depending on the environment from which you open it.

Adding or Removing Elements in a Group

- 1 In the drawing area, select the group to modify. If the group to modify is nested, press *TAB* until the group is highlighted, and click to select it.
- 2 Click Modify Model Groups tab or Modify Attached Detail Groups tab ► Group panel ► Edit Group.
- 3 Click Edit Group panel ► Add, to add elements to the group, or click Edit Group panel ► Remove, to remove elements from the group.
- 4 Select the elements to add or remove from the group.

NOTE If you add a view-specific element to a model group (for example, a window tag), the view-specific element is placed in the project view and not in the model group.

- 5 When you are finished, click Finish.

Excluding Elements from a Group Instance

Excluding elements from a group instance may be useful when, for example, you place a hotel unit group defined with 4 bounding walls adjacent to a similar unit, and the walls overlap. You can exclude the overlapping wall from the group instance. If the excluded wall is hosting any elements (for example, a wall hosted tub or a door), Revit Architecture attempts to rehost those elements on the remaining wall.

You can exclude an element using any of the following methods:

- Exclude an element from a group instance. The element remains in the group but is not visible in the project view for that group instance. If the excluded element is hosting any elements, Revit Architecture attempts to rehost those elements.
- Move an element from a group instance to the project view. The element is visible in the project view, and can be edited from the project view. The element is also excluded from the group instance.


When elements are excluded and are not visible in the project view for a group instance, they are not included in schedules.

Excluded elements can be restored to their group instances.

To exclude an element from a group instance:

- 1 In the drawing area, place the cursor over the group element to exclude.
- 2 Press *TAB* to highlight the element, and then click to select it.



- 3 Click the icon () to exclude the element, or right-click and select Exclude from the shortcut menu.


NOTE You can also use the following keyboard shortcuts: *DELETE* or *CTRL-X*.

The element is excluded from the group instance, and hosted elements are rehosted as necessary.

To move an element from a group instance to the project view:

- 1 In the drawing area, place the cursor over the element to move.
- 2 Press *TAB* to highlight the element, and then click to select it.
- 3 Right-click and select Move to Project.

To restore an excluded element to a group:

- 1 In the drawing area, place the cursor over the excluded group element.
- 2 Press *TAB* to highlight the element, and then click to select it.
- 3 Click the icon () to restore the excluded element, or right-click and select Restore Excluded Member from the shortcut menu.

To restore all excluded elements in a group:

In the drawing area, right-click the group and click Restore all Excluded.

Editing a Group Externally

- 1 In the Project Browser, right-click the group name, and click Edit.
- 2 Click Yes to confirm that you want to edit the group externally.
The group opens as a Revit project file (RVT) if you are in the project environment, or opens as a Revit family file (RFA) if you are in the Family Editor.
- 3 Make the necessary changes and save the file.

To load (or reload) the group into a project or family:

- 4 Click Home tab ► Model panel ► Model Group drop-down ► Load as Group into Open Projects.
- 5 In the Load into Projects dialog, select the projects (or families) to load the group into.

NOTE In order for project or family files to appear in this list, they must be open.

- 6 Select Attached Details to load detail elements as attached detail groups.
- 7 Select levels to load levels into the group.
- 8 Select grids to load grids into the group.
- 9 Click OK.

The group is loaded into the project (or family), and the group file remains open.

Renaming a Group

- 1 In the Project Browser, right-click the group name and select Rename.
- 2 Enter a new name for the group, and press *ENTER*.

Showing/Hiding Attached Detail Groups

- 1 In the drawing area, select a model group that has an attached detail group, or groups.
- 2 Click Modify Model Groups tab ► Group panel ► Attached Detail Groups.
- 3 In the Attached Detail Group Placement dialog, select or clear check boxes to show or hide the attached detail group.
- 4 Click OK.

Detaching an Attached Detail Group from a Model Group

An attached detail group that does not include dimensions or tags can be detached from a model group.

- 1 In the drawing area, select an attached detail group.
- 2 Click Modify Attached Detail Groups tab ► Group panel ► Detach from Model Group.

Swapping Out Group Types

You can replace one group with another by selecting a group and then choosing a different group name in the Type Selector. Revit Architecture automatically replaces the group.

When you swap an instance of a group type for an instance of a different group type, Revit Architecture attempts to replace any attached detail groups from the old group instance with attached detail groups of the same name from the new group instance. For elements in attached detail groups that were not replaced, and for all other elements that depend on elements in the swapped group instance, Revit Architecture attempts to find references within the new group instance. If new references cannot be found for these dependent elements, Revit Architecture posts a warning to indicate which dependent elements it could not find references for. In addition, the origin of the new group is placed at the position of the first group. For more information on group origins, see [Specifying the Position of a Group by its Origin](#) on page 359

Specifying Height for Model Groups

- 1 In the drawing area, select a model group.
- 2 Click Modify Model Groups tab ► Element panel ► Element Properties.
- 3 Modify the instance parameters.
 - The Reference Level parameter sets the level the group is associated with.
 - The Origin Level Offset specifies a height above or below that level.
- 4 Click OK.

NOTE Some group members may not move as a result of entering an offset value. Some elements, such as components, remain on the level line if they are not hosted by another object like a floor.

Draw Order for Elements in Detail Groups

Detail elements in a detail group move as a unit with respect to draw order. They move forward or backward together when the group draw order is changed. If you want to change the draw order of individual members of the group, you first need to edit the group. After you change the draw order of the members of a detail group and finish editing the group, all instances of that detail group are updated with the new draw order.

For more information on draw order, see [Sorting the Draw Order of Detail Components](#) on page 1156.

Converting Groups and Linked Revit Models

You can convert groups to linked Revit models, and you can convert linked Revit models to groups. It is recommended that you use groups when there is significant geometrical interactivity in a model (for example, joins, inserts, or references) and where project standards need to be managed in one location. Sample scenarios where you would use groups are hotel rooms, apartments, and repeating floors.

Switching between groups and links may be useful in the following scenarios:

- Your model contains multiple groups of repeating elements that exist as linked Revit models. As you work in the main model, you can convert the linked models to groups to make edits. This allows you to make edits to linked models in context of the main model. When you finish modifying the group, you can convert it back to a link.
- You have created a group or linked Revit model, and then decide that you need to change the group to a linked model, or change the linked model to a group.

When you convert a group to a linked Revit model, any excluded elements are restored in the link. For more information about excluded elements, see [Excluding Elements from a Group Instance](#) on page 360.

Converting Groups to Linked Revit Models

- 1 In the drawing area, select the group.
- 2 Click Modify Model Groups tab ► Group panel ► Link.
- 3 In the Convert to Link dialog, select one of the following:
 - Replace with a new project file: Creates a new Revit model. When you select Create New, the Save Group dialog opens. Navigate to the location where you want to save the file. If you want the new link to have the same name as the group, leave the default name, otherwise enter a name for the link, and click Save.
 - Replace with an existing project file: Replaces the group with an existing Revit model. When you select this option, the Open dialog opens. Navigate to the location of the Revit file you want to use, and click Open.

If there is a linked Revit model in the project with the same name as the group, a message displays to indicate this. You can do one of the following:

- Click Yes to replace the file.
- Click No to save the file with a new name. The Save As dialog opens where you can enter a new name for the linked Revit model.
- Click Cancel to cancel the conversion.

Converting Linked Revit Models to Groups


- 1 In the drawing area, select the linked Revit model.
- 2 Click Modify RVT Links tab ► Link panel ► Bind Link.
- 3 In the Bind Link Options dialog, select the elements and datum to include in the group, and click OK.

If there is a group in the project with the same name as the linked Revit model, a message appears to indicate this. You can do one of the following:

- Click Yes to replace the group.
- Click No to save the group with a new name. Another message appears indicating that all instances of the linked model will be deleted from the project, but the linked model file will still be loaded in the project. You can remove the linked file from the project by clicking Remove Link in the message dialog, or you can remove it at a later time from the Manage Links dialog. See [Managing Links](#) on page 1286.
- Click Cancel to cancel the conversion.

Saving Groups

You can save a group as a Revit project file (RVT) if you are working in a project, or a Revit family file (RFA) if you are working in the Family Editor.

- 1 Click  ► Save As ► Library ► Group.
- 2 By default, the file name text box displays “Same as group name”. If you accept this name, Revit Architecture saves the file with the same name as the group. So a group called Group 5 saves as Group 5.rvt (or Group 5.rfa). If desired, you can change this name.
- 3 If your project has multiple groups, click the appropriate group from the Group to Save drop-down.
- 4 Select or clear the Include attached detail groups as views check box as needed.
- 5 Click Save.


Deleting Groups

To delete a group, you must first delete all instances of the group in the project.

- 1 In the Project Browser, right-click the group and click Select All Instances.
- 2 Click Modify <group type> Groups tab ► Modify panel ► Delete, or press *Delete*.
All instances of the group are deleted in the project.
- 3 In the Project Browser, right-click the group, and select Delete.

Group Properties

To view group properties

- 1 Select the group.
- 2 Click Modify Model Groups tab ► Group panel ► Edit Group.
- 3 On the Edit Group tab, click  (Group Properties).

To modify group properties

- 1 In the drawing area, select the group.
- 2 Right-click, and click Element Properties.
- 3 Change group properties as desired, and click OK.

Parameter	Description
Constraints	
Reference Level	The level where the group resides or to which it refers.
Origin Level Offset	An offset from the reference level where the group origin resides. See Specifying the Position of a Group by its Origin on page 359.

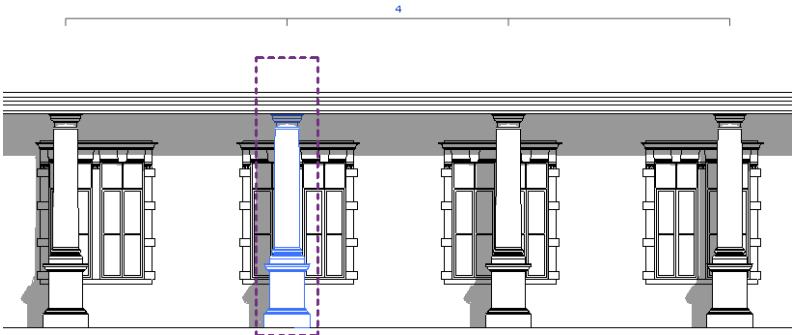
Using Arrays of Elements

The Array tool creates a linear or radial array of selected elements. For example, you can select a door and a window residing on a wall and create multiple instances of the door-window configuration.

Use the Array tool to create several instances of one or more elements and manipulate them simultaneously. Array members can belong to a group; therefore, you can add or remove items from the group. For example, you can create an array of 7 walls. When you group a desk with one of the walls, all walls in the array get a desk. For more information about grouping, see [Editing Elements in Groups](#) on page 354.

NOTE Arrays are not supported for most annotation symbols.

An array of windows and columns



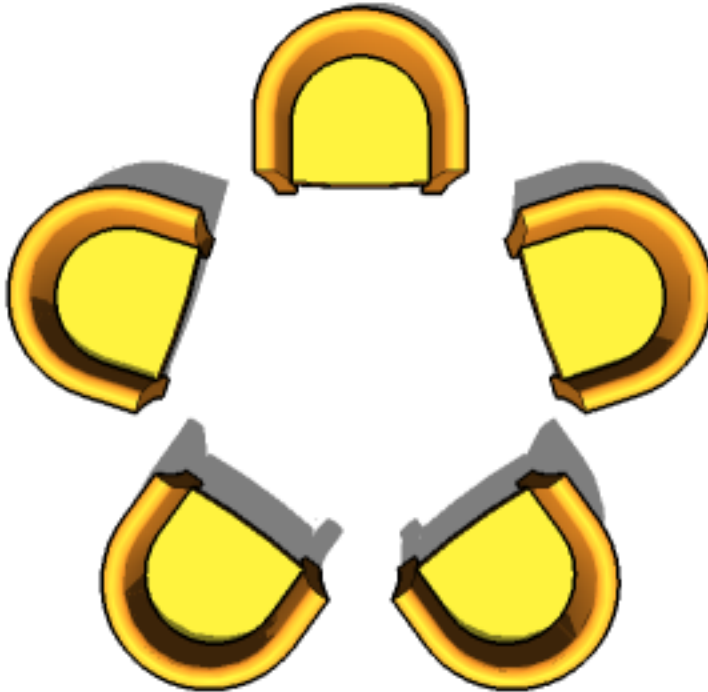
Creating an Array

- The elements of an array can follow a line (a linear array), or they can follow an arc (a radial array). When creating an array, you specify the distance between elements using either of the following methods:
- Specify the distance between the first and second elements. (Use the Move To 2nd option.) All subsequent elements use the same spacing.
 - Specify the distance between the first and last elements. (Use the Move To Last option.) All remaining elements are evenly spaced between them.


A linear array



A radial array



Creating a Linear Array

- 1 Select one or more elements to be copied in an array.
- 2 Click Modify <Element> tab ► Modify panel ► Array.
- 3 On the Options Bar, click  (Linear).
- 4 Select the desired options:
 - **Group And Associate:** Includes each member of the array in a group. If not selected, Revit Architecture creates the specified number of copies and does not group them. Once placed, each copy acts independently of the others.
 - **Number:** Specifies the total number of copies (of the selected elements) in the array.
 - **Move To:**
 - **2nd:** Specifies the spacing between each member of the array. Additional array members appear after the second member.
 - **Last:** Specifies the entire span of the array. Array members are evenly spaced between the first member and the last member.

- **Constrain:** Restricts movement of array members along vectors that run perpendicular or colinear to the selected elements.

NOTE You cannot group together detail components and model components.

5 If you selected **Move To 2nd**, place array members as follows:

- Click in the drawing area to indicate a starting point for measuring.
- Move the cursor the desired distance between members. As you move the cursor, a box appears to indicate the size of the selected elements. The box moves along snap points. A dimension appears between the first click location and the current cursor position.
- Click again to place the second member, or type a dimension and press **ENTER**.

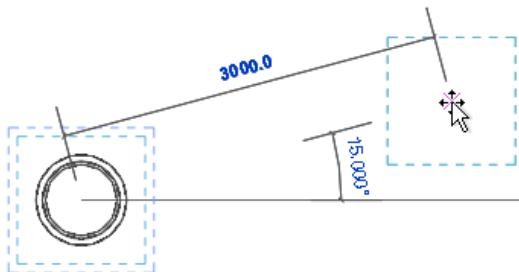
6 If you selected **Move To Last**, place array members as follows:

- Click in the drawing area to indicate a starting point for measuring.
- Move the cursor to the desired location for the last array member. As you move the cursor, a box appears to indicate the size of the selected elements. The box moves along snap points. A dimension appears between the first click location and the current cursor position.
- Click again to place the last member, or specify a dimension and press **ENTER**.

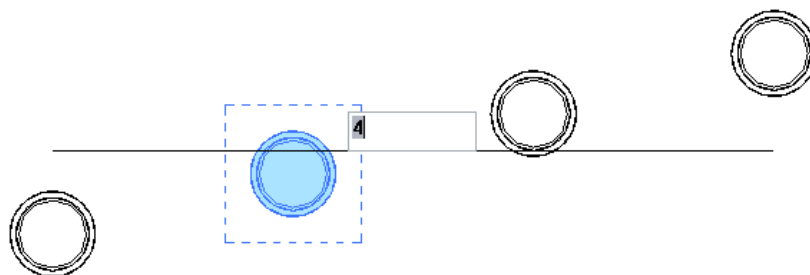
7 If you selected **Group and Associate** on the Options Bar, a number box appears, indicating the number of copies to create in the array. If desired, change the number and press **ENTER**.

Revit Architecture creates the specified number of copies of the selected elements, and places them using the appropriate spacing.

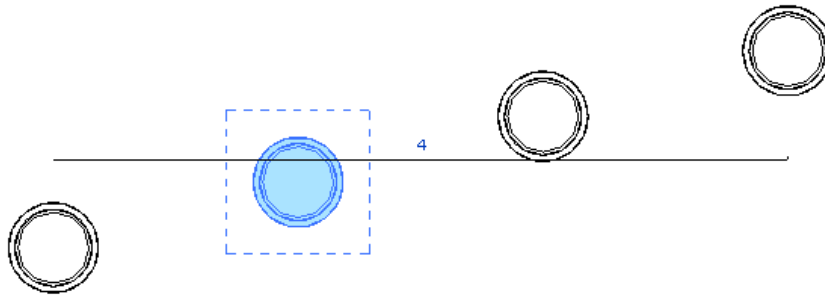
Placing the first and second items in a linear array




Specifying the number of elements in the array




The completed linear array



Creating a Radial Array

- 1 Select one or more elements to be copied in an array.
- 2 Click Modify <Element> tab ► Modify panel ► Array.
- 3 On the Options Bar, click  (Radial).
- 4 Select the desired options, as described for creating a linear array.

TIP When you create a radial array, the steps are similar to rotating a component and copying it. See [Rotating Elements](#) on page 379.

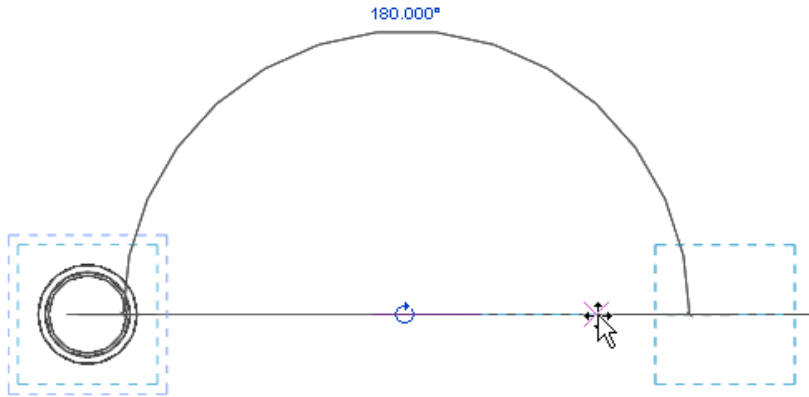
- 5 Drag the center of rotation symbol () to the desired location.
The array members will be placed around an arc measured from this point. In most instances, you want to drag the center of rotation symbol away from the center of the selected elements. The symbol snaps to points and lines of interest, such as walls and the intersections of walls and lines. You can also drag it onto open space.
- 6 Move the cursor to a position where the arc of the radial array will begin. (A line radiates from the center of rotation symbol to the cursor position.)

NOTE If you want to specify the angle of rotation (instead of drawing it), specify an Angle value on the Options Bar and press *ENTER*. Skip the remaining steps.

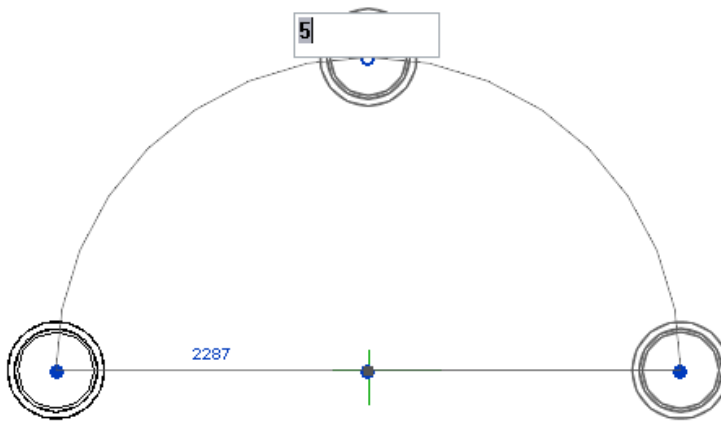
- 7 Click to position the first ray of rotation. If the cursor snaps while specifying the first ray, the snap line rotates along with the preview box and snaps to angles on the screen while placing the second ray.
- 8 Move the cursor to place the second ray of rotation.
Another line appears to indicate the ray. A temporary angular dimension appears as you rotate, and a preview image shows the selection rotating.
- 9 Click to place the second ray and finish the array.
If you selected Move To 2nd on the Options Bar, the second ray of rotation defines the location of the second member of the array. Additional array members are placed using the same spacing.
If you selected Move To Last, the second ray of rotation defines the location of the last member of the array. Additional array members are spaced equally between the first and last members.

If you selected Group and Associate on the Options Bar, controls appear on the radial array. Use the 2 end controls to resize the angle of the arc. Use the middle control to drag the array to a new location. Use the top control to resize the radius of the array.

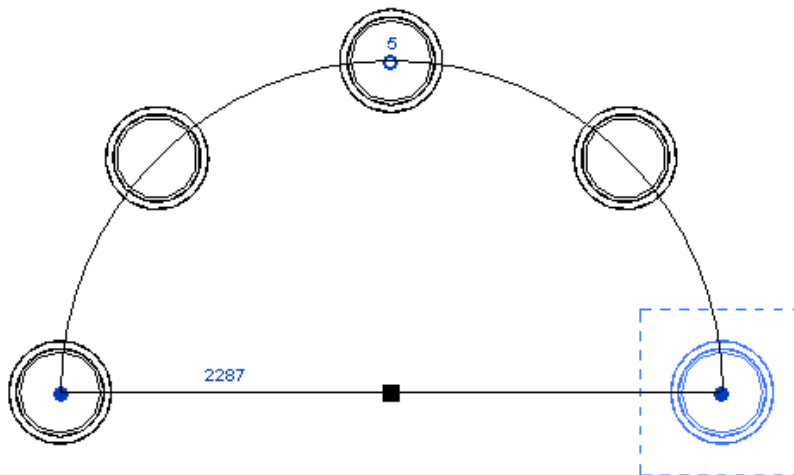
Drawing the arc for the radial array



Specifying the number of elements in the array

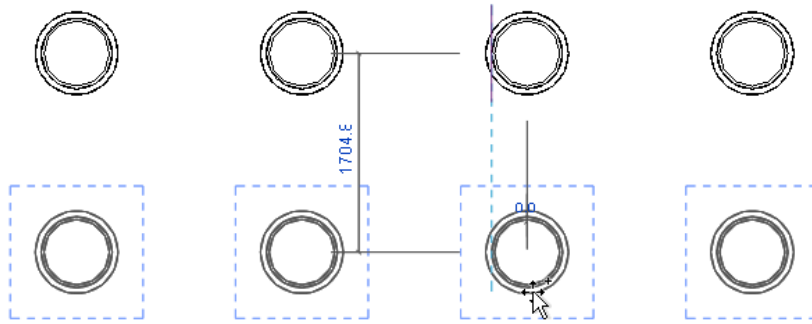


The completed radial array



Copying an Array

- 1 Select all members of the array.
- 2 While pressing *CTRL*, click and drag an array member to a new location.



Deleting Members from an Array

You can delete one or more members of an array. If the array was grouped, deleting a member of the array effectively ungroups the remaining members. Each member of the array then becomes an individual element.

To delete a member element of an array:

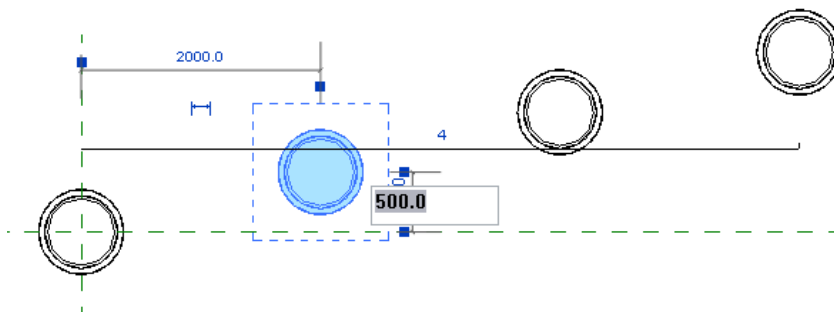
- 1 Select the element to delete from the array.
- 2 Use any of the following methods to delete the selected element:
 - Press *DEL*.
 - Click Modify <Element> tab ► Modify panel ► Delete.
 - Right-click the element, and click Delete.

Changing an Array

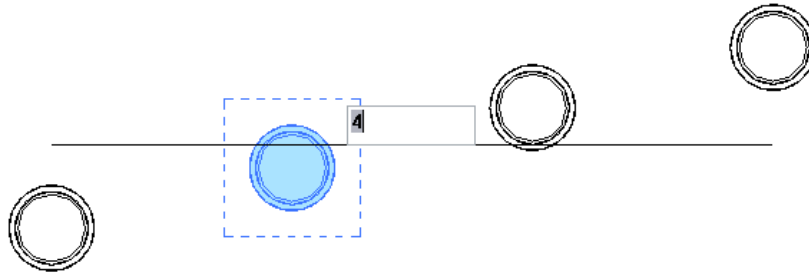
You can modify any dimension associated with array members. If the modified array member is part of a group, the change affects that element and proportionally affects other members of the group, depending on the dimension modified. If the modified array member is not part of a group, the change affects the selected element only. See [Changing a Dimension Value](#) on page 286.

If array members belong to a group, you can change the number of members in the array. Select the pattern line and enter a new value in the array instance number box. Controls for array groups are visible in all views in which the array is visible. When you modify the number of elements in an array, you can specify how elements are added to or removed from the array with the Append to End option.

Changing the dimensions of an array



Changing the number of elements in an array



Specifying how elements are added to or removed from an array

When you change the number of elements in an array, you can specify how the additional elements are added to (or removed from) the array.

- 1 Select the array.

An array is selected when the line that indicates the layout is selected, as shown in the following image.



- 2 On the Options Bar, select or clear the Append to End check box.

- If Append to End is selected, the spacing between the elements in the array remains the same, and any elements you add to (or remove from) the array are added to (or removed from) the existing endpoint of the array.

Array selected



Number of elements in the array changed with Append to End selected

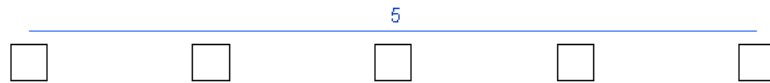


- If Append to End is not selected, the endpoints of the array remain the same, and any elements added to (or removed from) the array are evenly spaced in between the existing endpoints.

Array selected



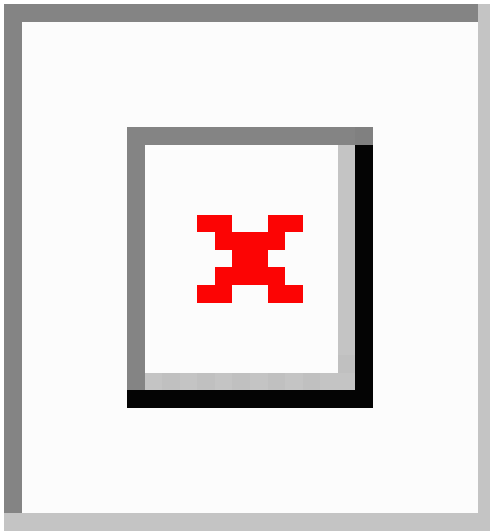
Number of elements in the array changed with Append to End cleared



Moving Elements

Revit Architecture offers a variety of ribbon options, keyboard actions, and on-screen element controls for moving elements in the drawing area, either independently or in association with other elements.

Moving a wall



You can move a hosted component from one host to another. For example, you can move a window from one wall to another wall. See [Rehosting](#) on page 811.

You can also move a component that is dimensioned to another element (by distance or angle) by changing the dimension. See [Changing a Dimension Value](#) on page 286.

Moving Elements by Dragging

You can click and drag a selected element to a new location in the drawing area. If multiple elements are selected, they all move when you drag one. The spatial relationships among them are preserved.

TIP When moving elements one at a time, select **Press & Drag** on the status bar to drag an element without selecting it first. When using this option, the element is selected as you drag it.

Some elements can move only horizontally or vertically by default; Revit Architecture provides visual cues about the way that a selected element can move. To remove this constraint, press and hold *Shift* while dragging the element.

Conversely, some elements can move in any direction by default. To constrain their movement, press and hold *Shift* while dragging the elements. For example, you can move a window freely in an elevation or a 3D view, but pressing *Shift* constrains the movement of the window so that its elevation does not change. Likewise, you can normally move walls, lines, or gridlines freely in any direction. Pressing *Shift* constrains their movement to directions perpendicular to the wall or line.

When you select a wall or line that has an end joined to another (unselected) wall or line, movement is constrained to a direction perpendicular to the selected wall or line to keep the joined end from extending or shrinking. Press and hold *Shift* to remove this constraint.

Moving Elements with Arrow Keys

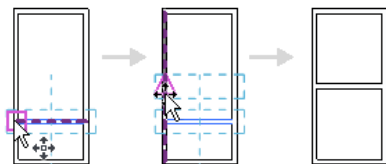
Use arrow keys on the keyboard to move selected elements vertically or horizontally. You cannot use the arrow keys to move a level-based element up or down from the level.

Moving Elements with the Move Tool

The Move tool works similarly to dragging. However, it offers additional functionality on the Options Bar and allows more precise placement. You can create multiple copies of an element when you move it.

To move elements with the Move tool:

- 1 Select the elements to move.
- 2 Click Modify <Element> tab ► Modify panel ► Move.
- 3 On the Options Bar, click the desired options:
 - **Constrain:** Click Constrain to restrict the movement of the element along vectors that run perpendicular or colinear to the element.
 - **Disjoin:** Click Disjoin to break the association between the selection and other elements before moving. This option is useful, for example, when you want to move a wall that is joined to another wall. You can also use the Disjoin option to move a hosted element from its current host to a new host. For example, you can move a window from one wall to another wall. This feature works best when you clear the Constrain option.
 - **Copy:** Click Copy to move a copy of the element. The original element remains in place. When you select the Copy option, the Disjoin option becomes selected; you cannot clear it.
 - **Multiple:** Click Multiple to create multiple copies of an element every time you click in the drawing area. The option is available only when the Copy option is selected. See [Copying Elements with the Copy Tool](#) on page 392. (To exit the Multiple Copy function, press *ESC*.)
- 4 Click once to enter a start point for moving.
A preview image of the element appears.
- 5 Move the cursor in the direction that you want the element to move.
The cursor snaps to snap points. Dimensions appear as guides.
- 6 Click again to complete the move, or, for more precision, type a value for the distance to move the element and press *ENTER*.



Related topics

- [Moving Elements](#) on page 372
- [Preventing Elements from Moving](#) on page 382
- [Copying Elements](#) on page 392

Moving Elements with the Offset Tool

Use the Offset tool to copy or move a selected model line, detail line, wall, or beam a specified distance perpendicular to its length. You can apply the tool to single elements or to chains of elements belonging to the same family. You can specify the offset distance by dragging the selected elements or by entering a value.

The following restrictions apply to the Offset tool:

- You can offset lines, beams, or braces in their own work planes only. For example, if you sketch a model line whose work plane is set to floor plan: level 1, you can offset that line only in the plan view plane.
- You cannot offset walls created as in-place families.
- You cannot offset elements in a view perpendicular to their move plane. For example, you cannot offset a wall in an elevation view.

To offset an element or a copy of an element:

1 Click Modify tab ► Edit panel ► Offset.

2 On the Options Bar, select how you want to specify the offset distance:

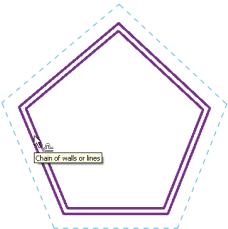
If you want to...	Then...
drag the selected element to the desired distance	select Graphical.
enter a value for the offset distance	select Numerical. Enter a positive number in the Offset box.

3 If you want to create and offset copies of the selected element, select Copy on the Options Bar. (If you selected Graphical in the previous step, pressing *CTRL* as you move the cursor has the same effect.)

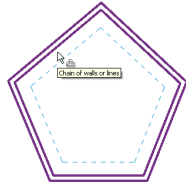
4 Select the element or chain to offset.

If you specified an offset distance using the Numerical option, a preview line displays at that distance from the highlighted elements on the side where the cursor is positioned, as shown.

Cursor at outside face of the wall



Cursor at inside face of the wall



- 5 Move the cursor as necessary to display the preview line at the desired offset position, and then click to move the element or chain to that position or to place a copy there. Or, if you selected the Graphical option, click to select the highlighted element, and then drag it to the desired distance and click again. After you start the drag, a listening dimension displays, and you can enter a specific offset distance.

Moving Elements with Cut-and-Paste

The Cut tool removes one or more selected elements from the drawing and pastes them to the clipboard. You can then use the Paste or Paste Aligned tools to paste the elements in the current drawing or in another project.

The Cut tool has the following restrictions:

- You cannot cut elements that cannot be deleted, such as the last level in a building model.
- You cannot cut some combinations of elements. For example, you cannot cut curtain panels and mullions without cutting the entire curtain system.
- You cannot cut an interior elevation arrow without cutting its adjoined elevation symbol.
- You cannot cut some elements in any context. For example, you cannot cut the Ref. Level in the Family Editor.

To cut and paste elements:

- 1 Select one or more elements in the drawing area.
- 2 Click Modify <Element> tab ► Clipboard panel ► Cut.

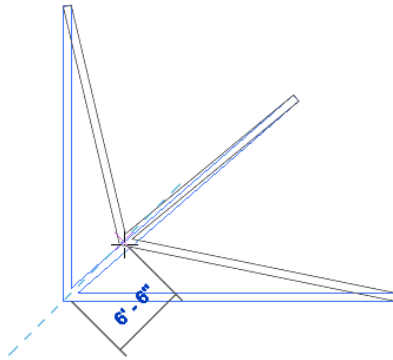
NOTE You can also use the keyboard shortcut **CTRL+X** to cut elements.

- 3 Paste the elements using either of the following tools on the Modify <Element> tab ► Clipboard panel:
 - Paste: To place the elements in another area of the drawing, or in another project. See [Pasting Elements from the Clipboard](#) on page 394.
 - Paste Aligned: To place the elements to another level exactly above or below the original location of the elements. See [Pasting Aligned Elements](#) on page 396.

Moving End-joined Components

You can move components that share a common end join simultaneously without breaking the join. To do this, use a drag control or select an option on the shortcut menu. This functionality is available for walls, lines, beams, braces, and line-based families.

The following image shows 3 walls moving together by their common end join.



Only selected joined components move. Unselected components that are part of a join detach from the join when it is moved. The exception to this is braces that are joined to beams. Braces always move with the beams that they are joined to.

To move end-joined components:

- 1 Right-click a member of the join, and click Select Joined Elements.
- 2 In the drawing area, click the drag end control, or right-click and click Drag End.

NOTE The name of the control and the shortcut menu option indicate the type of component that you are moving (Drag Wall End, Drag Structural Framing Component End, and so on).

- 3 Drag the join to the desired location.

Moving Lines and Components with Walls

You can specify that lines and components near a wall move a corresponding distance whenever that wall is moved. To do this, use the Moves with Nearby Elements option.

To move elements with nearby elements:

- 1 Select one or more elements.
- 2 On the Options Bar, select Moves With Nearby Elements.
You can also select this option on the Instance Properties dialog for one or more selected elements. (To display this dialog, right-click the element and click Element Properties.)
- 3 Move the selected elements to the desired position.
Witness lines show dimensions from walls and other points. If desired, you can click a dimension to change it.

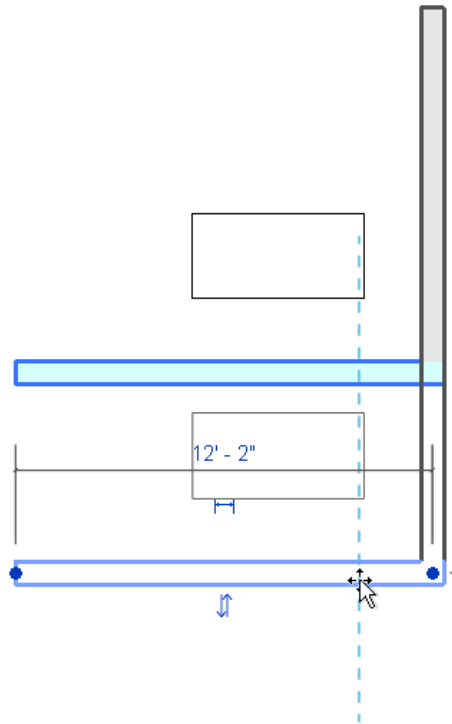
Now when you move the wall that the element is linked to, the element also moves, maintaining its distance from the wall.

The following restrictions apply to the Move With Nearby Elements option:

- Only straight lines that are parallel to a wall are affected by this option. It is not available for detail lines, sketch-based elements, and families.
- For arc lines, the radius remains at a constant offset from the arc wall, even if the radius of the wall changes. For example, if you change a wall radius from 40 to 30 meters, a 20-meter arc line radius updates to 10 meters, maintaining the 20-meter offset.
- If you copy a line or component that is set to move with nearby elements, the copy also moves with the element.

- If you move the line or component toward another element, it then moves with that new element. For example, suppose that a straight line moves with a wall. When you move the line closer to another straight wall with which it is parallel, the line now moves with the new wall. However, if you place a wall closer to the line or component, it does not move with that new wall. It retains its movement with the first wall.

Using the Moves with Nearby Elements option



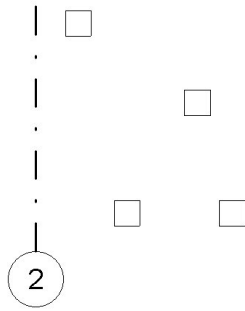
Aligning Elements

Use the Align tool to align one or more elements with a selected element. This tool is generally used to align walls, beams, and lines, but it can be used with other types of elements as well. The elements to align can be of the same type, or they can be from different families. You can align elements in a plan view or elevation view only.

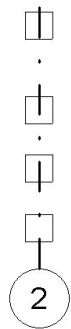
For example, you can use the Align tool to do the following:

- Align the ends of [Walls](#) on page 633 or [Beams](#) on page 840 with a selected beam, line or wall. (This action extends the lengths of the aligned walls or beams.)
- Align the centers of [Walls](#) on page 633 or [Beams](#) on page 840 with a selected beam, line or wall. (This action moves the aligned walls or beams.)
- Join selected endpoints (of walls, for example) with a selected line.

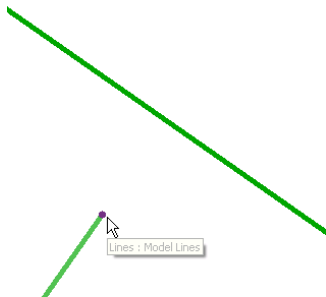
Grid line with 4 columns



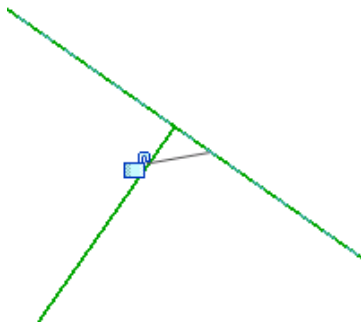
Align columns with grid lines



Selected point to align to an element



Element and point joined



To align elements:

- 1 Click Modify tab ► Edit panel ► Align.



The cursor appears with the align symbol

2 On the Options Bar, select the desired options:

- Select Multiple Alignment to align multiple elements with a selected element. (As an alternative, you can press *CTRL* while selecting multiple elements to align.)
- When aligning walls, use the Prefer option to indicate how selected walls will be aligned: using Wall Faces, Wall Centerlines, Faces of Core, or Center of Core. (The core options refer to walls that have multiple layers.)

3 Select the reference element (the element to align other elements to).

4 Select one or more elements to align with the reference element.

NOTE Before selecting, move the cursor over the element until the part of the element to align with the reference element is highlighted. Then click it.

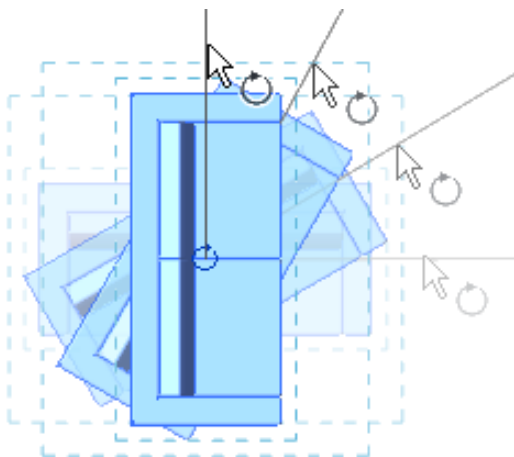
5 If you want the selected elements to stay aligned with the reference element (if you later move it), click the padlock to lock the alignment. If the padlock symbol has disappeared because you have done something else, click Modify and select the reference element to make the symbol reappear.

6 To start a new alignment, press *ESC* once.

7 To exit the Align tool, press *ESC* twice.

Rotating Elements

Use the Rotate tool to rotate elements around an axis. In floor plan, reflected ceiling plan, elevation, and section views, elements rotate around an axis perpendicular to the view. In 3D views, the axis is perpendicular to the work plane of the view.




Not all elements can rotate around any axis. For example, walls do not rotate in elevation views. Windows cannot rotate without their walls.

The Rotate tool is available only after the element is selected. After you rotate the element, Revit Architecture returns to Modify mode.

To rotate elements:

- 1 Select one or more elements to rotate.
- 2 Click Modify <Element> tab ► Modify panel ► Rotate.

A center of rotation symbol appears at the center of the selected component. 

- 3 If desired, drag the center of rotation symbol.

The symbol snaps to points and lines of interest, such as walls and the intersections of walls and lines. You can also drag it onto open space.

- 4 On the Options Bar, select any of the following options:

- **Disjoin:** Select Disjoin to break the connection between the selection and other elements before rotating. This option is useful, for example, when you want to rotate one wall that is joined to another wall.
- **Copy:** Select Copy to rotate a copy of the selection. The original remains in place.
- **Angle:** Specify the angle of rotation and press *ENTER*. Revit Architecture performs the rotation at the specified angle. Skip the remaining steps.

- 5 Click to specify the first ray of rotation.

A line displays to indicate the first ray. If the cursor snaps while specifying the first ray, the snap line will rotate with the preview box and snap to angles on the screen while placing the second ray.

- 6 Move the cursor to place the second ray of rotation.

Another line displays to indicate the ray. A temporary angular dimension displays as you rotate, and a preview image shows the selection rotating.

TIP You can also rotate an element using listening dimensions. After you click to specify the first ray of rotation, the angular dimension displays in bold. Enter a value using the keyboard.

- 7 Click to place the second ray and finish rotating the selection.

The selection rotates between the first and second rays.

Revit Architecture returns to the Modify tool with the rotated element still selected.

Flipping Elements

Revit Architecture provides the following ways to flip an element (change its orientation) in the drawing area.

- Press the *SPACEBAR* to flip one or more selected elements. Free-standing families, such as furniture and columns, rotate 90 degrees each time you press the *SPACEBAR*. See [Spacebar](#) on page 352.
- Click a flip control to change the orientation of a selected element. For example, click the flip control (



) for a compound wall to reverse the order of its component layers. See [Flip Controls](#) on page 350.

Mirroring Elements

The Mirror tool mirrors (reverses the position of) a selected model element, using a line as the mirror axis. For example, if you mirror a wall across a reference plane, the wall flips opposite the original. You can pick

the mirror axis or draw a temporary axis. Use the Mirror tool to flip a selected element, or to make a copy of an element and reverse its position in one step.


To mirror an element:

- 1 Select the element to mirror.

TIP You can select inserts, such as doors and windows, without their hosts.

- 2 Click Modify <Element> tab ► Modify panel ► Mirror drop-down ► Pick Mirror Axis or Draw Mirror Axis.

To select the line that represents the mirror axis, select Pick Mirror Axis. Or to sketch a temporary mirror axis line, select Draw Mirror Axis.

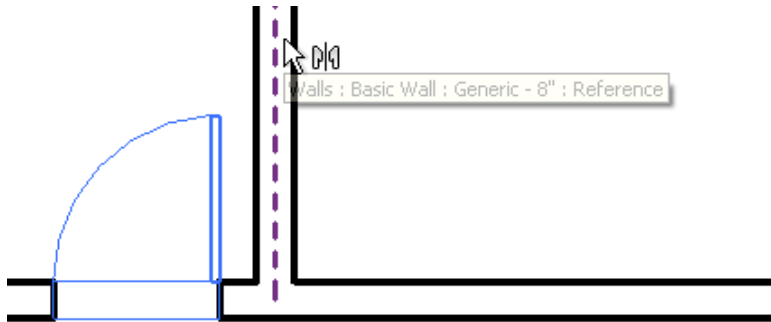
The mirror cursor appears: .

- 3 To move the selected item (rather than making a copy of it), clear Copy on the Options Bar.
- 4 Select or draw the line to use as a mirror axis.

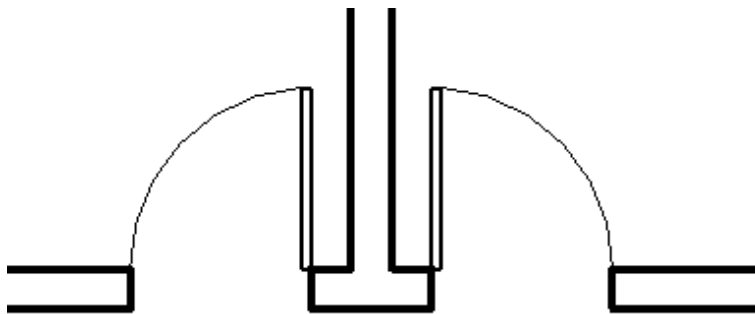
You can pick only a line or a reference plane that the cursor can snap to. You cannot mirror a component around empty space.

Revit Architecture moves or copies the selected element and reverses its position opposite the selected axis.

Selecting the element to mirror (and copy) and the mirror axis



Mirrored (and copied) door



Related topics

- [Selecting Elements](#) on page 339
- [Flipping Elements](#) on page 380

- [Moving Elements](#) on page 372
- [Copying Elements](#) on page 392

Preventing Elements from Moving

Use the Pin tool to lock a modeling component in place. When you pin a modeling component, it cannot be moved. If you try to delete a pinned component, Revit Architecture warns you that the component is pinned. A pushpin control appears near the element to indicate that it is locked.

If you pin a component, it can still move if the component is set to move with nearby elements or if the level where it is placed moves up or down. See [Moving Lines and Components with Walls](#) on page 376.

Using Pins to Lock Elements in Place

- 1 Select one or more components in your project.
- 2 Click Modify <Element> tab ► Modify panel ► Pin.

Revit Architecture displays a pushpin control near the component to indicate that it is pinned in place. To move or delete the component, you must first unlock it by clicking the pushpin control. Click the pushpin again to lock the component.

Related topics

- [Preventing Elements from Moving](#) on page 382
- [Unpinning Elements](#) on page 382
- [Constraints](#) on page 300

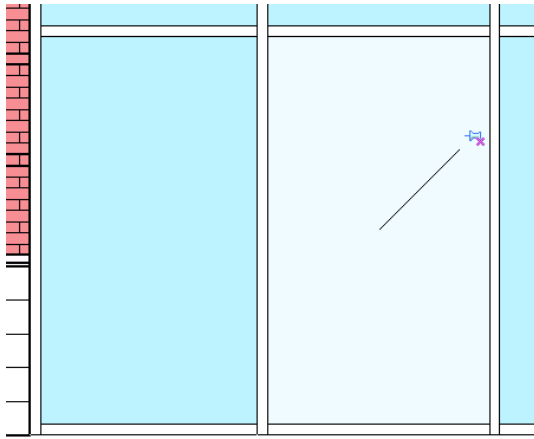
Unpinning Elements

The Unpin tool unpins a locked element. You can then move the element or delete it without being prompted. You can select multiple elements for unpinning. If some of the elements you select are not pinned, the Unpin tool has no effect.

To unpin elements:

- 1 Select one or more elements to unpin.
- 2 In the drawing area, click the pushpin control, or click Modify <Element> tab ► Modify panel ► Unpin.

When you unpin an element, an X appears near the pin control to indicate that it is unlocked.



Resizing Elements

To modify multiple elements simultaneously, use shape handles or the Scale tool. The Scale tool is available for lines, walls, images, DWG and DXF imports, reference planes, and position of dimensions. You can scale elements graphically or numerically.

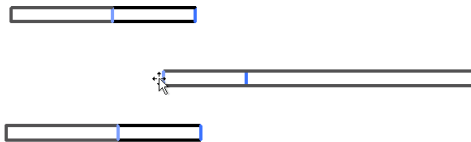
When resizing elements, consider the following:

- To resize an element, you define an origin, which is a fixed point from which the elements equally resize.
- All elements must lie in parallel planes. All walls in the selection must have the same base level.
- When you resize a wall, inserts remain at a fixed distance from the wall's midpoint.
- Resizing changes the position of dimensions but not their values. If you resize an element that a dimension references, the dimension value does change.
- Import symbols have a read-only instance parameter called Instance Scale. It shows how much the instance size differs from the base symbol. You can change it by resizing the import symbol.

Resizing Elements with Shape Handles

When you select and drag the handles of multiple elements, Revit Architecture resizes the elements simultaneously.

Dragging multiple wall handles to resize them simultaneously



To resize elements with shape handles:

- 1 Move the cursor over the part of the first element to resize and press **TAB** until the desired handle is highlighted. Click to select it.

For example, to resize the length of a wall, move the cursor over the end of the wall, press **TAB** to highlight that handle, and click to select it.

- 2 Move the cursor over the part of the next element to resize and press *TAB* until the desired handle is highlighted. While pressing *CTRL*, click to select it.
- 3 Repeat Step 2 for the remaining elements, until handles on all desired elements are selected. Remember to press *CTRL* when you click to select another element.

NOTE To deselect a selected element (without deselecting other elements), move the cursor over the selected element and, while pressing *SHIFT*, click the element.

- 4 Click the handle of one of the selected elements, and drag it to resize.

The other selected elements are resized at the same time.

Resizing Graphically

Graphical resizing requires 3 clicks: the first click determines the origin, and the next 2 clicks define the scale vectors. Revit Architecture calculates a scale factor by determining the ratio of the lengths of the 2 vectors. For example, suppose you sketch a first vector that is 5 feet and a second vector that is 10 feet. This creates a scale factor of 2. As a result, the elements become twice their original size.

To resize elements graphically:

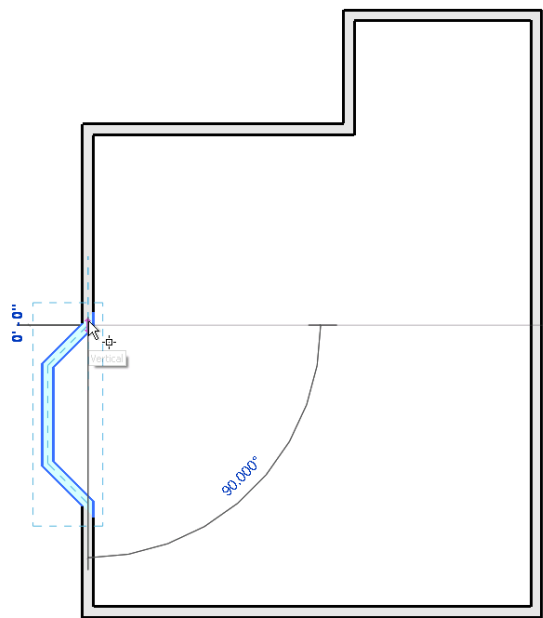
- 1 Select elements to resize.
Be sure to select only supported elements, such as walls and lines. The Scale tool is unavailable if your entire selection contains just one non-supported element.
- 2 Click Modify <Element> tab ► Modify panel ► Scale.
- 3 On the Options Bar, select Graphical.
- 4 In the drawing area, click to set the origin.
The origin is the point from which the size of the element will change. The cursor snaps to various references. Press *TAB* to change the snap points.
- 5 Move the cursor to define the first vector.
- 6 Click to set that length.
- 7 Move the cursor again to define the second vector.

TIP You can use listening dimensions to enter values for the lengths of the vectors.

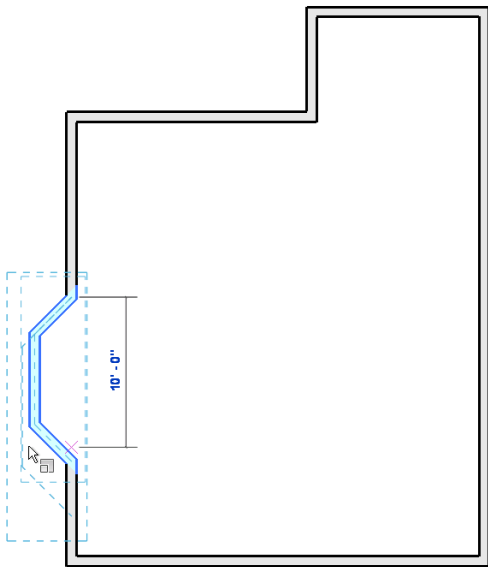
- 8 Click to set that point.

The selected element resizes so that the ends of vector 1 now coincide with those of vector 2.

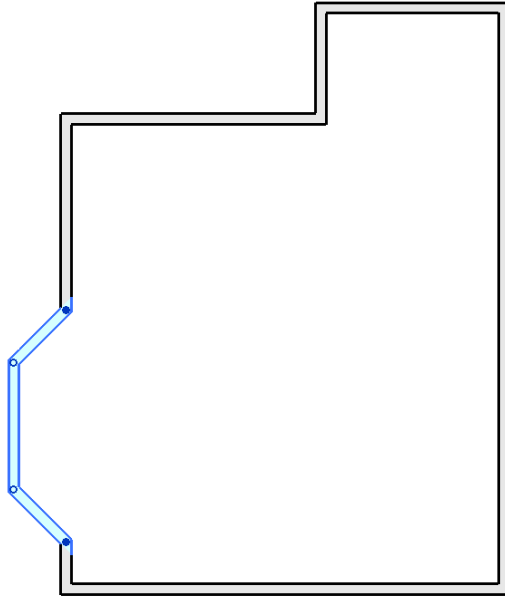
Defining the first scale vector



Defining the second scale vector



The resized component



Resizing Numerically

To resize numerically, enter a scale factor and specify the origin.

To resize elements numerically:

1 Select the elements to resize.

Be sure to select only supported elements, such as walls and lines. The Scale tool is unavailable if your entire selection contains just one non-supported element.

2 Click Modify <Element> tab ► Modify panel ► Scale.

3 On the Options Bar, select Numerical.

4 Enter a scale factor.

5 Click in the drawing area to specify the origin.

The element resizes by the defined scale factor.

Resizing Elements with Formulas

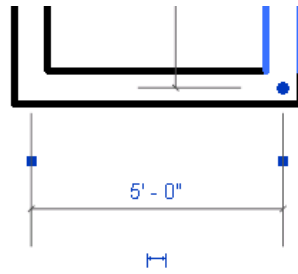
You can use formulas to modify the dimensions of specific elements. For example, as you sketch a wall, you can enter a formula for the temporary dimension of the wall. Begin the formula with an equal sign, and then use conventional mathematical syntax. See [Valid Formula Syntax and Abbreviations](#) on page 388.

For information about using formulas with family parameters, see [The Families Guide](#) on page 418.

To modify a dimension for an existing element

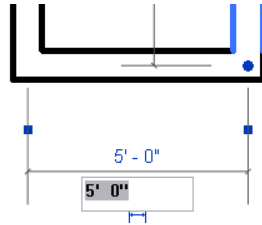
1 Select the element.

Revit Architecture displays a temporary dimension. (If the dimension uses the wrong reference points, drag the blue squares (of the witness lines) to the desired reference points.)

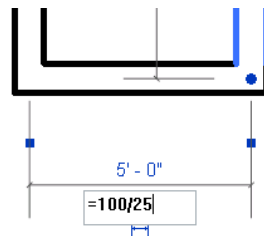


2 Click the dimension.

You may need to zoom in to see the dimension clearly. Revit Architecture displays its value in a text box.

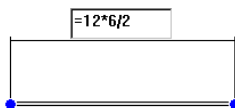


3 Edit the value, entering the desired formula.



TIP In formulas, keep units consistent. Do not mix units. You can use constants with no units assigned to them.

Valid formula for setting wall length



Using Formulas for Numerical Parameters

Formulas allow you to create parameters that depend on other parameters for their values. A simple example would be a width parameter set to equal twice the height of an object. In practice, formulas can be used in many ways, both simple and sophisticated. Typical uses include embedding design relationships, relating a number of instances to a variable length, and setting up angular relationships. For example, formulas can be used to

- Calculate area or volume of geometry
- Create a clearance dimension parameter controlled by element size
- Convert continuously variable values into integer values

- Add shelves as the height of casework increases
- Add diagonals in an open web joist as the length increases

Valid Formula Syntax and Abbreviations

Formulas support the following arithmetic operations: addition, subtraction, multiplication, division, exponentiation, logarithms, and square roots. Formulas also support the following trigonometric functions: sine, cosine, tangent, arcsine, arccosine, and arctangent.

The valid formula abbreviations for arithmetic operations and trigonometric functions are

- Addition— +
- Subtraction— -
- Multiplication—*
- Division—/
- Exponentiation—^: x^y , x raised to the power of y
- Logarithm—log
- Square root—sqrt: sqrt(16)
- Sine—sin
- Cosine—cos
- Tangent—tan
- Arcsine—asin
- Arccosine—acos
- Arctangent—atan
- e raised to an x power—exp
- Absolute Value—abs

You can enter integers, decimals, and fractional values in formulas, using normal mathematical syntax, as shown in the examples below:

- Length = Height + Width + sqrt(Height*Width)
- Length = Wall 1 (11000mm)+ Wall 2 (15000mm)
- Area = Length (500mm) * Width (300mm)
- Volume = Length (500mm) * Width (300mm) * Height (800 mm)
- Width = 100m * cos(angle)
- $x = 2 * \text{abs}(a) + \text{abs}(b/2)$
- ArrayNum = Length/Spacing

Parameter names in formulas are case sensitive. For example, if a parameter name begins with a capital letter, such as Width, you must enter it in the formula with an initial capital letter. If you enter it in a formula using lower-case letters instead, for example, width * 2, the software will not recognize the formula.

Conditional Statements in Formulas

You can use conditional statements in formulas to define actions in a family that depend on the state of other parameters. With conditional statements, the software enters values for a parameter based on whether a specified condition is satisfied. Conditional statements are useful in certain circumstances; however, they make families more complex and should be used only when necessary.

For most type parameters, conditional statements are unnecessary because the type parameter itself is like a conditional statement: If this is the type, then set this parameter to a specified value. Instance parameters are a more productive place to use conditional statements, particularly when they are used to set a parameter that does not vary continuously.

Syntax for Conditional Statements

A conditional statement uses this structure: IF (<condition>, <result-if-true>, <result-if-false>)

This means that the values entered for the parameter depend on whether the condition is satisfied (true) or not satisfied (false). If the condition is true, the software returns the true value. If the condition is false, it returns the false value.

Conditional statements can contain numeric values, numeric parameter names, and Yes/No parameters. You can use the following comparisons in a condition: <, >, =. You can also use Boolean operators with a conditional statement: AND, OR, NOT. Currently, <= and >= are not implemented. To express such a comparison, you can use a logical NOT. For example, $a \leq b$ can be entered as NOT($a > b$).

The following are sample formulas that use conditional statements.

Simple IF: =IF (Length < 3000mm, 200mm, 300mm)

IF with a text parameter: =IF (Length > 35', "String1", "String2")

IF with logical AND: =IF (AND (x = 1 , y = 2), 8 , 3)

IF with logical OR: =IF (OR (A = 1 , B = 3) , 8 , 3)

Embedded IF statements: =IF (Length < 35' , 2' 6" , IF (Length < 45' , 3' , IF (Length < 55' , 5' , 8')))

IF with Yes/No condition: =Length > 40 (Note that both the condition and the results are implied.)

Examples of Conditional Statement Usage

Typical uses for conditional statements in formulas include calculating array values and controlling an element's visibility based on a parameter value. For example, you can use conditional statements to

- Prevent an array parameter from taking a value less than 2.
In Revit Architecture, arrays can only have an integer value of 2 or greater. In some situations, it may be useful to create a conditional formula that maintains an array parameter of 2 even if the calculated value is 1 or 0. With such a formula, if the calculated array value is 2 or greater, the formula retains the value. However, if the calculated value is 1 or 0, the formula changes the value to 2.
Formula: Array number = IF (Arrayparam < 2, 2, Arrayparam)
- Make muntins visible only when the number of window lights is greater than 1.
For example, if you have a Lights parameter that you want to use to control the visibility of muntin geometry, you can create a Yes/No parameter like MuntinVis, and assign it to the Visible parameter in the Instance Properties dialog of the muntin geometry. Because the MuntinVis parameter is a Yes/No (or Boolean) operation, both the condition (IF) and the results are implied. In this example, when the condition is met (true), the MuntinVis parameter value is selected, and the muntin geometry is visible. Conversely, when the condition is not met (false), the MuntinVis parameter is cleared, and the muntin geometry is not visible.
Formula: MuntinVis = Lights > 1

Trimming and Extending Elements

Use the Trim and Extend tools to trim or extend one or more elements to a boundary defined by the same element type. You can also extend non-parallel elements to form a corner, or trim them to form a corner if they intersect. When you select an element to be trimmed, the cursor position indicates the part of the element to retain. You can use these tools with walls, lines, beams, or braces.

To trim or extend elements:

1 Do one of the following:

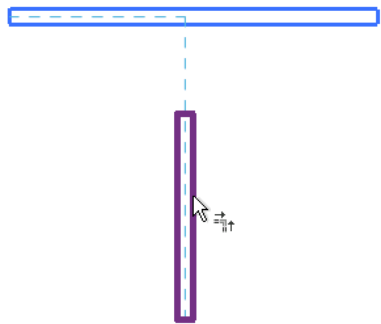
If you want to...	Then...
trim or extend 2 selected elements to a corner	click Modify tab > Edit panel > Trim. Select each of the elements. When selecting an element that needs to be trimmed to form the corner, make sure you click the part of the element to be retained.
trim or extend one element to a boundary defined by another element	click Modify tab > Edit panel > Extend drop-down > Trim/Extend Single Element. Select the reference to use as a boundary. Then select the element to trim or extend. If this element crosses the boundary (or a projection), the part that you click is retained. The part on the other side of the boundary is trimmed.
trim or extend multiple elements to a boundary defined by another element	click Modify tab > Edit panel > Extend drop-down > Trim/Extend Multiple Elements. Select the reference to use as a boundary. Then select each of the elements to trim or extend. For any elements that cross the boundary, the part that you click is retained. The part on the other side of the boundary is trimmed.

2 Continue trimming or extending elements with the currently selected option, or select a different option.

NOTE You can select a different Trim or Extend option at any time while the tool is active. This also clears any initial selection made with the previous option.

3 To exit the tool, press *ESC*.

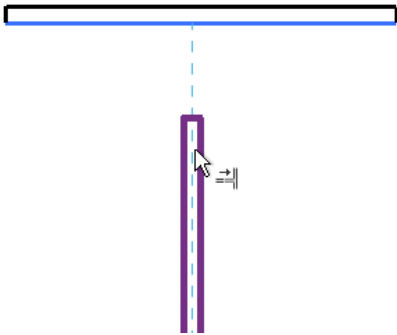
Preview for Trim/Extend to Corner tool



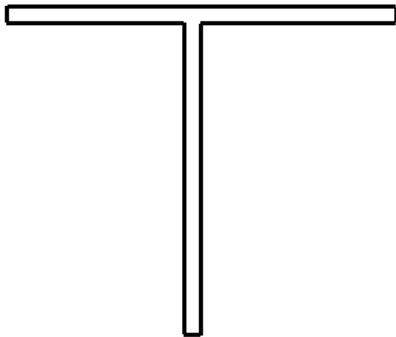
Result of Trim/Extend to Corner operation



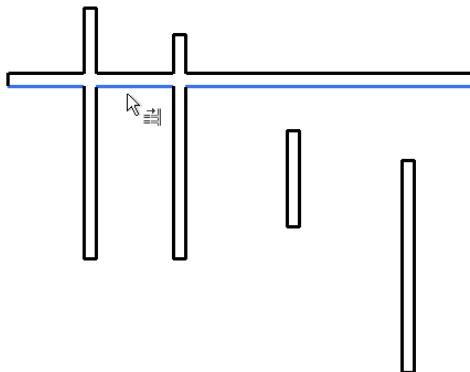
Preview of Trim/Extend Single Element option with horizontal wall selected as the boundary



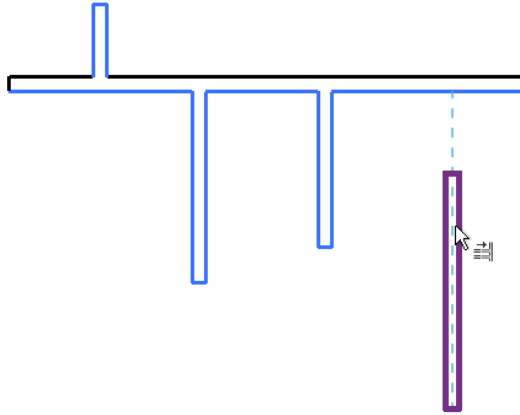
Result of Trim/Extend Single Element operation



Preview of Trim/Extend Multiple Elements option with horizontal wall selected as boundary



Result of clicking left-most vertical wall above the boundary, clicking next 2 walls below the boundary, and highlighting the wall on the right



Copying Elements

Revit Architecture provides several methods for copying one or more selected elements.

- Select an element and, while pressing the *CTRL* key, drag the element to copy it.
- Use the Copy tool to copy elements and place them immediately.
- Use the clipboard to copy-and-paste elements with *CTRL+C* and *CTRL+V*.
- Use the Create Similar tool to add a new instance of a selected element.
- Make a mirror copy of an element. (Use the Mirror tool with the Copy option. See [Mirroring Elements](#) on page 380.)
- Copy an array of elements. See [Copying an Array](#) on page 369.

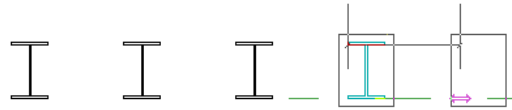
Copying Elements with the Copy Tool

The Copy tool copies one or more selected elements and allows you to place copies in the drawing immediately. It activates the Move tool with the Copy option selected.

The Copy tool is different from the Copy to Clipboard tool. Use the Copy tool when you want to copy a selected element and place it immediately (for example, in the same view). Use the Copy to Clipboard tool, for example, when you need to switch views before placing the copies.

To copy elements:

- 1 Select one or more elements in the drawing area.
- 2 Click Modify <Element> tab ► Modify panel ► Copy.
- 3 Click once in the drawing area to begin moving and copying the elements.
- 4 Move the cursor away from the original elements and toward the area where you want to place a copy.
- 5 Click to place the copy or enter a value for the listening dimension.
- 6 Continue placing more elements, or press ESC to exit the Copy tool.



Copying Elements to the Clipboard

The Copy to Clipboard tool copies one or more elements to the clipboard. You can then use the Paste from Clipboard or Paste Aligned tools to paste copies of the elements in the drawing or in another project.

The Copy to Clipboard tool is different from the Copy tool. Use the Copy tool when you want to copy a selected element and place it immediately (for example, in the same view). Use the Copy to Clipboard tool, for example, when you need to switch views before placing the copies.

To copy elements:

- 1 Select one or more elements in the drawing area.
- 2 Click Modify <Element> tab ► Clipboard panel ► Copy.
- 3 Paste the elements using either of the following tools:
 - Paste: To copy the elements to another area of the drawing, or to another project. See [Pasting Elements from the Clipboard](#) on page 394.
 - Paste Aligned: To copy the elements to another level exactly above or below the original location of the elements. See [Pasting Aligned Elements](#) on page 396.

The Copy to Clipboard tool has the following restrictions:

- You cannot copy an interior elevation arrow without copying its adjoined elevation symbol.
- You cannot copy some combinations of elements. For example, you cannot copy curtain panels and mullions without copying the entire curtain system.
- You cannot copy some elements in any context. For example, you cannot copy the Ref. Level in the Family Editor.

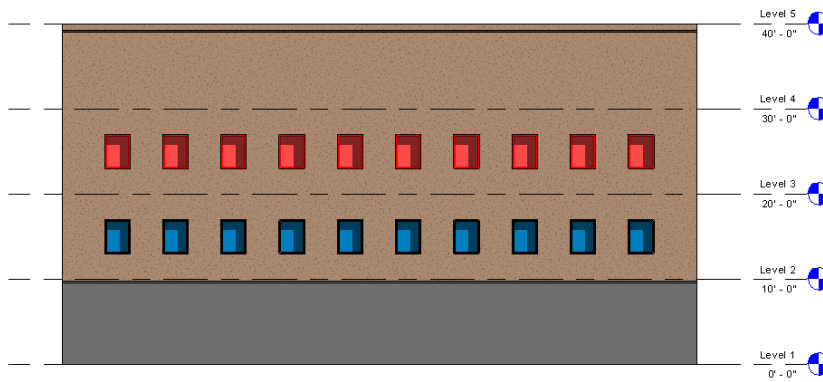
Related topics

- [Pasting Elements](#) on page 393
- [Copying Elements with the Create Similar Tool](#) on page 396
- [Moving Elements](#) on page 372

Pasting Elements

The Paste tool inserts elements from the clipboard to the current view or a different view. This tool is available only after cutting or copying elements. You can only copy (or cut) and paste elements within the same session of Revit Architecture.

The Paste Aligned tool allows you to copy multiple elements (such as walls, components, and windows) on one level and paste them to another level exactly above or below the location of the original elements. This tool is most useful for multi-story buildings, where you can copy and paste aligned elements from one level to many other levels.



Pasting Elements from the Clipboard

1 Cut or copy elements to the clipboard.

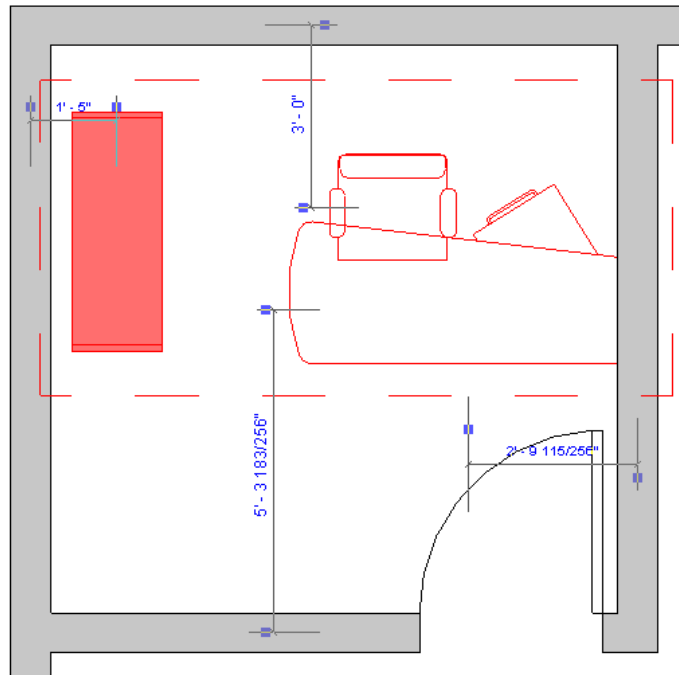
See [Moving Elements with Cut-and-Paste](#) on page 375 or [Copying Elements to the Clipboard](#) on page 393.

2 Place the cursor in the view where you want to paste the elements.

3 Click Modify tab ► Clipboard panel ► Paste.

NOTE You can also use the keyboard shortcut *CTRL+V* to paste elements.

In Paste mode, a preview image of the elements appears in the drawing area, similar to the following. Temporary dimensions and witness lines display to help position the elements.



4 Click to place the preview image in the desired location.

The pasted elements appear in the drawing area. They are selected so that you can adjust them if needed.

5 Refine placement of the pasted elements, if desired.

While the elements are selected, you can modify them as desired. Depending on the type of elements being pasted, you may be able to use the Move, Rotate, and Mirror tools.

You can also use tools on the Modify <Element> tab. The available options depend on the pasted elements. For example, for building components, you can use the Pick Host or Edit Family options. For other types of elements, you can use the Activate Dimensions (this option appears on the Options Bar) or Edit Pasted Elements options.

6 To finish the paste operation, click in the drawing area away from the pasted elements to deselect them. (For some types of elements, click Modify <Element> tab ► Tools panel ► Finish.)

If you want to quit Paste mode, discarding the pasted elements, click Cancel on the Modify <Element> tab, or press *CTRL+Z*.

Editing Pasted Elements

During a paste operation, you may need to refine the placement of pasted elements, rehost pasted building components, or specify new references for pasted elements. The Edit Pasted Elements tool allows you to move or modify elements before the paste operation is finalized.

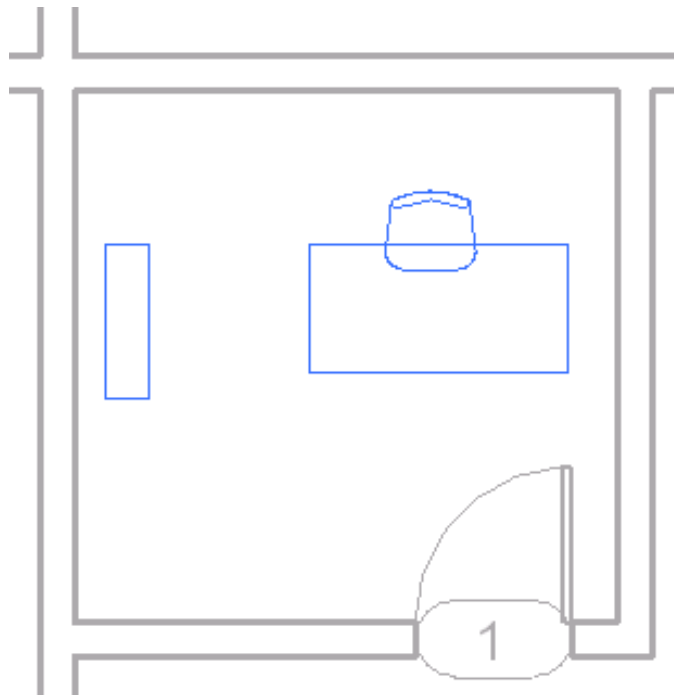
To edit pasted elements:

1 Paste one or more elements from the clipboard.

See [Pasting Elements from the Clipboard](#) on page 394.

2 Click Modify <Element> tab ► Tools panel ► Edit Pasted Elements.

Revit Architecture enters Edit Pasted mode. The newly pasted elements display in the defined selection color, indicating that they are selected so you can move them. Other elements in the drawing area display in gray, indicating that you cannot modify them during Edit Pasted mode.



While in Edit Pasted mode, you can deselect and select specific elements. (Deselected elements display in black; selected elements display in blue [or the defined selection color].) This tool allows you to move a specific element without moving all pasted elements. After moving a

pasted element, you can deselect it, and then select another element to move it to the desired location.

3 The Paste Selection panel displays the available tools. Use these tools as follows:

- **Finalize Selected** finalizes the placement of the currently selected elements. The elements display in gray, indicating that you can no longer modify them during Edit Pasted mode. You can continue to move or modify any pasted elements that display in black.

- **Select All** selects all pasted elements, so that you can move or modify them.

4 Use other tools as needed to rehost building components, activate listening dimensions to refine placement, or perform other actions.

5 To complete the paste process, click Finish.

If you want to quit Edit Paste mode, discarding the pasted elements, click Quit on the Paste Edit panel.

The pasted elements display in black. In addition, the other elements in the drawing area, which appeared gray during Edit Paste mode, display in black.

Pasting Aligned Elements

1 Cut or copy elements to the clipboard.

See [Moving Elements with Cut-and-Paste](#) on page 375 or [Copying Elements to the Clipboard](#) on page 393.

2 Click Modify tab ► Clipboard panel ► Paste Aligned drop-down, and select one of the following options:

- **Select Levels:** If you copy all model elements, you can paste them into one or more levels. In the dialog that displays, choose the levels by name. To select more than one, press **CTRL** while selecting the names.

- **Select Views:** If you copy view-specific elements (such as dimensions) or model and view-specific elements, you can paste them into similar types of views.

- **Current View:** Pastes the elements to the current view. For example, you can paste elements from a plan view to a callout view. The view must be different from the view where the elements were cut or copied.

- **Same Place:** Pastes the elements into the same place from where you cut or copied them. This is useful for pasting elements between worksets or design options. Also, you can use it to paste between 2 files that have shared coordinates.

- **Pick Level Graphics:** Pastes the elements in an elevation view. You must be in an elevation view to use this tool, because it requires that you select a level line on which to paste the elements.

NOTE Do not pick levels using the Project Browser.

Revit Architecture aligns the elements as directed.

Copying Elements with the Create Similar Tool

Use the Create Similar tool to place an element of the same type as the selected element. For example, when you right-click a door in a view and click Create Similar, the Door tool becomes active with the selected

door type already chosen in the Type Selector. The Create Similar tool is available for most Revit Architecture elements.

When you use Create Similar, each new element inherits family instance parameters defined in the Family Editor for the selected element. Elements created with Create Similar do not inherit values of instance parameters that were not defined in the Family Editor (such as Comments). The instance parameter values for the selected element apply to all elements created using that tool until the type is changed in the Type Selector.

For example, if the selected element is a wall, then its height properties are specified as the default for new walls. Walls created on the same level have the same Base Offset, Unconnected Height, Top Extension Distance, Bottom Extension Distance, Top Constraint, and Top Offset. If the new wall is created on a different level, the Top Constraint is set to the appropriate level.

To create similar elements:

- 1 Select an element.
- 2 Click Modify <Element> tab ► Create panel ► Create Similar, or right-click an element in the drawing area and click Create Similar on the shortcut menu.
- 3 Click in the drawing area to place the newly created instance in the desired location. Repeat as many times as needed.
- 4 To exit the Create Similar tool, press *ESC* twice.

Modifying Elements

Revit Architecture provides tools to manipulate, modify, and otherwise manage the display of elements in the drawing area.

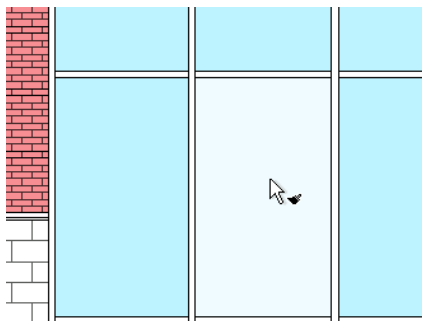
Changing Component Types Using the Match Type Tool

Use the Match Type tool to convert one or more elements of the same category so that they match another selected type in the same category. For example, you can select a generic 12" wall, and then select other walls of various types and convert them all to generic 12" walls.

The Match Type tool copies instance parameters from the source element to target elements. These instance parameters must be defined in the Family Editor.

To change an element's type:

- 1 Click Modify tab ► Clipboard panel ► Match Type.
The cursor changes to a paint brush.
- 2 Click an element of the type to which you want to convert other elements.
The cursor paint brush is now full.



3 Click an element of the same category to convert it to the type you selected.

To convert multiple elements, continue clicking them individually, or select Multiple on the Options Bar, draw a selection box to select the elements, and click Finish Selection.

4 If you want to select a new type, click an open space in the drawing area (or press *ESC* once) to empty the paint brush cursor and start over.

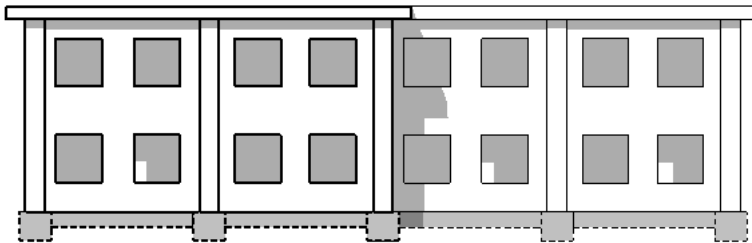
5 To exit the tool, press *ESC* twice.

The following restrictions apply to the Match Type tool:

- The Match Type tool only works within one view. You cannot match types between project views.
- You cannot select multiple element types to change using a selection box. You must change element types by selecting them with the paint brush.
- To match a family type or a group type from the Project Browser, make your selection in the Project Browser first. Then start the Match Type tool, and select the elements to be converted in the drawing area.
- When changing a wall's type, the Match Type tool copies Base Offset, Unconnected Height, Top Extension Distance, and Base Extension Distance from the source wall type to the target wall. If the target wall is on the same level as the source wall, then the values for Top Constraint and Top Offset are also copied.

Changing the Line Style of Elements

Use the Linework tool to quickly change the line style for selected edges of model elements in a view.



For example, you can use the Linework tool to do any of the following:

- Differentiate cut edges and projection edges of the model.
- Hide selected edges (by applying an Invisible line style).
- Reveal edges of elements that exist in the model, but are hidden in the view.
- Differentiate the edges of a building in an elevation view.
- Differentiate edges in an imported CAD file or a linked Revit file.

Related topics

- [Overriding Visibility and Graphic Display of Individual Elements](#) on page 199
- [Overriding Graphic Display of Element Categories](#) on page 201
- [Hiding Elements in a View](#) on page 208

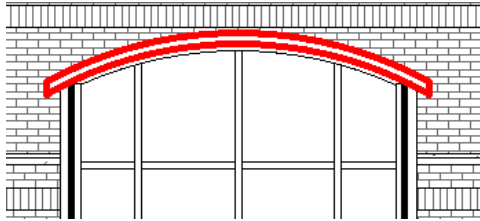
Linework Overview

The Linework tool does not create new model or detail lines in the view. Instead, it overrides the current line style of the selected line and applies a different line style. For information about defining and modifying line styles, see [Line Styles](#) on page 494.

You can use the Linework tool to change the line style of the following:

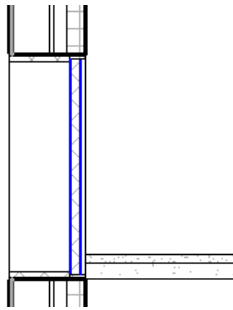
- Projection edges of model elements, including silhouette edges and projection edges caused by plan regions

Red linework applied to projection edges of a roof



- Cut edges of model elements

Blue linework applied to cut edges of a window



- Edges in imported CAD files
- Edges in linked Revit files (See [Changing Line Styles in a Linked Model](#) on page 401.)

NOTE You cannot use the Linework tool to modify the line style of a dimension or any other annotation line.

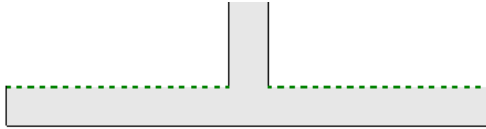
Linework and Cut Edges

In addition to using the Linework tool for projection edges, you can use it to apply other line styles to different types of cut edges of the same model element. For example, you can apply one line style to the front cut edge of a face, and another line style to the back cut edge of the same element. (A front cut edge is an edge of a model element that is generated by a section box or front clip plane. A back cut edge is an edge of a model element that is generated by the back clip plane.)



When you select an edge for the Linework tool, Revit Architecture applies the same line style to all segments of that face edge. You cannot apply different line styles to different segments of the same edge. For example,

the upper edge of the following wall is a single face, so the green dashed line style is applied to the entire edge. You cannot apply different line styles to each part of the face edge.



Linework and Views

You can use the Linework tool in all types of views except drafting views and legends. You can also use the Linework tool in graphical column schedules.

In perspective 3D views, you cannot specify segments for projection edges, and you cannot change the line pattern. However, you can use different line colors and weights.

Any changes that you make to model elements using the Linework tool are view-specific. The line style change does not affect other views.

Using the Linework Tool

- 1 Open the view in which you want to change line styles.
- 2 (Optional) To turn off Thin Lines, click View tab ► Graphics panel ► Thin Lines.
- 3 Click Modify tab ► Edit Linework panel ► Linework.

TIP The keyboard shortcut for the Linework tool is **LW**.

- 4 Click Linework tab ► Element panel, and select the line style to apply to the edge from the Line Style drop-down.

For information about defining and modifying line styles, see [Line Styles](#) on page 494.

- 5 In the drawing area, highlight the edge whose line style you want to change.

For components with multiple edges, press **TAB** to cycle the highlighting from individual edges to the whole component. The tooltip and the status bar identify the currently highlighted entity.

- 6 Click the highlighted edges to apply the selected line style.

If you are changing the line style of a projection edge, see [Changing the Line Style of a Projection Edge](#) on page 401.

NOTE You can restore the original line style to a changed edge. With the Linework tool active, select By Category in the Line Style drop-down. Then select the edge.

- 7 Continue applying the selected line style to edges in the view, or select a new style in the Line Style drop-down.

- 8 To exit the Linework tool, press **ESC**.

Related topics

- [Linework Overview](#) on page 399
- [Using Hidden Lines](#) on page 402
- [Changing Line Styles for a View Underlay](#) on page 402
- [Changing Line Styles in a Linked Model](#) on page 401

Changing Line Styles in a Linked Model

You can use the Linework tool to change the line style for edges in a linked Revit model. To do this, you must set the view's visibility property for the linked model to By host view, as follows.

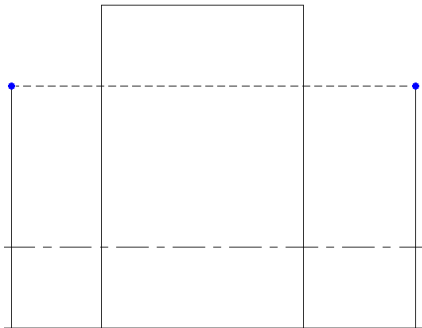
- 1 In the host model, open the view in which you want to change line styles.
- 2 Type **VG**, or click View tab ► Graphics panel ► Visibility/Graphics.
- 3 In the Visibility/Graphic Overrides dialog, click the Revit Links tab.
- 4 For the linked model, if the Display Settings value is not By host View, do the following:
 - a Click in the Display Settings cell.
 - b In the RVT Link Display Settings dialog, on the Basics tab, select By host view.
 - c Click OK.
- 5 Click OK.

Now you can use the Linework tool to change the line style of edges in the linked model. See [Using the Linework Tool](#) on page 400.

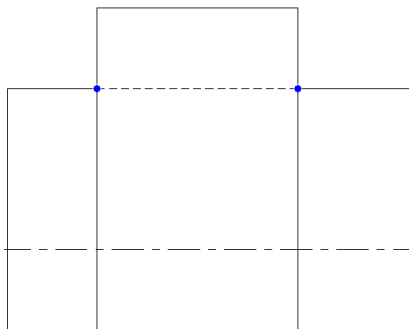
Changing the Line Style of a Projection Edge

You can change the line style of only a part of a projection edge. When you are changing the line style for a single edge (see [Using the Linework Tool](#) on page 400), blue controls display at each end of the edge. You can drag these controls so that the new style is applied only to a segment of the edge.

For example, the following elevation view shows a hidden line style applied to the top edge of one wall that stands behind another.



The controls can then be dragged toward each other so that the hidden line style is applied only to the segment that is obscured by the taller wall in the foreground, as follows.



If you want the entire edge to use the selected line style (instead of a segment of it), press and hold **SHIFT**, and then click the edge.

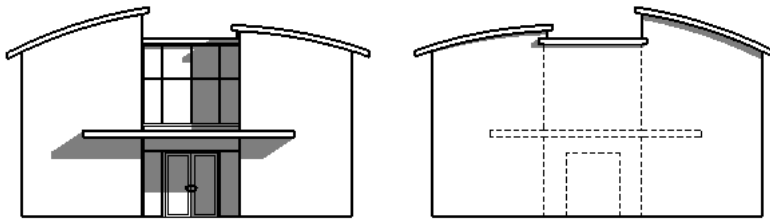
Changing Line Styles for a View Underlay

When you use a level as an underlay in the current view and use the Linework tool on the edges of elements from that level, the elements become part of the current view, and you can modify them. See [View Properties](#) on page 259.

For example, in a Level 1 floor plan view, you can specify Level 2 as an underlay. If Level 2 has a roof, you can select the roof in the plan view and then modify it. You can even underlay the same level as the view to select a ceiling or beams or other elements that are not shown in the view. You can use the Overhead line style for tracing underlays or define your own line style. (See [Line Styles](#) on page 494 and [Halftone/Underlay](#) on page 497.)

Using Hidden Lines

You can use hidden lines to display elements that are not visible in a view. For example, suppose you have an entrance on the south elevation, and you want to show an outline of this entrance using hidden lines on the north elevation.



To use hidden lines

- 1 Open a view where an element is obscuring an element you want to show using hidden lines. For example, in the sample above, you would open the north elevation view.
- 2 On the View Control Bar at the bottom of the drawing area, select the Wireframe model graphics style.
- 3 Click **Modify** tab ► **Edit Linework** panel ► **Show Hidden**.
- 4 In the drawing area, select the element that is obscuring the hidden element.
- 5 Select the element that you want to show in Hidden Line mode.
- 6 Click **Modify** to exit the Hidden Lines tool.

When you switch the view back to Hidden Line mode (select Hidden Line for the model graphics style on the View Control Bar), the obscured element is visible.

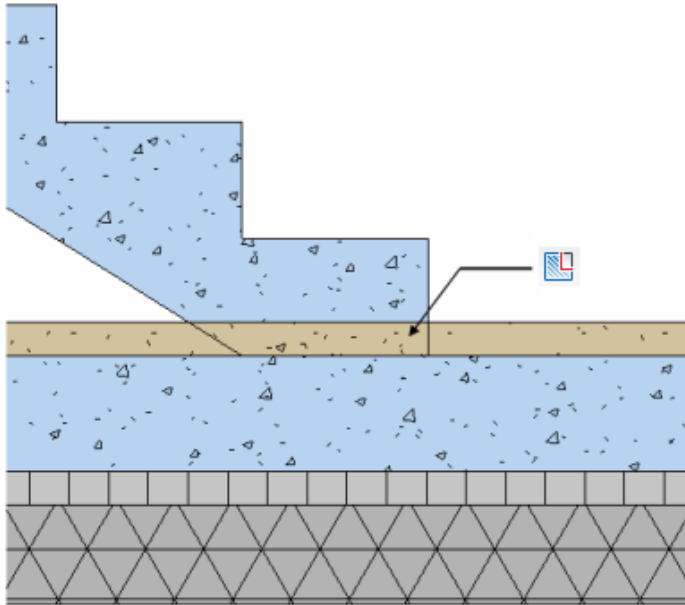
Using Linework for Coincident Edges

You can use linework to achieve the desired effect when several edges of model components project onto the same line (for example, a door opening that coincides with some edges of a door frame in an elevation view). In this case, the Linework tool may not immediately produce the desired results, because each of the coincident edges is treated as a separate line.

To apply a dashed line style to one of 3 coincident edges, for example, apply the <Invisible lines> style to 2 of the edges. (See [Using the Linework Tool](#) on page 400.) Then apply a dashed style (such as <Demolished>) to the third edge.

Changing the Cut Profile of Elements

Use the Cut Profile tool to change the shape of elements that are cut in a view, such as roofs, floors, walls, and the layers of compound structures. The tool is available in plan, RCP, and section views. Changes made to the profile are view-specific; that is, the element's 3D geometry or its appearance in other views does not change.



To edit an element's cut profile:

- 1 Click Modify tab ► Edit Linework panel ► Cut Profile.
- 2 On the Options Bar, for Edit, select Face (to edit the entire boundary around the face) or Boundary Between Faces (to edit the boundary line between faces).
- 3 Move the cursor over an element in the view (for example, a compound wall).
Depending on the selected Edit option, a valid cut face or a boundary line is highlighted.
- 4 Click the highlighted cut face or boundary to select it and enter Sketch mode.
- 5 Sketch an area to be added to or subtracted from the selection. Use a sequence of lines that starts and ends at the same boundary line.

You cannot sketch a closed loop or cross the starting boundary line. However, if you are using the Boundary Between Faces option, you can sketch over other boundaries of the face.

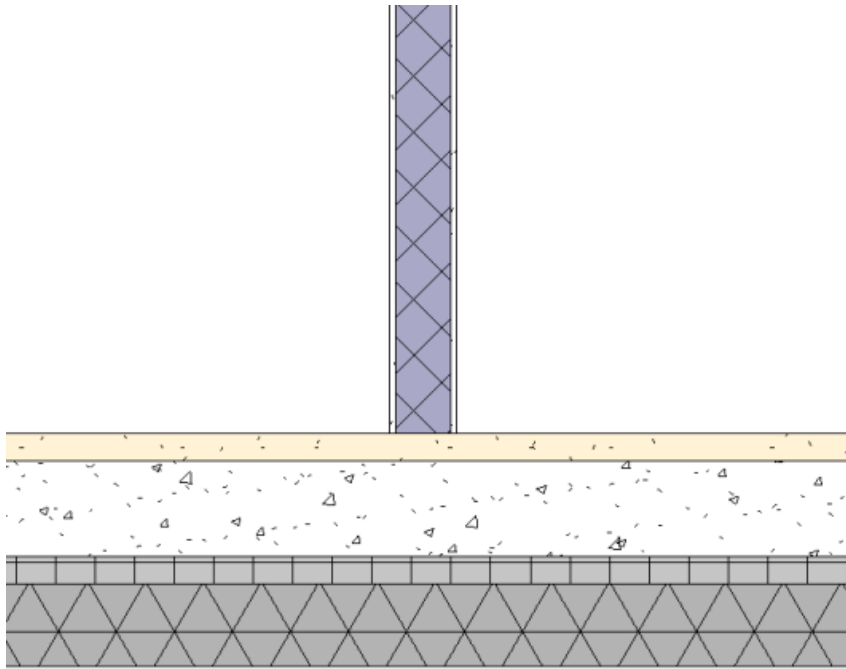
A control arrow displays on the first line that you sketch. It points toward the portion that will remain after editing. Click the control arrow to change its direction.

NOTE When you are editing a boundary line between faces, you only need to sketch the 2 boundary lines for the area. A connecting line appears between the 2 lines that you sketch. You do not need to sketch this line.

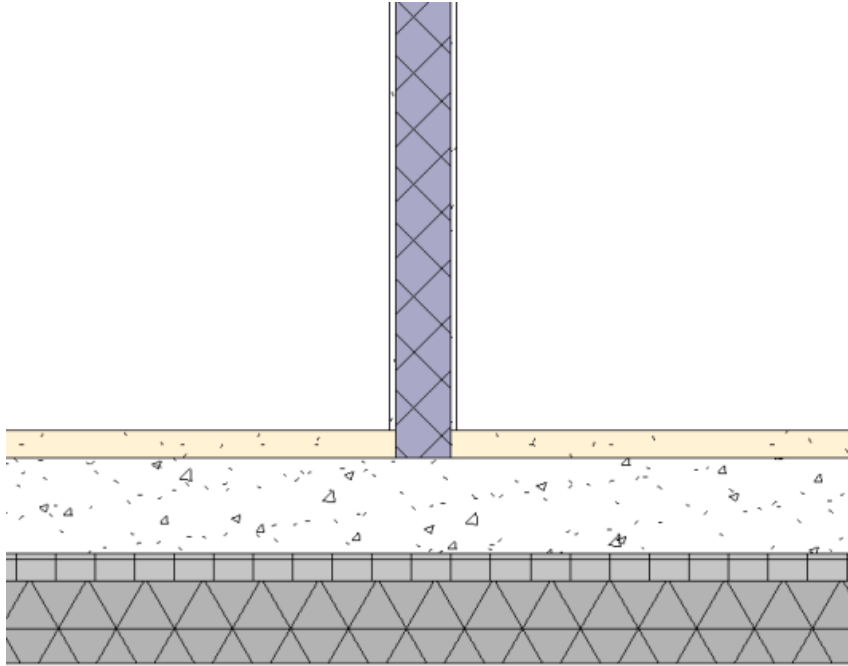
- 6 When finished editing, click Finish Cut Profile.

7 To change the graphic display (such as line weight or color) of elements in the view, right-click the element, and click **Override Graphics in View** ► **By Element**. See [Overriding Visibility and Graphic Display of Individual Elements](#) on page 199.

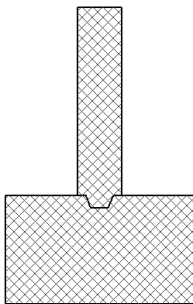
Before the Cut Profile tool



After the Cut Profile tool



When you have 2 adjoining elements and you want to edit the profile as shown below, use the Boundary Between Faces option to achieve the desired effect.



Measuring Elements

The Measure tool provides a quick way to measure and temporarily display the length (and angle from the horizontal, if applicable) of individual walls or lines that you select in plan views. In elevation views, you can use this tool to select only the ends of walls running perpendicular to the view direction (to display the height of the wall). In both plan and elevation views, however, you can draw a temporary line or a chain of lines connecting points that you specify. In either case, the dimensions generated by the tool remain on the screen until you start the next measurement or exit the tool. Length dimensions also display in the Total Length box on the Options Bar.

To measure elements:

- 1 Click **Modify** tab ► **Inquiry** panel ► **Measure** drop-down ► **Measure Between Two References** or **Measure Along An Element**.

If you select **Measure Between Two References**, you can measure a certain length from a starting point. Click the starting point, move the cursor in the direction that you want the line to extend, and enter a value for the length of the line.

If you select **Measure Along An Element**, select the element in the drawing area. Temporary dimensions display for the element and the total length displays on the **Options Bar**.

- 2 If you want to display dimensions for a chain of temporary lines that you draw, on the **Options Bar**, select **Chain** and do either of the following:

- Specify a series of points.
- Specify the first point, move the cursor in the direction that you want the line to extend, and enter a value for the length of the line, repeating until all lines in the chain are drawn.

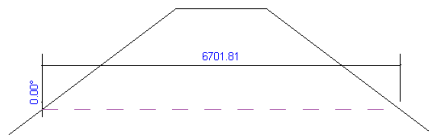
The **Total Length** box on the **Options Bar** keeps a running total for the length of the chain. Double-click to end the chain.

NOTE Chain is only available when you select **Measure Between Two References**.

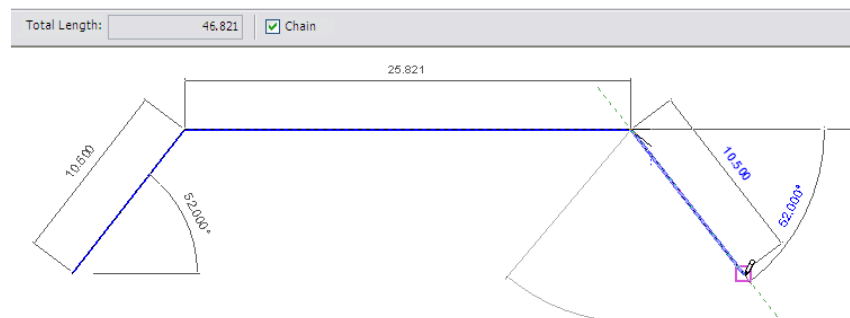
- 3 Press **ESC** once to exit the current measurement.

- 4 Press **ESC** twice to exit the Measure tool.

Measure line with length and angle measurements



Measure chain with the total length displaying on the Options Bar



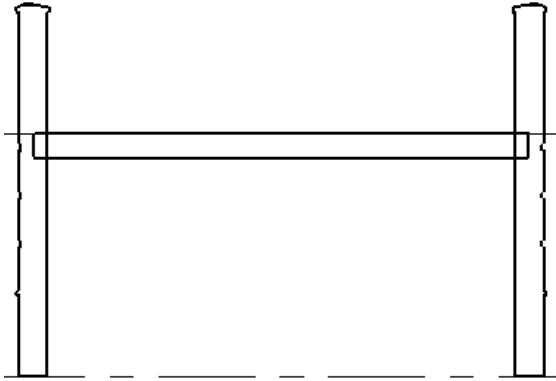
Joining Geometry

Use the **Join Geometry** tool to create clean joins between 2 or more host elements that share a common face, such as walls and floors. You can also use the tool to join hosts and in-place families, or hosts and project families. As shown in the following illustrations, the tool removes the visible edge between the joined elements. The joined elements then share the same line weight and fill pattern.

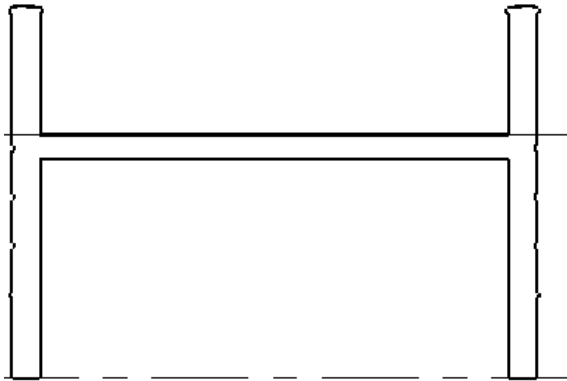
Related Topics

- [Manipulating Joined Forms](#) on page 567

Uncleaned join between walls and floor



Cleaned join between walls and floor after Join Geometry tool is used



When you join geometry in the Family Editor, you create a union between different shapes. In a project, however, one of the joined elements actually cuts the other according to the following scheme:

- Walls cut columns.
- Structural elements cut host elements (walls, roofs, ceilings, and floors).
- Floors, ceilings, and roofs cut walls.
- Gutters, fascias, and slab edges cut other host elements. Cornices do not cut any elements.

To join geometry:

- 1 Click **Modify** tab ► **Edit Geometry** panel ► **Join**.
- 2 If you want to join the first selected geometry instance to several other instances, select **Multiple Join** on the **Options Bar**. If you do not select this option, you must make a first and second selection each time.
- 3 Select the first geometry to join (for example, a wall face).
- 4 Select the second geometry to join to the first (for example, an edge of a floor).
- 5 If you selected **Multiple Join**, continue selecting other geometry to join to the first.
- 6 To exit the tool, click **Modify** or press *ESC*.

NOTE If you join solids in the Family Editor, you can apply a **Visibility** (on/off) parameter only to the entire joined geometry, not to the sub-elements that were joined. Use *TAB* to toggle to the combined geometry.

Unjoining Geometry

Use the Unjoin Geometry tool to remove a join (between 2 or more elements) that was applied using the Join Geometry tool. For information on the kinds of elements that can be joined and unjoined with these tools, see [Joining Geometry](#) on page 406.

To unjoin geometry:

- 1 Click Modify tab ► Edit Geometry panel ► Join drop-down ► Unjoin Geometry.
- 2 Select the geometry to unjoin.
- 3 To exit the tool, click Modify or press *ESC*.

Splitting Walls and Lines

Use the Split tool to cut walls or lines at a selected point, or to remove segments between 2 points.

To split walls and lines:

- 1 Click Modify tab ► Edit panel ► Split.
- 2 If desired, select Delete Inner Segment on the Options Bar. When you select this option, Revit Architecture removes the segment of the wall or line between selected points.
- 3 Click the wall or line at the point you wish to split. If you selected Delete Inner Segment, click at another point to remove a segment.

Splitting wall with Delete Inner Segment option selected



- 4 With the wall or line split, you can select pieces of it and perform a function on that piece.

Splitting Walls Horizontally

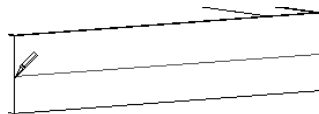
You can split a wall along a horizontal line in an elevation or a 3D view. After you split a wall, Revit Architecture treats it as 2 separate walls, which means that you can modify one part independently of the other.

For example, in a 2-level building, suppose you snap the split to Level 2, and the top piece has a base constraint of Level 1. The lower wall has a height constraint of Level 2. If you split the walls at another point away from the levels, the lower wall has an explicit height constraint, while the top wall has a value for the base offset. For more explanation of these properties, see [Curtain Wall Properties](#) on page 786.

To split a wall horizontally:

- 1 Click Modify tab ► Edit panel ► Split.
- 2 Place the cursor on the wall or line at the point you wish to split.
A temporary horizontal line appears on the wall when you place the cursor near vertical edges. If desired, you can snap to levels, so you split the wall evenly between levels.

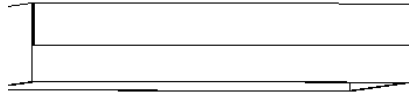
Temporary horizontal line appearing



- 3 Click to place the split.

A permanent horizontal line appears on the wall indicating the split.

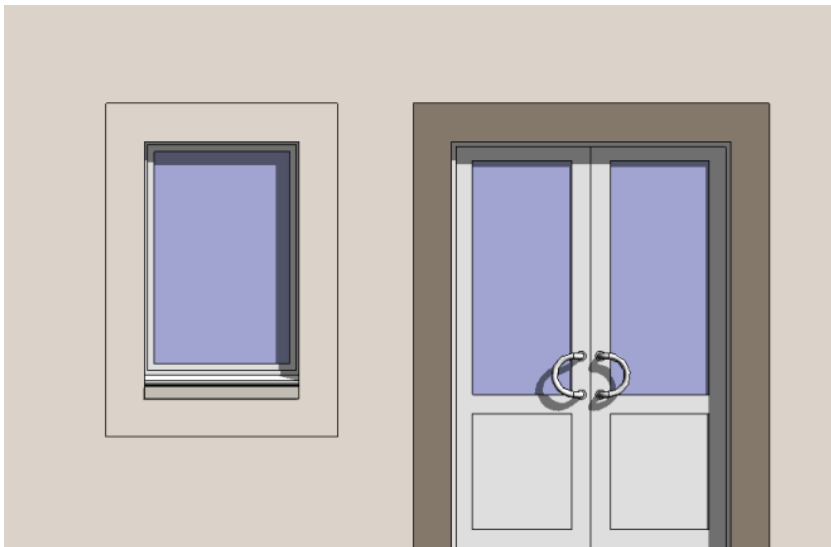
Permanent horizontal split



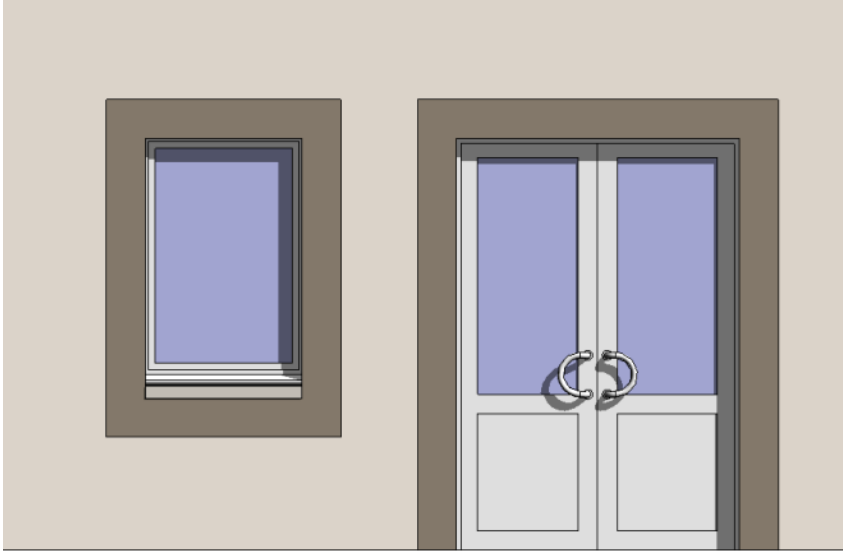
Splitting Faces

You can use Split Face on any non-family instance. The Split Face tool splits the selected face of the element; it does not change the structure of the element. After splitting the face, you can use the Paint tool to apply a different material to this section of face. See [Applying a Material to the Face of an Element](#) on page 411.

A wall with a split face (around the window) before painting



A wall with a split face (around the window) after painting

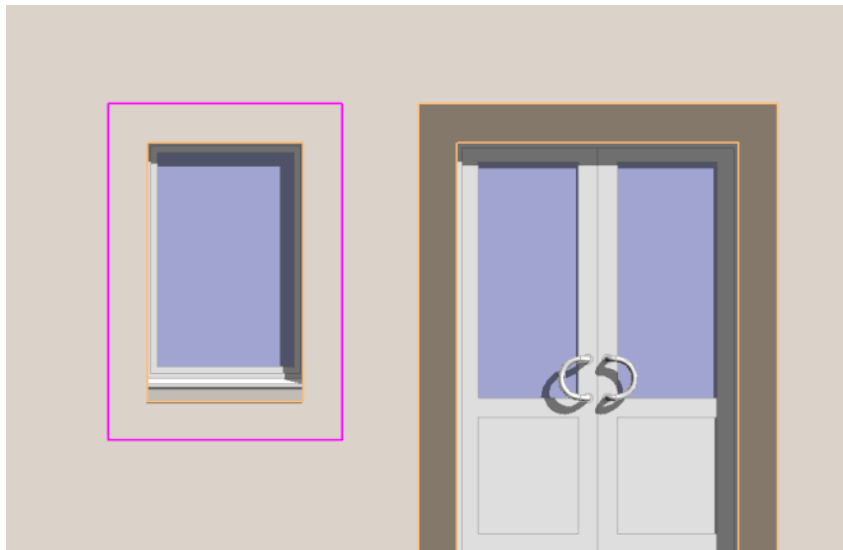


To split a face:

- 1 Click Modify tab ► Edit Face panel ► Split Face.
- 2 Place the cursor on the element face to highlight it. You may need to press *TAB* to select the desired face.
- 3 Click to select the face.
- 4 Sketch the face area to split. For more information about the sketching tools, see [Sketching](#) on page 303.

NOTE The sketch must be in a closed loop inside the face or an open loop that ends on the boundary of the face.

In the following example, the wall around the window is split, so that it can be painted to match the border around the door.



TIP You can split the face of a column. However, if you plan to have multiple instances of the split-face column in your project, create the column in the Family Editor and apply the split there.

Applying a Material to the Face of an Element

The Paint tool applies a material to the selected face of the element or family; it does not change the structure of the element. (See [Materials](#) on page 468.)

Elements that you can paint include walls, roofs, massing, families, and floors. If the element highlights when you place the cursor near it, you can paint it. The Paint tool is especially useful for applying materials to split faces. See [Splitting Faces](#) on page 409.

If the surface pattern for the material is a model pattern, you can select references in the pattern for dimensioning or aligning. See [Fill Patterns](#) on page 459 and [Working with Model Patterns](#) on page 463.

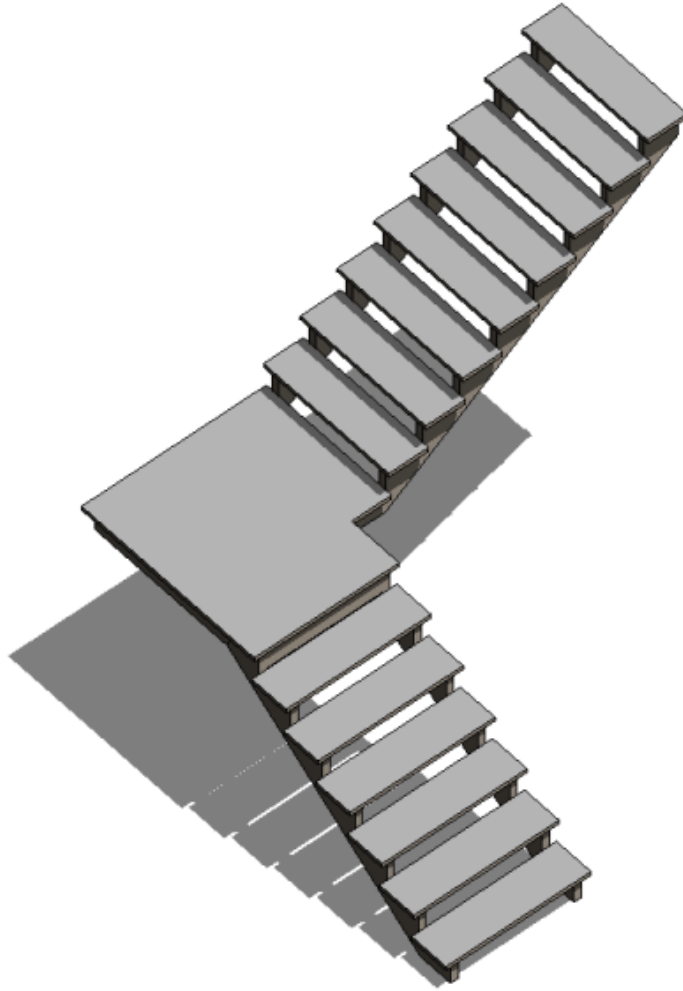
To paint a surface:

- 1 Click Modify tab ► Edit Face panel ► Paint.
- 2 Click Paint tab ► Element panel, and select the material to apply from the Material drop-down.
- 3 Place the cursor on the element face to highlight it. You may need to press *TAB* to select the desired face.
If you highlight a face that has already been painted, the status bar indicates the material that is applied to it.
- 4 Click to apply the paint.

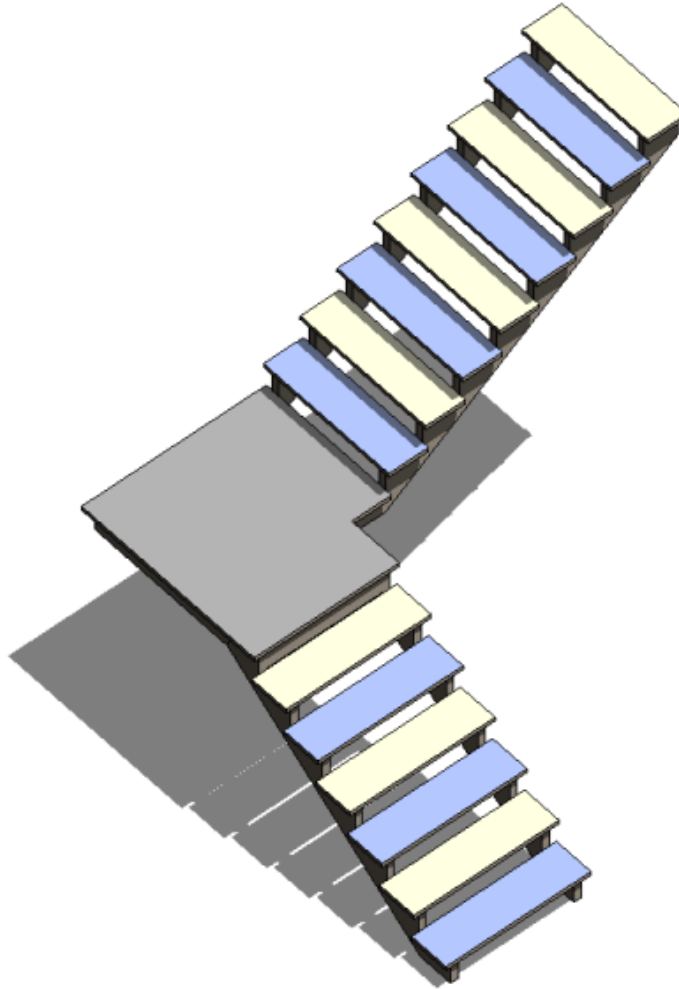
More About Painting Surfaces

- You cannot apply materials to family instances in a project. You must apply the materials to faces in the Family Editor.
- To remove the paint, activate the Paint tool and choose <By Category> from the Material drop-down. Click a face that was painted, and the paint is removed.
- You can apply paint to the face of a column. However, if you plan to have multiple instances of the painted column in your project, create the column in the Family Editor and apply the paint there.
- When you are in the Family Editor, you can create a family parameter of type material. You can then paint that face of the family with that parameter. For more information on creating a parameter, see [Creating Parameters](#) on page 431.

Before painting (applying material to) stairs



After painting (applying material to) stairs



Deleting Elements

The Delete tool removes selected elements from the drawing. The Delete tool is available only after selecting elements. It does not paste deleted elements to the clipboard.

To delete elements:

- 1 Select one or more elements in the drawing area.
- 2 Click Modify <Element> tab ► Modify panel ► Delete, or press *DELETE*.

Revit Families

9

All of the elements that you add to your Revit projects – from the structural members, walls, roofs, windows, and doors that you use to assemble a building model to the callouts, fixtures, tags, and detail components that you use to document it – are created with families.

By using predefined families and creating new ones in Revit Architecture, you can add both standard and custom elements to your building models. Families also provide a level of control over elements that are similar in use and behavior, allowing you to easily make design changes and manage your projects more efficiently.

For complete information about creating, modifying, and working with families, download the Revit Architecture Families Guide, which contains detailed conceptual information, tutorials, and information about best practices. For more information, see [The Families Guide](#) on page 418.

Families Overview

A *family* is a group of elements with a common set of properties, called parameters, and a related graphical representation. Different elements belonging to a family may have different values for some or all of their parameters, but the set of parameters (their names and meanings) is the same. These variations within the family are called *family types* or *types*.

For example, the Furniture category includes families and family types that you can use to create different pieces of furniture, like desks, chairs, and cabinets. Although these families serve different purposes and are composed of different materials, they have a related use. Each type in the family has a related graphical representation and an identical set of parameters, called the family type parameters.

When you create an element in a project with a specific family and family type, you create an *instance* of the element. Each element instance has a set of properties, in which you can change some element parameters independent of the family type parameters. These changes apply only to the instance of the element, the single element in the project. If you make any changes to the family type parameters, the changes apply to all element instances that you created with that type.

For complete information about creating, modifying, and working with families, download the Revit Architecture Families Guide, which contains detailed conceptual information, tutorials, and information about best practices. For more information, see [The Families Guide](#) on page 418.

Different Kinds of Families

There are 3 kinds of families in Revit Architecture:

- system families
- loadable families
- in-place families

Most elements that you create in your projects are system families or loadable families. Loadable families can be combined to create nested and shared families. Non-standard or custom elements are created using in-place families.

System Families

System families create basic building elements such as walls, roofs, ceilings, floors, and other elements that you would assemble on a construction site. System settings, which affect the project environment and include types for levels, grids, drawing sheets, and viewports, are also system families.

System families are predefined in Revit Architecture. You do not load them into your projects from external files, nor do you save them in locations external to the project.

Loadable Families

Loadable families are families used to create both building components and some annotation elements. Loadable families create the building components that would usually be purchased, delivered, and installed in and around a building, such as windows, doors, casework, fixtures, furniture, and planting. They also include some annotation elements that are routinely customized, such as symbols and title blocks.

Because of their highly customizable nature, loadable families are the families that you most commonly create and modify in Revit Architecture. Unlike system families, loadable families are created in external RFA files and imported, or loaded, in your projects. For loadable families that contain many types, you can create and use type catalogs, which allow you load only the types that you need for a project.

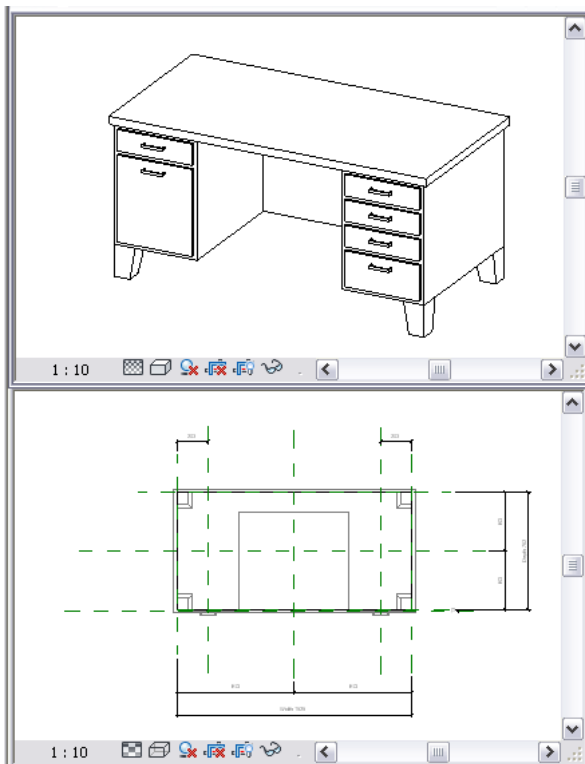
In-Place Families

In-place elements are unique elements that you create when you need to create a unique component that is specific to the current project. You can create in-place geometry so that it references other project geometry, resizing or adjusting accordingly if the referenced geometry changes. When you create an in-place element, Revit Architecture creates a family for the in-place element, which contains a single family type.

Creating an in-place element involves many of the same Family Editor tools as creating a loadable family. For detailed information about Revit Architecture families, see [The Families Guide](#) on page 418.

Family Editor

The Family Editor is a graphical editing mode in Revit Architecture that allows you to create and modify families to include in your project. When you start creating a family, you open a template to use in the editor. The template can include multiple views, such as plans and elevations. The Family Editor has the same look and feel as the project environment in Revit Architecture, but it features different tools. The availability of tools depends on the type of family you are editing.



Before you use the Family Editor to edit or create a family, you should learn about families. See [The Families Guide](#) on page 418.

To learn how to start the Family Editor, see [Opening the Family Editor](#) on page 417.

Opening the Family Editor

You use the Family Editor to make changes to existing families or to create new families. The method you use for opening the Family Editor depends on what you want to do.

You use the Family Editor to create and edit loadable families and in-place elements. The tabs and panels change depending on the type of family that you are editing. You do not use the Family Editor to edit system families.


Before you edit or create a family, you should become familiar with families. See [The Families Guide](#) on page 418.

To edit a family from a project


Do one of the following:

- Select an instance of the family in the drawing and click Modify <Element> tab ► Family panel ► Edit Family.
- In the Project Browser, right-click the family and click Edit.

To edit a loadable family outside a project

- 1 Click  ► Open ► Family.
- 2 Browse to the file containing the family, and click Open.

To create a loadable family from a template file

- 1 Click  ► New ► Family.
- 2 Browse to the template file, and click Open.

To create an in-place element

- 1 Click Home tab ► Build panel ► Component drop-down ► Model In-Place.
- 2 In the Family Category and Parameters dialog, select the family category, and click OK.
- 3 Enter a name for the in-place element family, and click OK.

To edit an in-place element

- 1 Select the in-place element in the drawing.
- 2 Click Modify <Element> tab ► Model panel ► Edit In-Place.

The Families Guide

The Revit Architecture Families Guide provides detailed information about working with families and creating custom content. The Families Guide includes the following information:

- how to use families in your projects
- concepts of parametric design and family creation
- best practices to use when creating your own families

The Families Guide contains conceptual explanations, procedures, and reference information.

To access the Revit Architecture Families Guide, click (Help) drop-down ► Families Guide.

Working with Families

This topic covers tasks that are commonly performed when working with families. For detailed information about families, see [The Families Guide](#) on page 418.

Viewing Families in a Project or Template

You can view all the families that are available in a project using the [Project Browser](#) on page 93.

Families are listed by category and type in the Project Browser. See [Categories, Families, and Types](#) on page 120.

For detailed information about families, see [The Families Guide](#) on page 418.

To view the families in a project or template

- 1 Open a project or a template.
- 2 In the Project Browser, expand Families.
A list of all families in the project (or template) displays. The list includes system families, loadable families, and in-place families.
- 3 Expand the family category that contains the family types that you want to view.
In most cases, one or more families display under the family category.

- 4 Expand the family to view the family types.

Viewing Elements with a Specific Family Type in a Project

You can highlight all the elements in a project that use a specific family type.

- 1 Open a project view.
- 2 In the Project Browser, expand Families.
- 3 Expand the component category and family that contains the type that you want to select.
- 4 Select the desired type, right-click, and click Select All Instances.

NOTE If the current project does not contain any elements that use that family type, the Select All Instances tool is unavailable.

All elements in the view that use the family type are highlighted.

In the lower-right corner of the Revit window, the number of selected elements in the project displays.

- 5 Open other project views.
Any of the elements that use the family type are highlighted.
- 6 Press *Esc* to restore the original display of the elements.

Creating an Element from a Family Type

Use this procedure to create an instance of a system family or loadable family using the Project Browser. For information about creating an element from an instance in a project, see [Copying Elements with the Create Similar Tool](#) on page 396.

For detailed information about creating families and family elements, see [The Families Guide](#) on page 418.

To create an element from a family type

- 1 Do one of the following:
 - On the Home tab ► Build panel, click the element that you want to create.
 - Select the family type in the Project Browser, and drag it to the drawing area.
 - Select the family type in the Project Browser, right-click, and click Create Instance.
- 2 On the Place <Element> tab ► Element panel, from the Type Selector drop-down, select the type of element that you want to create.
The list displays the available family types first by family or subfamily and then by type, separated by a colon.
- 3 On the Options Bar, specify any necessary values or selections.
- 4 In the drawing area, click to place the element.
- 5 Create another element, or click Place <Element> tab ► Select panel ► Modify.

Changing the Family Type of an Element

To change the family type of an element in the drawing area of a project, do one of the following:

- Select the element and change the family type using the [Type Selector](#) on page 99.

- Change the family type using the [Element Properties](#) on page 120.
- Change the family type using the Match tool. See [Changing Component Types Using the Match Type Tool](#) on page 397.

For detailed information about families and family types, see [The Families Guide](#) on page 418.

Modifying a Family Type

You can access the properties of a family type in the Project Browser or from an element that uses that type in a current project. For detailed information about modifying families, see [The Families Guide](#) on page 418.

To modify a family type

1 Do one of the following:

- In the Project Browser, under Families, right-click the family type, and click Properties.
- Select an element in the project, right-click, and click Element Properties. In the Instance Properties dialog, click Edit Type.

2 In the Type Properties dialog:

- Under Type Parameters, change parameter values as desired.
The parameters that display vary depending on the family type that you are modifying.
- If desired, in the upper-left corner, click Rename, and enter a new name.

3 Click OK to exit all dialogs.

If you are modifying a family type in a project, any instances of elements with the same family type in the project update to reflect your modifications.

Adding a Type to a Family

After loading a family into a project, you can create different family types from within the project.

To add a type to a family using the Project Browser

1 In the Project Browser, expand Families.

2 Expand the family category.

3 Expand the family.

4 Do either of the following:

- Select the family, right-click, and click New Type.
- Select a type, right-click, and click Duplicate.

BEST PRACTICE To minimize type property editing, duplicate the family type that most resembles the type that you want to create.

5 Enter a new name for the type.

6 Select the type, right-click, and click Properties.

7 In the Type Properties dialog, enter new parameter values, and click OK.

To create a family type from an element in a project, see [Creating a New Family Type in a Project](#) on page 122.

Deleting Unused Families and Family Types

You can delete unused families or unused family types from your projects and templates using either of 2 methods: you can select and delete the families and types in the Project Browser, or you can run the Purge Unused tool.

Select and delete families and types when you have only a few families or types that you need to delete. Use the Purge Unused tool when you need to "clean up" your projects. Removing all of the unused families and types usually decreases the project file size.

Whichever method you use, you cannot delete the following:

- Family types that have dependencies (such as those that host other families)
- Families with types that are in use in the current project or template

For more information about deleting families, see [The Families Guide](#) on page 418.

To select and delete families and types in the Project Browser

- 1 In the Project Browser, expand Families.
- 2 Expand the category that contains the family or type that you want to delete.
- 3 If you want to delete a loadable family type, expand the family.
- 4 Select the family or type to delete.

TIP To select more than one family or type, press and hold *Ctrl* while selecting.

- 5 Do either of the following:
 - Right-click, and click Delete.
 - Press *Delete*.

The family or type is deleted from the project or template.

If you are deleting a family or type from a project, and the project contains one or more instances of a family type, a warning displays.

To delete families and types using the Purge Unused tool

- 1 Click Manage tab ► Project Settings panel ► Purge Unused.

The Purge Unused dialog lists all the families and family types that you can unload from the project, including system and in-place families. By default, all unused families are selected for purging.

IMPORTANT If the project is workset-enabled, all worksets must be open to use this tool.

- 2 Do either of the following:
 - To purge all unused family types, click OK.
 - To purge only the types that you select, click Check None, expand the families and subfamilies that contain the types that you want to purge, select the types, and click OK.

System Families

System families contain family types that you use to create basic building elements such as walls, floors, ceilings, and stairs in your building models. System families also include project and system settings, which affect the project environment and include types for elements such as levels, grids, sheets, and viewports.

System families are predefined in Revit Architecture and saved in templates and projects, not loaded into templates and projects from external files. You cannot create, copy, modify, or delete system families, but you can duplicate (copy) and modify the types within system families to create your own custom system family types. You can delete all but one system family type in a system family, because you need at least one type per family to create new system family types.

Although you cannot load system families into templates and projects, you can copy and paste or transfer system family types between projects and templates. You can copy and paste any number of individual types, or use a tool to transfer all types in the system families that you specify.

System families can also host other kinds of families, usually loadable families. For example, a wall system family may host a standard door/window assembly.

For detailed information about system families, see [The Families Guide](#) on page 418.

Revit System Families and Settings

Revit Architecture includes the following system families and project and system settings.

For a list of system families included in all Revit products, see [The Families Guide](#) on page 418.

System Families:

- Ceilings
- Curtain Systems
- Curtain Wall Mullions
- Detail Items
- Floors
- Fluids (a Revit MEP-specific family)
- Model Text
- Railings
- Ramps
- Roofs
- Site (Pad)
- Stairs
- Structural Columns
- Structural Foundations
- Structural Framing
- Walls

Project/System Settings:

- Area and Volume Calculations
- Arrowheads
- Color Fill Schemes
- Detail Level
- Dimensions
- Drawing Sheets
- Elevations
- Filled Regions/Fill Patterns
- Filters
- Grids
- Keynoting
- Levels
- Lines
- Load Types
- Match Lines
- Materials
- Model Text
- Object Styles
- Phases
- Project Browser Organization
- Project Units
- Sections
- Site Settings
- Spot Dimensions
- Snaps
- Structural Settings
- Sun and Shadow
- Temporary Dimensions
- Text
- Viewports
- View Tags (Callout, Elevation, and Section Tags)
- View Templates

Workflow: Using System Families in Your Projects

System families are predefined in Revit Architecture and saved in templates and projects, not loaded into templates and projects from external files. You can duplicate (copy) and modify the types within system families to create your own custom system family types.

For detailed information about system families, see [The Families Guide](#) on page 418.

Before you begin a project, use the workflow that follows to determine whether you can use existing system family types, or whether you need to create your own custom system family types.

- 1 Determine the system family types that your project requires.
- 2 Search existing system families and determine if you can find the system family types that you need in Revit Architecture templates or in your office templates.
- 3 If you can find a system family type that is similar to the family type that you need, save design time by modifying it to meet your needs.
- 4 If you cannot find the system family type that you need and you cannot modify a similar family type to fit your needs, create your own system family type.

Loading System Family Types

Because system families are predefined in Revit Architecture, you can only load system family types in projects or templates.

To load system family types, you can:

- copy and paste one or more selected types from one project or template to another
- transfer all system family types of a selected system family or families from one project to another

Copy and paste system family types when you have only have a few system family types that you need to load between projects or templates.

Transfer system family types when you are creating a new template or project, or anytime that you need to transfer all the types of a system family or families.

NOTE When you transfer system family types, you use the Transfer Project Standards tool. You can also transfer system settings with this tool.

For information about the Transfer Project Standards tool, see [Transferring Project Standards](#) on page 446.

For detailed information about loading, copying, and transferring system family types, see [The Families Guide](#) on page 418.

Loadable Families

Loadable families are families used to create both building components and some annotation elements. Loadable families create the building components that would usually be purchased, delivered, and installed in and around a building, such as windows, doors, casework, fixtures, furniture, and planting. They also include some annotation elements that are routinely customized, such as symbols and title blocks.

Because of their highly customizable nature, loadable families are the families that you most commonly create and modify in Revit Architecture. Unlike system families, loadable families are created in external RFA files and imported (loaded) in your projects. For families that contain many types, you can create and use type catalogs, which allow you load only the types that you need for a project.

When you create a loadable family, you begin with a template that is supplied in the software and contains information about the family that you are creating. You sketch the geometry of the family, use parameters to establish relationships between family components, create the variations or family types that it includes, and determine its visibility and detail level in different views. When you finish the family, you test it in a sample project before using it to create elements in your projects.

Revit Architecture includes a library of content in which you can access loadable families that are supplied by the software and save the families that you create. You can also access loadable families from various sources on the Web.

Nesting and Sharing Families

You can load instances of families in other families to create new families. By nesting existing families inside other families, you can save yourself modelling time.

Depending on how you want instances of these families to act when you add them to your projects (as a single element or as individual elements), you can specify whether the nested families are shared or not shared.

For detailed information about loadable families, see [The Families Guide](#) on page 418.

Revit Architecture Standard Loadable Families

Revit Architecture includes the following standard loadable families:

- Annotations
- Balusters
- Casework
- Columns
- Curtain Wall Panels
- Detail Components
- Doors
- Electrical Fixtures
- Entourage
- Furniture
- Furniture Systems
- Lighting Fixtures
- Mass
- Mechanical Equipment
- Planting
- Plumbing Fixtures
- Profiles
- Site
- Specialty Equipment
- Structural

- Sustainable Design
- Title Blocks
- Windows

Workflow: Using Loadable Families in Your Projects

Loadable families are the most extensive and customizable families in Revit Architecture. You can create your own custom families, but a number of families are ready for use in the family library and on the Web.

Before you begin a project, use the following workflow to determine whether you can use existing families, or whether you need to create your own custom families.

- 1 Determine the families that your project requires.
- 2 Search existing loadable families and determine whether you can find the families that you need in the library, on the Web, in Revit templates, or in your office templates.
- 3 If you find an appropriate family but not the specific type that you need, create a new type.
- 4 If you can find families that are similar to the families that you need, save design time by modifying existing families to your needs.
- 5 If you cannot find the families that you need or modify similar families to fit your needs, create your own families.

For detailed information about loadable families, see [The Families Guide](#) on page 418.


Working with Modern Medium Families

Ketiv's Modern Medium Library has been converted into Revit Architecture families and made available on the Web. Modern Medium families cannot be altered structurally within Revit Architecture. You can, however, change the appearance of a Modern Medium family type by changing the render appearance of the material linked to its object style.

NOTE Loading a large number of families from the Modern Medium Library can substantially increase the project file size and impede system performance.

For example, you could download and load a Modern Medium piano so the family displays under Families\Specialty Equipment in the Project Browser. To change the color to natural wood, you can create a new material called Piano, and then select the color and texture desired. The appearance of the piano will change after you apply the new material to the object style of the piano.

To apply a different render appearance to a Modern Medium family

- 1 Download Modern Medium families from the Web, and add them to a project.
- 2 Click Manage tab ► Project Settings panel ► Settings drop-down ► Object Styles.
- 3 On the Object Styles dialog, click the Imported Objects tab.
- 4 Under the Category heading, select the layer name of the Modern Medium family.
- 5 Click in the Material Field, and click .
- 6 In the Materials dialog, select a material, and click OK twice.
- 7 Save the family.

Loading and Saving Families

To use loadable families in your projects or templates, you must load (import) them with the Load from Library tool. After you load a family into a project, it is saved with that project.

Some families are preloaded in the templates that are included with Revit Architecture. Any projects that you create with these templates include the families loaded in the template.

You can find, preview, and load other families from the following sources:

- the Revit Architecture library that is installed with the software
- other local or networked libraries
- the Revit Web Content Library (see [Opening Files from the Web Library](#) on page 113)
- Autodesk Seek (see [Autodesk® Seek](#) on page 108)
- manufacturers' websites
- other third-party websites

Most of the families that you load from the Revit Architecture library, the Revit Web Content Library, and Autodesk Seek are fully editable.

When loading large families that contain many types into a project, you can use a type catalog to load only the types that you need. Type catalogs are easy to create. By allowing you to load only selected family types, they help to keep your project sizes from growing needlessly large.

For more information about working with loadable families, see [The Families Guide](#) on page 418.

Loading Families

When you load families into a project, the Revit Architecture imperial or metric family library (located in C:\Documents and Settings\All Users\Application Data\Autodesk\RAC 2010\Imperial or Metric Library) is accessed by default.

If your office is using a different library of content in another location, your system may access that library by default. Contact your CAD Manager for more information.

Use the following procedure to load families. For more information about loadable families, see [The Families Guide](#) on page 418.

To load families

- 1 Click Insert tab ► Load from Library panel ► Load Family.

Depending on the current drawing units (imperial or metric), the Load Family dialog lists the family categories in either the Imperial or Metric Library.

- 2 In the Load Family dialog, double-click the category of the family that you want to load.

- 3 Preview any of the families (RFA) in the category:

- To preview a single family, select it from the list.
At the top right of the dialog, under Preview, a thumbnail image of the family displays.
- To display a thumbnail image in the list for all families in the category, at the top right corner of the dialog, click Views ► Thumbnails.

- 4 Select the family that you want to load, and click Open.

The family type is now available to place in the project. It displays in the appropriate component category under Families in the Project Browser.

Related topics

- [Revit Families](#) on page 415
- [Loadable Families](#) on page 424
- [Loading Families with Shared Components into a Project](#) on page 428
- [Loading a Family with a Type Catalog](#) on page 428

Loading Families with Shared Components into a Project

You load families that contain nested components or nested and shared components into a project using the same methods as any other family. When you load a family comprised of nested components or nested and shared components into a project, the following rules apply:

- The host family, along with all nested and shared components, is loaded into the project. Each nested component is available within the Project Browser under its respective family category.
- A nested family can exist within a project and be shared by more than one host family.
- When loading shared families, if a version of one of the families already exists within the project, you have the option to use the version from the project or from the family you are loading.

IMPORTANT After a shared family is loaded into a project, you cannot reload an unshared version of the same family and overwrite it. You must delete the family and reload it.

To load families with shared components into a project

- 1 Open the project into which you want to load the family.
- 2 Click Insert tab ► Load from Library panel ► Load Family.
- 3 In the Load Family dialog, select the family to load, and click Open.
- 4 Add instances of the family to your projects.

Loading a Family with a Type Catalog

When you load a family with many types into a project, using a type catalog allows you to select and load only those types that you need. The type catalog provides a dialog that lists the available family types that you can sort through and select before you load types into a project.

For information about creating a type catalog, see [The Families Guide](#) on page 418.

After you create a type catalog for a family, you can use it to load only the family types that you need into projects and templates.

To load a family with a type catalog

- 1 Create and place the type catalog in the same location (directory) as the family that you want to load.
- 2 In a Revit project or template, click Insert tab ► Load From Library panel ► Load Family.
- 3 Navigate to the directory containing the family you want to open.
- 4 Select the family (RFA file) to load.
The Type Catalog displays.
- 5 In the Type column of the Type Catalog, select the family type or types to load.

You can select multiple types by pressing *Ctrl* during selection. You can also narrow the range of search items by selecting specific parameters from the list at the top of each column.

6 Click Open.

Loading the Current Family into a Project

After working in the Family Editor to create or modify a family, you can load the family into one or more open projects.

NOTE The projects into which you want to load the family must be open.

1 In the Family Editor, click Load into Project.


If only one project is currently open, the family is loaded into that project, and the project displays in the drawing area.

2 If multiple projects are open, the Load into Projects dialog displays. Select the open projects to receive the family, and click OK.

Saving Loaded Families

You can save a family that is loaded in the current project or template as an RFA file in a location that you specify. You can save the family to a location on your system or to a network location. All family types are saved with the family.

1 Do either of the following:

- Click  ► Save As ► Library ► Family.
- Right-click a family in the Project Browser, and click Save.

2 In the Save Family dialog:

- a If you are using Save As ► Library ► Family, for Family to save, select the family from a list of families loaded in the project.
- b For Save in, navigate to the location in which you want to save the family.
- c Specify the name and file type for the family, and click Save.

Reloading a Family into a Project

1 Click Insert tab ► Load from Library panel ► Load Family.

2 Navigate to the directory containing the family file to reload.

3 Select the family file or files and click Open. The Family Already Exists dialog displays.

4 Do one of the following:

- Click Overwrite the existing version.
- Click Overwrite the existing version and its parameter values.
The parameter values of the existing family are overridden by the parameter values of the family you are loading.

IMPORTANT If the family is used in the building model and you override the parameter values of existing types, the family will update throughout the project with the new values.

- Click Cancel.

TIP When reloading multiple families, you can select Do this for all loading families.

Creating Loadable Families

For detailed information about creating loadable families, see [The Families Guide](#) on page 418. Complete the tutorials in the Families Guide before creating your own families.

Depending on the complexity of the family, the creation process can be time-consuming. If you can identify a family that is similar to the one you want to create, you can save time and effort by copying, renaming, and modifying the family to create the new family.

For best results when creating a family, use the following workflow.

- 1 Before beginning family creation, plan your family. Identify requirements regarding family sizes, how the family displays in different views, whether a host is required, the detail level to be modeled, and the origin of the family.
- 2 Create a new family file with the appropriate family template.
- 3 Define subcategories for the family to help control the visibility of the family geometry.
- 4 Create the family skeleton, or framework:
 - Define the origin (the insertion point) of the family.
 - Lay out reference planes and reference lines to aid in sketching component geometry.
 - Add dimensions to specify parametric relationships.
 - Label dimensions to create type or instance parameters or 2D representation.
 - Test, or flex, the skeleton.
- 5 Define family type variations by specifying different parameters.
- 6 Add a single level of geometry in solids and voids, and constrain the geometry to reference planes.
- 7 Flex the new model (types and hosts) to verify correct component behavior.
- 8 Repeat previous steps until the family geometry is complete.
- 9 Specify 2D and 3D geometry display characteristics with subcategory and entity visibility settings.
- 10 Save the newly defined family, and then load it into a project for testing.
- 11 For large families that include many types, create a type catalog.

Modifying Families in a Project (or Nested Family)

For detailed information about modifying loadable families, see [The Families Guide](#) on page 418.


Within a project or family, you can edit a loaded family and reload it into the same project or any other open projects or families. Before or after reloading the family into the project, you can save the family to a library with the same name or a new name.

- 1 In the drawing area, select the family to edit.
- 2 Do either of the following:
 - Click Modify <Element> tab ► Family panel ► Edit Family.
 - In the drawing area or the Project Browser, right-click the family, and click Edit.

3 In the alert dialog, click Yes to edit the family.

The family opens in the Family Editor. The original project is still open in the background.

4 Modify the family.

5 If you want to save a copy of the modified family, click  ► Save.

6 To load the family into any open projects, on any tab, click Family Editor panel ► Load into Project.

7 In the Load into Projects dialog, select the projects in which you want to load the family, and click OK.

If the family is already loaded into the project, the Family Already Exists dialog displays. Do one of the following:

- Click Overwrite the existing version.

- Click Overwrite the existing version and its parameter values.

The parameter values of the existing family are overridden by the parameter values of the family you are loading.

IMPORTANT If the family is used in the building model and you override the parameter values of existing types, the family will update throughout the project with the new values.

- Click Cancel.

TIP When reloading multiple families, you can select Do this for all loading families.

8 Close the family file.

Creating Parameters

You can create new instance parameters or type parameters for any family type. By adding new parameters, you have more control over the information contained in each family instance or type. You can create dynamic family types for increased flexibility within the model.

For detailed information about family parameters, see [The Families Guide](#) on page 418.

To create parameters

1 In the Family Editor, on any tab, click Family Properties panel ► Types.

2 In the Family Types dialog, click New, and enter a name for the new type.

This creates a new family type that will be available in the Type Selector when you load it into a project.

3 Under Parameters, click Add.

4 In the Parameter Properties dialog, under Parameter Type, select Family parameter.

5 Enter a name for the parameter.

6 Select a discipline.

7 For Type of Parameter, select the appropriate parameter type.

Name	Description
Text	Completely customizable. Can be used to collect unique data.
Integer	A value that is always expressed as an integer.

Name	Description
Number	Used to collect miscellaneous numeric data. Can be defined by a formula. Can also have real numbers.
Length	Can be used to establish the length of an element or subcomponent. Can be defined by a formula.
Area	Can be used to establish the area of an element or subcomponent. Formulas can be used in this field.
Volume	Can be used to establish the length of an element or subcomponent. Formulas can be used in this field.
Angle	Can be used to establish the angle of an element or subcomponent. Formulas can be used in this field.
Slope	Can be used to create parameters that define slope.
Currency	Can be used to create currency parameters.
URL	Provides web link to user defined URL.
Material	Establishes parameters in which a specific material can be assigned.
Yes/No	Used most often for instance properties when the parameter is defined with either a Yes or No.
Family Type	Used with nested components and allows you to swap components after the family is loaded into a project.

8 For Group parameter under, select a value.

After the family is loaded into a project, this value determines which group header the parameter displays under in the Instance Properties dialog.

9 Select either Instance or Type. This defines whether the parameter is an Instance or Type parameter.

10 Click OK.

NOTE To assign a material to a family element, save the family and load it into a project. Place the family in the project and select it. On the Family Properties panel, click Types and set a value for the material parameter.

Creating Family Parameter Links


By linking family parameters, you can control the parameters of families nested inside host families from within a project view. You can control instance parameters or type parameters.

To link parameters, they must be the same type. For example, link a text parameter in the host family to a text parameter in the nested family.

You can link a host-family parameter to more than one nested family parameter of the same type. Also, you can link this parameter to multiple nested families.

To create family parameter links

- 1 Create a family with instance parameters or type parameters of the available types.
- 2 Save the family and load it into a host family.
- 3 With the new family open, click Create tab ► Model panel ► Component drop-down ► Place a Component, and place as many instances of the loaded family as desired.
- 4 Click Manage tab ► Family Properties panel ► Types.
- 5 In the Family Types dialog, under Parameters, click Add.
- 6 Follow the steps for creating a new parameter of the same type as the parameter you want to control in the nested family.
- 7 Click OK to close the Family Types dialog.
- 8 Select an instance of the loaded family in the host family, and click Modify <Element> tab ► Element panel ► Element Properties drop-down ► Instance Properties or Type Properties. For instance properties and type properties, there is a column that has an equal sign (=) in the column heading. Gray buttons next to certain parameters indicate that they can be linked to other parameters.
- 9 Click the button next to a parameter that is of the same type as the one you created in Step 6. For example, if you created a text parameter, you must select a text parameter here.
- 10 In the dialog that appears, select the parameter you created in Step 6 to associate it with the current parameter, and click OK.

NOTE When you associate 2 parameters, an equal sign appears on the button: 

- 11 Click OK to close properties dialog.
- 12 Continue creating the host family, and save it.
- 13 Load the family into a project, and place a few instances of it.
- 14 Select an instance of the family and click Modify <Element> tab ► Element panel ► Element Properties drop-down ► Instance Properties or Type Properties.
- 15 Locate the type or instance property you created.
- 16 Set it to the desired value and click OK.
The nested family changes according to the value you entered.

Family Category and Parameters

The Family Category and Parameters tool assigns the properties of a predefined family category to the component you are creating. The tool is only available within the Family Editor. For example, if you are creating a lighting fixture family, you can select the Lighting Fixtures category, and then select or clear the Always Vertical parameter. If the Always Vertical parameter is selected, this means the family always appears vertical at 90 degrees, even if it is on a sloping host, such as a floor or ceiling.

- 1 In the Family Editor, on any tab, click Family Properties panel ► Category and Parameters.
- 2 From the dialog, select a family category whose properties you want to import into the current family.
- 3 Specify the family parameters.

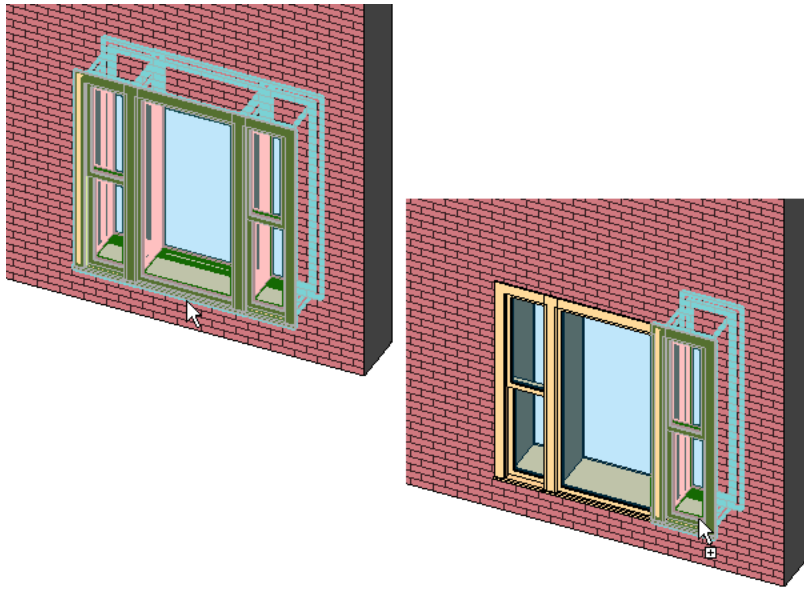
NOTE Family parameter options vary depending on family category.

- 4 Click OK.

Working with Shared Components in a Project

A family that contains nested and shared families works as any other family within a project. However, you can press *Tab* to toggle to the nested and shared components.

Selecting sub-instances of a shared family



If you select a nested instance, you can do the following:

- Click Modify <Element> tab ► Element panel ► Element Properties drop-down ► Instance Properties. In the Instance Properties dialog, modify some parameters, such as Mark and Comments.
- Modify type properties. When you do this, all instances of that type also update to reflect the changes.

If you select a nested instance, you cannot do the following:

- Select and delete a nested instance.
- Mirror, copy, move, or array a nested instance.
If you do this, the entire host family adapts, not just the nested instance.
- Modify the position, the size, or shape of a nested instance.

In-Place Elements

In-place elements are custom elements that you create in the context of a project. Create an in-place element when your project needs unique geometry that you do not expect to reuse or geometry that must maintain one or more relationships to other project geometry.

You can create multiple in-place elements in your projects, and you can place copies of the same in-place element in your projects. Unlike system families and loadable families, however, you cannot duplicate in-place family types to create multiple types.

Although you can transfer or copy in-place elements between projects, you should do so only when necessary, because in-place elements can increase file size and degrade software performance.

Creating an in-place element involves many of the same Family Editor tools as creating a loadable family. For detailed information about creating in-place elements, see [The Families Guide](#) on page 418.

Workflow: Working with In-place Elements

In-place elements are custom elements that you create in the context of a project. Create an in-place element when a project requires unique geometry that you do not expect to reuse or geometry that must maintain one or more relationships to other project geometry.

For detailed information about in-place elements, see [The Families Guide](#) on page 418.

- 1 Identify any unique or single-use element that your project requires. If your project requires an element that will be used in more than one project, create it as a loadable family.
- 2 If your project requires an in-place element that exists in another project (or is similar to one that exists in another project) you can copy the in-place element into your project or load it into your project as a group.
- 3 If you cannot find an in-place element that meets your needs, create a new in-place element in the project.

Creating an In-Place Element

For detailed information about creating in-place elements, see [The Families Guide](#) on page 418. Complete the tutorials in the Families Guide before creating in-place elements.

- 1 In a project, click Home tab ► Build panel ► Component drop-down ► Model In-Place.
- 2 In the Family Category and Parameters dialog, select a category for the element, and click OK.
The category that you choose will be the category under which the family for the in-place element will display in the Project Browser, in which it will schedule, and in which you can control its visibility.
- 3 In the Name dialog, type a name, and click OK.
The Family Editor opens.
- 4 Use the Family Editor tools to create the in-place element.
- 5 When you finish creating the in-place element, click Finish Model.

Connectors

Knowing how to add and remove connectors to loadable families can be useful to architects when using building components, such as manufactured items from Inventor®, or when exporting a building site to civil engineering applications, such as Civil 3D®. For example, you might want to add, move, or delete a connector for a pipe that connects a custom vanity designed in Inventor to a plumbing system in Revit MEP. Or, you might want to modify the connectors on site utilities, such as gas or water connections, before they are exported with the building site. After the building site is imported into Civil 3D, the connectors on the site utilities become fully functional.

When you add connectors to a family, you can specify one of the following disciplines:

- **Duct connectors** are associated with ductwork, duct fittings, and other elements that are part of the air handling systems.
- **Electrical connectors** are used for any type of electrical connections, including power, telephone, alarm systems, and others.
- **Pipe connectors** are used for piping, pipe fittings, and other components that are meant for transmitting fluids.

NOTE The term fluid does not necessarily limit the use of piping systems to liquids. Steam, medical gases and other non-fluid materials are often transmitted using piping systems.

Selecting the correct discipline is critical to the content working correctly. After this selection is made, it cannot be changed without first deleting the connector and adding it again with the correct discipline.

Before you begin creating Revit families that include connectors, you should learn how to create families. For more information, see [The Families Guide](#) on page 418.

For information about working with other applications and Revit Architecture families with connectors, see [Exporting Building Sites](#) on page 1376 and [Importing Building Components](#) on page 1398.

Working with Connectors

You can place connectors using one of the following methods:

■ Place on Face

This option (Edge loop centered=true) maintains its point at the center of the edge loop. In most cases, this is the preferable method for placing a connector. Typically the Place on Face option is easier to use, and is suitable for most cases.

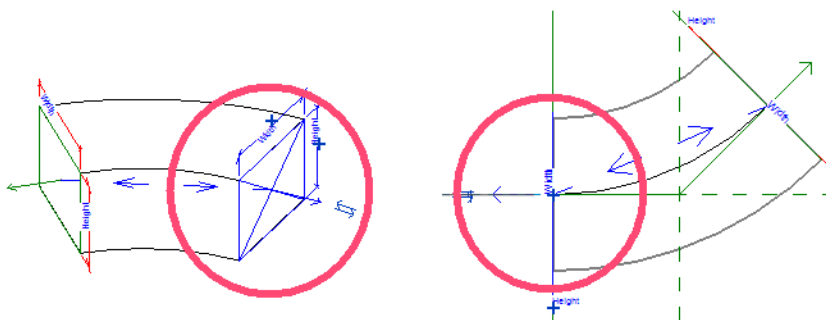
■ Place on Work Plane

This option allows placement of the connector on a selected plane. For many cases, you can imitate the Place on Face option by specifying a plane and using dimensions to constrain the connector to the desired location. However, this method generally requires additional parameters and constraints to be used effectively.

Connector Orientation

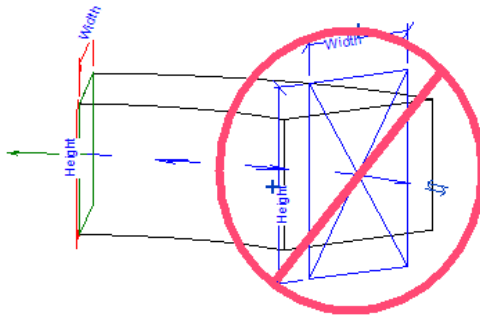
Fittings (pipe and duct fittings) expect the instance origin of the family to be the intersection of the connectors. In most cases for fittings, there is a point on the fitting where all of the connectors (if extended into the fitting) will collide. Fittings expect this collision to be placed at the original intersection of the Center (Front / Back), Center (Left / Right), and Reference Level work planes. For this reason, it is good practice to pin these reference planes before beginning to build the family.

When you place fitting connectors, the primary connector must be placed on the face that is on the X-axis. Crosshairs display indicating that this is the primary connector. You can verify this by viewing the face in a floor plan view. Unexpected behavior can result if the primary connector is not properly placed relative to the other connectors, and if all connectors are not properly rotated and linked.

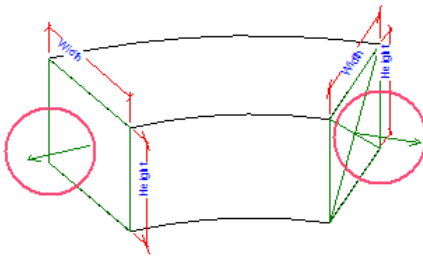


Connector rotation is a critical part of connector placement. The connector orientation determines the correct orientation of the objects that are automatically inserted on the part. Although this is not as important for round connectors, it is extremely important for rectangular connectors such as those on rectangular duct fittings. For rectangular connectors, the rectangular connector must be oriented so that the width is assigned to the face that is on the X and Y axes. The height is not on these axes. If rectangular connectors are not

rotated properly, the rectangular duct fitting will be inserted improperly, creating an unexpected result. You may find it easier to rotate connectors in a 3D view, where the part geometry is clearly visible.



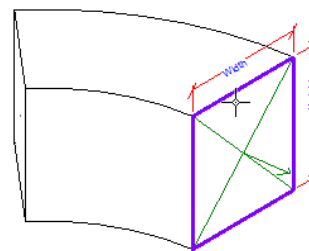
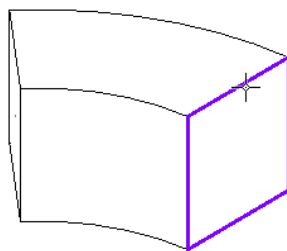
Connector arrows indicate the direction of a duct or pipe (extrusion) when it is being created to complete a connection. It does not indicate flow direction. In most instances, a connector arrow points outward away from the object to which the connector is associated. Otherwise, the duct or pipe when created will pass through the object geometry instead of away from it. You can modify the connector arrow direction by selecting the connector and clicking the flip arrows.



Placing a Connector

Place a Connector on a Face

- 1 In the Project Browser, double-click Views (all) ► 3D Views ► 3D, and spin the model to view the face where you want to place a connector.
The first connector that you place for a specific type is assigned as the primary connector. You can [change the assignment](#) on page 438 later.
- 2 Click Create tab ► Connectors panel, and click a connector type, such as (Duct Connector).
- 3 Place the cursor over the face that is on the X axis. After the edges highlight, click to place the primary connector. (By default, is already selected.)
The primary connector is placed.

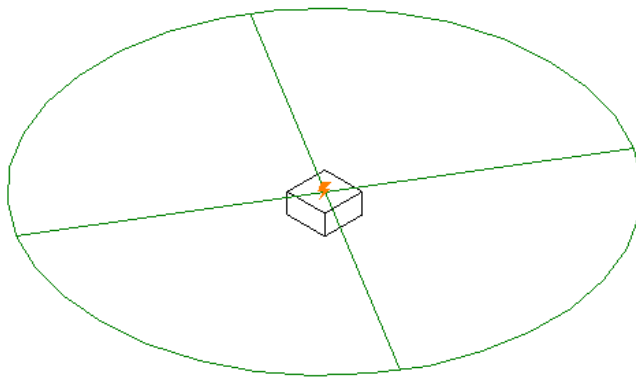


- 4 Select the connector and specify instance properties as needed.

The sizes and orientation that you specify determines how connections are made with compatible components. You can enter parameter values or associate them with family parameters for the component.

Place a Connector on a Work Plane


- 1 Open a plan view and a 3D view where you want to place a connector.
The first connector that you place for a specific type is assigned as the primary connector. You can [change the assignment](#) on page 438 later.
- 2 Click Create tab ► Connectors panel, and click a connector type (Electrical, Duct, or Pipe).
For example, click (Electrical Connector), and click Place Electrical Connector tab ► Placement panel ► Work Plane.
- 3 In the Work Plane dialog, select the work plane where you want to place the connector, and click OK.
In this example, an electrical connector is placed on the top work plane of a junction box.



- 4 Select the connector, move it, and specify instance properties as needed.
You can enter parameter values or associate them with family parameters for the component.

Selecting a Primary Connector

The first connector that you place for a specific type is assigned as the primary connector. However, you can change the connector assignment at any time. You select the connector that is placed on the X-axis as the primary connector.

- 1 Open a view that allows you to select the connector that will be assigned as primary.
- 2 Select a connector on the component, and click Modify Connector Element tab ► Primary Connector panel ►  .
Crosshairs display on the primary connector.

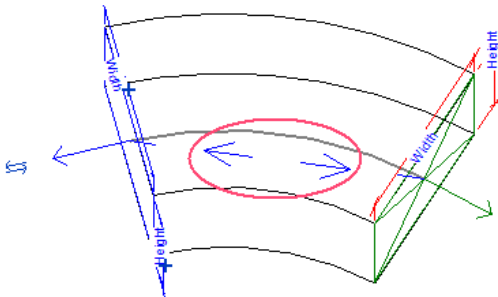
Orienting a Connector

When connectors are added, you must verify that connector arrows point in the direction from which other components can connect, and that the width and height are properly oriented with respect to the component dimensions.

- 1 In the Project Browser, open a 3D view that allows you to select the connector that will be oriented.
- 2 To specify the direction for the connector arrow, select the connector, and click the flip control.
- 3 To rotate the connector, select the connector, and click Modify Connector Element tab ► Modify panel ► Rotate.

Linking Connectors

- 1 Open a view containing the connectors being linked.
 - 2 Select a connector.
 - 3 Click Modify Connector Element tab ► Connector Links panel ► Link Connectors. Then select the connector that will be linked to the first connector.
 - 4 Select either of the linked connectors.
- Arrows display between the connectors to indicate the link.



Unlinking Connectors

- 1 Open a view containing the connector being unlinked.
 - 2 Select either of 2 linked connectors.
 - 3 Click Modify Connector Element tab ► Connector Links panel ► Remove Link.
- The link is removed.

Deleting a Connector

- 1 Open a view containing the connector being deleted.
- 2 Select the connector, and press *Delete* or click Modify Connector Element tab ► Modify panel ► Delete.

Connector Properties

The discipline assigned to a connector determines its properties. The following tables show the different connector parameters, by property group, for each discipline and a brief description of their functionality.

Electrical	
Constraints	
Edge loop centered	Connector placement method (read only).

Graphics

Size on screen	Size of the connector display inside the Family Editor.
----------------	---

Electrical - Loads

True Load Phase 3	Calculated based on (Apparent Load Phase 3) x (Power Factor).
True Load Phase 2	Calculated based on (Apparent Load Phase 2) x (Power Factor).
True Load Phase 1	Calculated based on (Apparent Load Phase 1) x (Power Factor).
Power Factor	Percentage of power attributed to this connector. Active only when Power is specified as System Type.
Apparent Load Phase 3	Calculated based on (Voltage) x (Current - Phase 3). Active only when Balanced Load is False and System Type is Power, and Number of Poles >2.
Apparent Load Phase 2	Calculated based on (Voltage) x (Current - Phase 2). Active only when Balanced Load is False and System Type is Power, and Number of Poles >1.
Apparent Load Phase 1	Calculated based on (Voltage) x (Current - Phase 1). Active only when Balanced Load is False and System Type is Power.
Apparent Load	Calculated based on (Voltage) x (Current). Active only when Balanced Load is True and System Type is Power.
Voltage	The voltage specified on the connector. Active only when the System Type is Power.
System Type	Possible values are: Data, Power - Balanced, Power - Unbalanced, Telephone, Security, Fire Alarm, Nurse Call, Controls, Communication.
Load Classification	Possible values are: HVAC, Lighting, Power, Other.
Power Factor State	Possible values are: Lagging, Leading.
Number of Poles	Possible values are: 1, 2, or 3.

Identity Data

Index	A unique identifier for a connector in a family (read only).
Primary Connector	Possible values are: True or False (read only). A single connector of each discipline is allowed to be primary in each family. The family's electrical data that displays in a schedule is derived from the primary connector.
Connector Description	A description of the connector.
Utility	Indicates whether the connector is exported on a site utility to an Autodesk Exchange file (ADSK). See Importing Building Components on page 1398.

Mechanical (HVAC)

Constraints

Edge loop centered	Connector placement method (read only).
Angle	Used for adjustable angle families (such as elbows and adjustable tees) to push the angle value into the family from connected components.
Graphics	
Size on screen	Size of the connector display inside the Family Editor.
Mechanical	
Flow Factor	Percentage of the system flow attributed to this connector. Active only when the Flow Configuration is System.
Loss Coefficient	Active only when the Loss Method is Coefficient.
Flow Configuration	Possible values are: Calculated, Preset, System.
Flow Direction	Possible values are: In, Out, Bidirectional.
System Type	Possible values are: Supply, Return, Exhaust, Other, Undefined.
Loss Method	Possible values are: Not Defined, Coefficient, Specific Loss.
Mechanical - Airflow	
Pressure Drop	Active only when the Loss Method is Specific Loss.
Flow	The amount of air flowing at this connector.
Dimensions	
Shape	Possible values are: Rectangular or Round.
Height	The height of the connector when the Shape is defined to be rectangular.
Width	The width of the connector when the Shape is defined to be rectangular.
Radius	The radius of the connector when the Shape is defined to be round.
Identity Data	
Index	A unique identifier for a connector in a family (read only).
Primary Connector	Possible values are: True or False (read only). A single connector of each discipline is allowed to be primary in each family. The family's HVAC data that displays in a schedule is derived from the primary connector.
Link Connector Index	The index of the linked connector, -1 if none. (read only).
Connector Description	A description of the connector.

Utility	Indicates whether the connector is exported on a site utility to an Autodesk Exchange file (ADSK). See Importing Building Components on page 1398.
Mechanical (Piping)	
Constraints	
Edge loop centered	Connector placement method (read only).
Angle	Used for adjustable angle families (such as elbows and adjustable tees) to push the angle value into the family from connected components.
Graphics	
Size on screen	Size of the connector display inside the Family Editor.
Mechanical	
Fixture Units	Active only when the System Type is Sanitary, Domestic Hot Water, or Domestic Cold Water and the Flow Configuration is Fixture Units.
K Coefficient	K Coefficient (K Factor) is only editable if Loss Method is specified as "K Coefficient".
Flow Factor	Percentage of the system flow attributed to this connector. Active only when the Flow Configuration is System.
Flow	Volumetric flow rate of fluid through connector.
Pressure Drop	Active only when the Loss Method is Specific Loss
Flow Configuration	Possible values are: Calculated, Preset, System.
Flow Direction	Possible values are: In, Out, Bidirectional. Bidirectional is active only when the Flow Configuration is Calculated.
Loss Method	Possible values are: Not Defined, K Coefficient from Table, K Coefficient, Specific Loss.
Allow Slope Adjustments	Possible values are: Checked or unchecked.
System Type	Possible values are: Undefined, Hydronic Supply, Hydronic Return, Sanitary, Domestic Cold Water, Domestic Hot Water, Fire Protection, Other.
K Coefficient Table	Possible values are: Bell Mouth Inlet or Reducer, Inward Projecting Pipe, Outlet, Square Edged Inlet. Active only when the Loss Method is K Coefficient from Table.
Dimensions	
Radius	The nominal size of the connector.
Identity Data	
Index	A unique identifier for a connector in a family (read only).

Primary Connector	Possible values are: True or False (read only). A single connector of each discipline is allowed to be primary in each family. The family's piping data that displays in a schedule is derived from the primary connector.
Link Connector Index	The index of the linked connector, -1 if none. (read only).
Connector Description	A description of the connector.
Utility	Indicates whether the connector is exported on a site utility to an an Autodesk Exchange file (ADSK). See Importing Building Components on page 1398.

Customizing Project Settings

10

Revit Architecture provides many options for project customization, including creating templates, customizing fill patterns and materials, creating view templates, and much more.

Creating a Custom Project Template

Project templates provide initial conditions for a project. Several templates are provided with Revit Architecture, or you can create your own. Any new project based on the template inherits all families, settings (such as units, fill patterns, line styles, line weights, and view scales), and geometry from the template. For more information on what you can include in a project template, see [Project Template Settings](#) on page 446.


There are various methods you can use to create a custom project template:

- Open an existing template file, modify the settings as necessary, and save it as a new template (RTE) file.
- Start with a blank project file, define all settings for it, and then save it as a template (RTE) file.
- Start with a blank project file and specify all names for views, levels, and viewports. You can create a set of drawings by creating sheets and adding views to the sheets. As you start to draw the geometry in those views, the views on the sheets update. See [Sheets](#) on page 1030 and [Adding Views to a Sheet](#) on page 1033.
- Start with a project that includes geometry that can be used as a base for new projects. For example, if you have defined geometry for a college campus and want to include that geometry in multiple new projects for the college, save the project with the geometry as a template. Each time you open a project with this template, the geometry is included.

Templates use the file extension RTE.

For information about using a custom template when starting a new project, see [Starting a New Project Using a Template](#) on page 118.

Creating a Template

1 Click  ► New ► Project.

2 In the New Project dialog, under Template file, select:

- None to create your template from a blank project file.
- Browse to base your template on an existing project template. Navigate to the template location.

3 Under Create new, select Project template.

4 Click OK.

NOTE If you do not base the template on an existing template, the Select Initial Units dialog displays. Specify either Imperial or metric units.

5 Define settings.

6 Create any geometry that will be used as a base in future projects.

7 Click  ► Save As ► Template.

8 Enter a name and select a directory for the template.

9 Click Save.

Project Template Settings

In a Revit Architecture project template, you can predefine the following:

- Project information. This includes information such as the name of the project, the project number, the client name, and so on. See [Specifying Project Information](#) on page 447.
- Project settings. For example, you can predefine line styles for components and lines, fill patterns for materials, project units, snapping increments for model views, and so on. Most project settings are described in [Customizing Project Settings](#) on page 445.
- Families. These include system families and loaded families. You can modify or duplicate system families (for example, walls) as necessary for a project. You can also load families, for example, commonly used families, custom families, and titleblocks. See [Loading Families](#) on page 427 and [Title Blocks](#) on page 1046.
- Project views. Predefine plan views, levels, schedules, legends, sheets, and so on. See [Project Views](#) on page 125.
- Visibility/graphic settings. Visibility and graphic settings are specified for the project in the Object Styles dialog. See [Object Styles](#) on page 493. If necessary, you can override settings on a view-by-view basis. See [Visibility and Graphic Display in Project Views](#) on page 198.
- Print settings. Predefine printers and print settings. See [Print Setup](#) on page 1081.
- Project and shared parameters. Predefine project parameters and identify a shared parameter file. See [Custom Parameters](#) on page 450.

NOTE You cannot include worksets in project templates.

Transferring Project Standards

You can copy project standards from one project and apply them to another. Project standards include family types (this includes system families, but not loaded families), line weights, materials, view templates, and object styles.

You can specify which standards to copy. Any object referenced by an object that will be copied is included in the transfer. For example, if you select a wall type and forget to copy the material, Revit Architecture copies it.

To transfer project standards:

- 1 Open both the source and target projects.
- 2 In the target project, click Manage tab ► Project Settings panel ► Transfer Project Standards.
- 3 In the Select Items to Copy dialog, select the source project for Copy from.
- 4 Select the desired project standards. To select all project standards, click Check All.
- 5 Click OK.
- 6 If the Duplicate Types dialog opens, select from the following options:
 - Overwrite: Transfers all new project standards, and overrides duplicate types.
 - New Only: Transfers all new project standards, and ignores duplicate types.
 - Cancel: Cancels the operation.

Specifying Project Information

- 1 Click Manage tab ► Project Settings panel ► Project Information.
- 2 In the Instance Properties dialog, specify the following:
 - Energy Data - specifies parameters that define values that are exported to a gbXML file. See [Specifying Energy Analysis \(gbXML\) Settings](#) on page 447.
 - Project Issue Date.
 - Project Status.
 - Client Name.
 - Project Address: Click Edit, enter the address in the text box, and click OK.
 - Project Name.
 - Project Number.
- 3 Click OK.

Project information can be included in schedules that contain elements from linked models. It can also be used in title blocks on sheets.

Related topics

- [Including Elements from Linked Models in a Schedule](#) on page 177
- [Specifying Title Block Information for Sheets](#) on page 1037
- [Creating Shared Project Parameters](#) on page 459
- [Adding Custom Fields to a Title Block](#) on page 1054

Specifying Energy Analysis (gbXML) Settings

You can define the gbXML information that can be used by third-party energy analysis software.

gbXML settings specify the parameter values used by third-party software applications when calculating energy use. The following parameters must be specified prior to exporting the building model to a gbXML file for use with an energy analysis application:

- Building Type - specifies the type of building according to the gbXML schema 0.37 (similar to ASHRAE).
- Postal Code - determinates the location of the building.
- Ground Plane - specifies the level that serves as the ground level reference for the building. Surfaces below this level are considered to be underground. The default level is zero.
- Project Phase - specifies the stage of construction (Existing, New Construction).
- Sliver Space Tolerance - specifies the tolerance for areas that will be considered sliver spaces.

To specify gbXML settings:

- 1 Click Manage tab ► Project Settings panel ► Project Information.
- 2 In the Instance Properties dialog, click Edit for the Energy Data parameter.
The Type Properties dialog opens.
- 3 In the Type Properties dialog, do the following:
 - For Building Type, select one of the predefined values.
 - For Postal Code, enter a valid postal code.
 - For Project Phase, select Existing or New Construction.
 - For Sliver Space, specify a tolerance value for sliver spaces. All areas that are within the sliver space tolerance are considered sliver spaces.
- 4 Click OK twice.

Project Location and Orientation

When you create a project, specify the project location on the globe using the nearest major city or the latitude and longitude. This project-wide setting is useful for generating location-specific shadows for views that use them, such as solar studies, walkthroughs, and rendered images.

You can also rotate a view to reflect True North (instead of Project North, which is the top of the view). This procedure ensures that natural light falls on the correct side of the building model to produce realistic shadows for solar studies, walkthroughs, and rendered images.

Related topics

- [Shared Positioning](#) on page 1296
- [Relocating and Mirroring a Project](#) on page 1300
- [Mirroring a Project](#) on page 1301

Specifying the Project Location

- 1 Click Manage tab ► Project Location panel ► Location.
The Manage Place and Locations dialog opens.
As an alternative, you can access the Manage Place and Locations dialog from the [Sun and Shadow Settings dialog](#) on page 253.

- 2 Click the Place tab.
- 3 Specify the project location using one of the following methods:
 - **Nearest major city:** For City, select a city from the list.
 - **Exact location:** Enter values for Latitude and Longitude.
- 4 If you want shadows to reflect daylight savings time for the specified location, select Automatically adjust clock for daylight savings changes.
- 5 Click OK.

Related topics

- [Defining Named Locations](#) on page 1296
- [Setting up Shadow Studies](#) on page 253
- [Rendering an Image](#) on page 1220
- [Solar Studies](#) on page 1241

Rotating a View to True North

- 1 Open a plan view.

NOTE If you need to rotate a 3D view to True North, use the ViewCube. See [ViewCube](#) on page 217.

- 2 Change the view orientation to True North, as follows:
 - a Click View tab ► Graphics panel ► View Properties.
 - b In the Instance Properties dialog, for Orientation, select True North, and click OK.

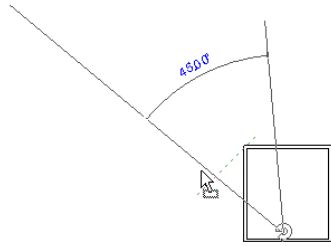
This change allows you to see accurate shadows in the plan view. See [Casting Shadows](#) on page 253.

- 3 Rotate the project to True North, as follows:
 - a Click Manage tab ► Project Location panel ► Position drop-down ► Rotate True North.
 - b Rotate the building model, using one of the following methods:
 - On the Options Bar, for Angle from Project to True North, enter a value to set the angle of rotation.
For example, if the difference between Project North (the top of the view) and True North is 45 degrees, enter 45. The model rotates in the view to the specified angle.
 - Click in the view to rotate the model to True North graphically (similar to using the [Rotate tool](#)).

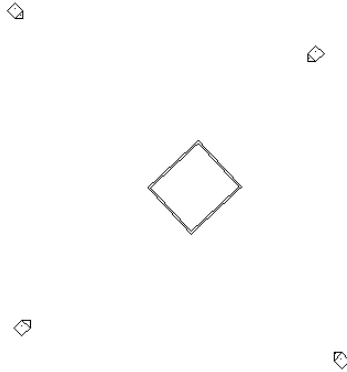
Related topics

- [Project Location and Orientation](#) on page 448
- [Shared Positioning](#) on page 1296

Rotating a building model in a plan view that is oriented to True North



Plan view with the building model rotated to True North



Rotating Project North

Drafting conventions dictate that Project North is the top of the view. If you need to change Project North, use the Rotate Project North tool. This tool changes Project North for all views in the project.

- 1 Click Manage tab ► Project Location panel ► Position drop-down ► Rotate Project North.
- 2 In the Rotate Project dialog, select the desired option.
- 3 Click OK.

A message displays to indicate that the project was rotated. It also shows errors, if any. You can export errors to review and correct them. See [Exporting Warnings to a File](#) on page 1416.

Custom Parameters

You can create custom parameters for any element or component category in your project. Parameters that you create display in the Instance or Type Properties dialog under the group you define and with the values you define.

There are 2 types of custom parameters:

■ Shared parameters

Shared parameters can be shared with other projects or families. Use shared parameters when the same piece of information must exist in more than one project or family.

For example, if a parameter in a family or a project needs to be tagged, that parameter must exist in the project (or element family) and the tag family. Therefore, taggable parameters need to be shared parameters. Shared parameters can also be used when elements of 2 different families are scheduled together. For example, if you need to create 2 different Isolated Foundation families, and need the Thickness parameter of both families scheduled in the same column, Thickness needs to be a shared parameter that is loaded in both Isolated Foundation families.

■ Project parameters

Project parameters are specific to a single project file. Information stored in project parameters cannot be shared with other projects. A project parameter can be used, for example, to categorize views within a project.

Shared Parameters

Shared parameters are parameters that you can add to families or projects and then share with other families and projects. They give you the ability to add specific data that is not already predefined in the family file or the project template.

Shared parameters are particularly useful when you want to create a schedule that displays various family categories; without a shared parameter, you cannot do this. If you create a shared parameter and add it to the desired family categories, you can then create a schedule with these categories. This is called creating a multi-category schedule in Revit Architecture.

Shared parameters are stored in a file independent of any family file or Revit Architecture project; this allows you to access the file from different families or projects.

Categories Allowing Shared Parameters

Only certain categories within Revit Architecture allow shared parameters. This table lists the categories that allow them.

Family Categories Allowing	Additional Categories
Casework	Areas
Ceilings: created as in-place families	Drawing Sheets
Columns	Structural Beam Systems
Curtain Panels	Structural Columns
Curtain Wall Mullions	Structural Connections
Doors	Structural Foundations
Electrical Equipment	Structural Framing
Electrical Fixtures	Structural Rebar
Floors: created as in-place families	
Furniture	
Furniture Systems	
Generic Models	
Lighting Fixtures	
Mechanical Equipment	
Parking	

Family Categories Allowing	Additional Categories
Planting	
Plumbing Fixtures	
Railings	
Ramps	
Roofs	
Rooms	
Site	
Specialty Equipment	
Stairs	
Structural Columns	
Structural Foundations	
Walls	
Windows	

Setting Up Shared Parameter Files

You can create shared parameters in the project environment or in the Family Editor. Shared parameters are saved in a text file; you can then place this file in a shared area on your network to allow others to access it.

Shared parameters are organized in groups that you create to assist with categorization. For example, you might create a group called electrical for specific electrical parameters or a hardware group for specific hardware parameters. You can create as many groups and parameters as desired.

Your session of Revit Architecture can reference only one shared parameter file at a time. If there are other shared parameters in a different file that you want in the active shared parameter file, you need to export the parameters to the active file.

Creating Shared Parameters Files, Groups, and Parameters

- 1 Click Manage tab ► Project Settings panel ► Shared Parameters.

The Edit Shared Parameters dialog opens.

- 2 Click Create.

- 3 In the Create Shared Parameter File dialog, enter a file name, and navigate to the desired location.

- 4 Click Save.

To add groups:

- 5 In the Groups box, click New.

- 6 Enter a name for the parameter group, and click OK.

To add parameters:

7 From the Parameter group drop-down menu, select a group.

8 In the Parameters group box, click New.

9 In the Parameter Properties dialog, enter a name, discipline, and type for the parameter.

Type specifies the format of the information you can enter for the parameter value. You can select:

- Text
- Integer
- Number
- Length
- Area
- Volume
- Angle
- Slope
- Currency
- URL
- Material. Allows you to select a material from the Materials dialog when you edit the parameter value in the Instance or Type Properties dialog.
- Yes/No. A check box appears for the parameter value in the Instance or Type Properties dialog.
- <Family Type>. If you select this option, the Select Category dialog opens where you can select the family type.

NOTE You do not specify the parameter to be instance or type. You decide that later when you add the parameter to a family or a project.

10 When finished creating parameters, click OK.

Related topics

- [Shared Parameters](#) on page 451
- [Categories Allowing Shared Parameters](#) on page 451
- [Setting Up Shared Parameter Files](#) on page 452
- [Viewing, Moving, and Deleting Shared Parameters](#) on page 454

Renaming Parameter Groups

1 Click Manage tab ► Project Settings panel ► Shared Parameters.

2 In the Edit Shared Parameters dialog, select the group from the Parameter group menu.

3 Click Rename.

4 Enter the new name, and click OK.

Deleting Parameter Groups

- 1 Click Manage tab ► Project Settings panel ► Shared Parameters.
- 2 In the Edit Shared Parameters dialog, select the group from the Parameter group menu.
- 3 Delete or move all parameters from the group.
- 4 Click Delete from the Groups box.

Viewing, Moving, and Deleting Shared Parameters

After you create shared parameters, you cannot rename them or change their type. You can do the following:

- View their properties.
To view the properties of a parameter, such as its value type, click Manage tab ► Project Settings panel ► Shared Parameters. In the Edit Shared Parameters dialog, select the parameter from the Parameters pane and click Properties from the Parameters group box.
- Move them to another parameter group.
To move a parameter to another group, click Manage tab ► Project Settings panel ► Shared Parameters. In the Edit Shared Parameters dialog, select the parameter from the Parameters pane and click Move from the Parameters group box. Choose another group from the menu and click OK.
- Delete them.
To delete a parameter, click Manage tab ► Project Settings panel ► Shared Parameters. In the Edit Shared Parameters dialog, select the parameter from the Parameters pane and click Delete from the Parameters group box.

WARNING Use care when deleting shared parameters since they may be used in other projects. If you delete a parameter and then create another parameter with the same name, Revit Architecture does not consider it to be the same parameter.

Adding Shared Parameters to Families

You add shared parameters to families in the Family Editor.

- 1 Start creating a family or open an existing one.
- 2 Click Manage tab ► Family Properties panel ► Types.
- 3 In the Family Types dialog, under the Parameters group box, click Add.
- 4 In the Parameter Properties dialog, select Shared parameter. If this option is not enabled, check to be sure you are working with a valid family category. See [Categories Allowing Shared Parameters](#) on page 451.
- 5 Click Select and choose the appropriate shared parameter from the appropriate parameter group.
- 6 If desired, click Edit; this returns you to the Edit Shared Parameters dialog, where you can open a different shared parameter file or add new parameters.
- 7 Choose whether to store the parameter by instance or type.
For more information on instance and type properties, see [Modifying Type Properties](#) on page 121.
- 8 Click OK.
The parameter name appears in the Family Types dialog.
- 9 Enter a value for the shared parameter or create a formula to calculate its value.
- 10 Click OK when finished entering values.

- 11 Save the family and load it into a project.

Shared and Family Parameters

If you click the Modify button in the Family Types dialog, the Parameter Properties dialog opens. You can replace a shared parameter with a family parameter or a family parameter with a shared parameter. Family parameters are specific to one family. You can also replace one shared parameter with another.

Exporting Shared Parameters to a Shared Parameter File

You can export shared parameters to a new shared parameter file if the old parameter file is deleted, or if there are shared parameters in a family or a project that are not in the current shared parameter file.

Before you can export them, you must already have added the shared parameters into a Revit Architecture project file or family file. For more information on adding shared parameters, see [Adding Shared Parameters to Families](#) on page 454 and [Project Parameters](#) on page 458.

- 1 Create or open a shared parameter file.

For more information on creating shared parameter files, see [Setting Up Shared Parameter Files](#) on page 452.

- 2 Select a shared parameter in either a family or a project.

- 3 Click Modify.

- 4 In the Parameter Properties dialog, click Export.

NOTE The Export option is never enabled if the selected shared parameter is already in the current shared parameter file.


An informational message appears informing you that the shared parameter will be exported to the shared parameter file you set up in Step 1.

- 5 Click OK to complete the export.

Tagging with Shared Parameters

Shared parameters are available for both single- and multi-category tags. You can apply a multi-category tag to any kind of component, regardless of its category, by applying a filter parameter to a tag.

Creating a Single-Category Tag

- 1 Click  ► New ► Annotation Symbol, select a template (such as, Door Tag.rft) and click Open.

The Family Editor opens.

- 2 Click Create tab ► Annotate panel ► Label.


- 3 Click in the drawing area. The Edit Label dialog opens.

- 4 Click  (Add Parameter).

- 5 In the Parameter Properties dialog, click Select and select the shared parameter to add to the label.


- 6 Click OK twice.

The selected parameter displays in the Category Parameters list.

- 7 Select the shared parameter from the Category Parameters list and click  (Add parameters to label).
- 8 Click OK.
- 9 Create the tag using the Lines tool and save the file.

When you tag instances of the category in the project, the tag label displays a value only if those category instances have the external parameter. For example, you create a door tag with the shared parameter Door Trim Finish. You can then tag all doors with that tag, but the tag displays a value for Door Trim Finish only if the door has that shared parameter, otherwise a “?” appears in the tag.

Creating a Multi-Category Tag

- 1 Click  ► New ► Annotation Symbol, select the Multi-Category Tag.rft template for imperial, or M_Multi-Category Tag.rft for metric, and click Open.
The Family Editor opens.

- 2 Click Create tab ► Annotate panel ► Label.


- 3 Click in the drawing area. The Edit Label dialog opens.

- 4 Click  (Add Parameter).

- 5 In the Parameter Properties dialog, click Select and select the shared parameter to add to the label.

- 6 Click OK twice.

The selected parameter displays in the Category Parameters list.

- 7 Select the shared parameter from the Category Parameters list and click  (Add parameters to label).
- 8 Select an option for Filter Parameter at the bottom of the dialog. With this option set, a tag attaches only to a component with that same filter parameter.

NOTE If you do not specify a filter parameter for the tag, the tag cannot attach to any component. A multi-category tag must have a label with a shared parameter set as a filter parameter.

- 9 Click OK.

- 10 Create the tag using the Lines tool and save the file.

TIP If you want to change the filter parameter for the tag, click Manage tab ► Family Properties panel ► Category and Parameters. Change the value of Filter Parameter in the dialog.

Using the Multi-Category Tag in a Project

You can include shared parameters in tags for system families, such as rooms, walls, and stairs.

- 1 Load the multi-category tag into a project.
- 2 Place several components into the project that have the specific shared filter parameter.
- 3 Click Annotate tab ► Tag panel ► Multi-Category.

- 4 If necessary, click Multi-Category tab ► Element panel, and from the Type Selector, select the multi-category tag you loaded.
- 5 As you move the cursor in the drawing area, you can highlight only those components that have the filter parameter.
- 6 Click to place the tag.

TIP You can also use the Tag All tool to quickly tag components with the filter parameter. Click Annotate tab ► Tag panel ► Tag All. In the Tag All Not Tagged dialog, select the multi-category tag and click OK.

Related topics

- [Creating a Multi-Category Tag](#) on page 456
- [Tagging with Shared Parameters](#) on page 455
- [Shared Parameters](#) on page 451

Schedules with Shared Parameters

You can schedule shared parameters in both single- and multi-category schedules.

Creating a Single-Category Schedule

Follow the procedure for creating multi-category schedules. For more information, see [Creating a Multi-Category Schedule](#) on page 457. In place of <Multi-Category>, choose the appropriate category, such as doors or windows. Also, the Filter tab is not available for a single-category schedule.

Creating a Multi-Category Schedule

- 1 Place several components into your project that have shared parameters.
- 2 Click View tab ► Create panel ► Schedules drop-down ► Schedule/Quantities.
- 3 In the New Schedule dialog, select <Multi-Category> from the Category list.
- 4 In the Fields tab of the Schedule Properties dialog, you notice that shared parameters are available as schedulable fields. Add the appropriate shared parameter to the scheduled fields list.
- 5 Click the Filter tab in the Schedule Properties dialog and choose the shared project parameter you just added. Only components that have this parameter display in the schedule.

NOTE If you do not specify a filter parameter for the schedule, then all family categories in your project that can have a shared project parameter will display in the schedule. See [Categories Allowing Shared Parameters](#) on page 451.

- 6 Format the rest of the schedule as desired. For more information, see [Specifying Schedule Properties](#) on page 176.
- 7 When finished, click OK.

The schedule lists all components with the shared parameter.

TIP You can modify or add a shared parameter in the Fields tab of the Schedule Properties dialog. To modify a shared parameter, select it and click Edit under Scheduled fields. To add a new parameter, click Add Parameter. In both cases, the Parameter Properties dialog opens.

Project Parameters

Project parameters are parameters you define and then add to multiple categories of elements in a project. They are specific to the project and cannot be shared with other projects. You can then use those project parameters in multi-category or single-category schedules. See [Schedules with Shared Parameters](#) on page 457.

Creating Project Parameters

- 1 Click Manage tab ► Project Settings panel ► Project Parameters.
- 2 In the Project Parameters dialog, click Add.
- 3 In the Parameter Properties dialog, select Project parameter.
- 4 Enter a name for the project parameter.
- 5 Select a discipline.
- 6 Select the Type of Parameter.

Parameter Type	Description
Text	A value that is entered as text. This value is completely customizable.
Integer	A value that is expressed as an integer.
Number	A value that is numeric. Can have real numbers.
Length	A value that is the length of an element or sub-component.
Area	A value that is the area of an element or sub-component.
Volume	A value that is the volume of an element or sub-component.
Angle	A value that is the angle of an element or sub-component.
Slope	Can be used to create parameters that define slope.
Currency	Can be used to create currency parameters in addition to the default Cost parameter.
URL	Provides a web link to a user-defined URL.
Material	A value that is the material for the element.
Yes/No	Used most often for instance properties when the parameter is defined with either a Yes or No.

- 7 Under Group parameter under, select the heading under which the parameter should display in the Instance or Type Properties dialog.
- 8 Choose whether the parameter is stored by instance or type.
For more information on instance and type properties, see [Modifying Type Properties](#) on page 121.
- 9 Select the element categories to which you want to apply this parameter.
- 10 Click OK.

Creating Shared Project Parameters

- 1 Click Manage tab ► Project Settings panel ► Project Parameters.
- 2 In the Project Parameters dialog, click Add.
- 3 In the Parameter Properties dialog, under Parameter Type, select Shared parameter, and click Select.
- 4 In the Shared Parameters dialog, select the appropriate parameter from the appropriate parameter group, and click OK.

If you click Edit, the Edit Shared Parameters dialog displays. From this dialog, you can open a different shared parameter file or add new parameters. See [Creating Shared Parameters Files, Groups, and Parameters](#) on page 452.
- 5 In the Parameter Properties dialog, under Categories, select the categories to which you want to apply this parameter.

If the shared parameter provides project-specific information, select the Project Information category. You can then click Manage tab ► Project Settings panel ► Project Information to see or change the parameter's value.

If the shared parameter provides sheet-specific information, select the Drawing Sheet category. The parameter is then listed in each sheet's view properties.

TIP If you add a shared parameter to the Drawing Sheets or Project Information category, you can add the parameter to a titleblock family, so you can have custom parameters on the titleblock. See [Adding Custom Fields to a Title Block](#) on page 1054.

- 6 Under Parameter Data, select Instance or Type to store the parameter by element instance or family type.

For more information on instance and type properties, see [Modifying Type Properties](#) on page 121.
- 7 For Group parameter under, select the heading under which the parameter should display in the Instance or Type Properties dialog.
- 8 Click OK.

Fill Patterns

Fill patterns control the appearance of surfaces that are cut or shown in projection. Use the Fill Patterns tool to create or modify drafting and model patterns.

Model Patterns

Model patterns represent actual element appearance on a building, such as brick coursing or ceramic tile on a wall, and are fixed with respect to the model. This means they scale with the model, so as the view scale changes, the pattern scales accordingly.

Lines in model patterns represent actual lines on a building object, such as brick, tile, and parquet lines and are in measurable units on the model. Like other elements in Revit Architecture, model pattern lines can be edited. You can:

- Move pattern lines by dragging or by using the Move tool.
- Create dimensions that reference pattern lines; resize dimensions to move pattern lines.
- Rotate the pattern.
- Align pattern lines to other elements, such as reference planes, lines, windows.

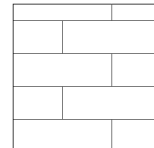
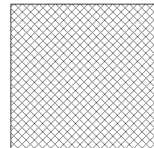
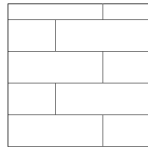
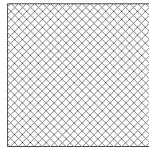
You can apply model patterns to families and modify them in the Family Editor only. After you have placed an instance of the family in a project view, you cannot modify the pattern.

Drafting Patterns

Drafting patterns represent materials in symbolic form; for example, sand is represented by a stipple pattern. The density of drafting patterns is fixed with respect to the drawing sheet.

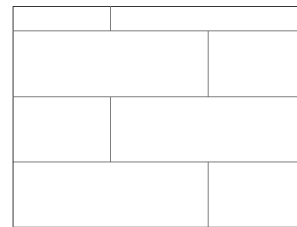
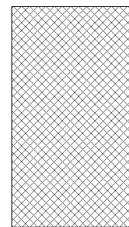
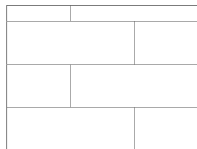
Differences Between Model Patterns and Drafting Patterns

The following illustrations show the differences between model and drafting patterns when the view scale changes. Model patterns remain a fixed size relative to the model, and drafting patterns remain a fixed size relative to the sheet.



Drafting Pattern Scale = 1:4

Model Pattern Scale = 1:4



Drafting Pattern Scale = 1:2

Model Pattern Scale = 1:2

NOTE If you zoom into a view, both drafting and model patterns display larger or smaller. As you zoom out, the pattern becomes more dense. At a certain point, the pattern displays as a solid fill. This is known as pattern overscaling. See [Zooming Project Views](#) on page 243.

You can place model and drafting patterns on planar and cylindrical surfaces and on families. You can also place drafting patterns on cut component surfaces in plan or section views.

Revit Architecture includes several fill patterns and stores them in the default project template file. Alternatively, you can create your own or edit an existing fill pattern to meet your needs.

A fill pattern is stored in the file in which it was created. To save the pattern to a template file, open the template file and create the pattern there.

You can transfer fill patterns between projects using the Transfer Project Standards tool. See [Transferring Project Standards](#) on page 446.

Creating a Simple Fill Pattern

A simple fill pattern consists of a series of parallel or orthogonal lines; examples include Diagonal Crosshatch or Vertical Siding.

To create a fill pattern using parallel lines:

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Fill Patterns.

- 2 In the Fill Patterns dialog, under Pattern Type, select Drafting or Model.
- 3 Click New.
- 4 If you are creating a drafting fill pattern, select how to orient the fill pattern in the host layers.
See [Fill Pattern Host Orientation](#) on page 461 for details.
- 5 In the New Pattern dialog, select Simple.
- 6 Enter a name for Name.
- 7 Select Parallel lines.
- 8 Enter values for Line angle and Line spacing 1. For a drafting pattern, these values affect spacing on the sheet; for a model pattern, these values affect spacing on the model.
- 9 Click OK.

To create a crosshatch fill pattern:

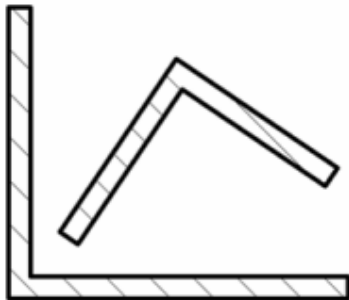
- 1 Follow steps 1-6 of the previous procedure.
- 2 Select Crosshatch.
- 3 Enter values for Line angle, Line spacing 1, and Line spacing 2. For a drafting pattern, these values affect spacing on the sheet; for a model pattern, these values affect spacing on the model.
- 4 Click OK.

Fill Pattern Host Orientation

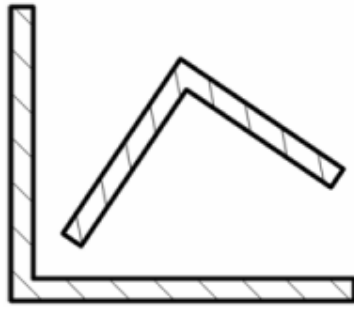
Drafting fill patterns can have different orientations to their host layers. Orientation affects how drafting patterns display when used as cut patterns in hosts (walls, floors, roofs, ceilings).

The following examples show the same fill pattern applied with the different orientation options.

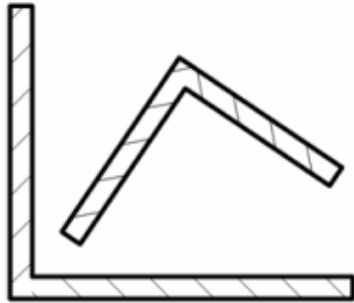
- **Orient to View.** All patterns share the same orientation and origin with respect to paper, so they perfectly align at element transitions.



- **Keep Readable.** This option mimics the behavior of text. Patterns align with the host; however patterns flip 90 degrees when the host is slanted 45, 135, 225, and 315 degrees. A right diagonal pattern always stays more or less right diagonal, and a 90 degree corner has a smooth transition. Patterns share the same origin with respect to paper.



- **Align with Element.** Patterns align with the host and compute a good origin.



For information on applying these patterns, see [Creating a Simple Fill Pattern](#) on page 460 or [Creating a Custom Fill Pattern](#) on page 462.

Creating a Custom Fill Pattern

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Fill Patterns.
- 2 In the Fill Patterns dialog, under Pattern Type, select Drafting or Model.
- 3 Click New.
- 4 If you are creating a drafting fill pattern, select how to orient the fill pattern in the host layers.
See [Fill Pattern Host Orientation](#) on page 461 for details.
- 5 In the New Pattern dialog, select Custom.
- 6 Click Import.
- 7 Select the desired pattern file (PAT), and click Open. See [Custom Pattern Files](#) on page 466 for information on creating a custom pattern (PAT) file.

NOTE Default Revit Architecture fill patterns are stored in the *revit.pat* and *revit metric.pat* files in the Revit Architecture program group Data directory. The *revit metric.pat* file contains various metric masonry and iso patterns.

- 8 Click the menu next to Import to view the list of available patterns. Select a pattern from the list.
- 9 If desired, enter a new name for Name.
- 10 If desired, enter a value for Import scale.
- 11 Click OK twice.

Applying a Fill Pattern

You can apply fill patterns to the surfaces of components and families using the Materials tool or the Paint tool. See [Applying Materials to Elements](#) on page 471 and [Applying a Material to the Face of an Element](#) on page 411.

Deleting a Fill Pattern

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Fill Patterns.
- 2 In the Fill Patterns dialog, select the appropriate fill pattern.
- 3 Click Delete.
- 4 When prompted to confirm deletion, click Yes.

NOTE You cannot delete the Solid fill drafting pattern.

Editing a Fill Pattern

You can edit simple fill patterns. To edit a custom pattern, you must reload the pattern from the PAT file.

NOTE You cannot edit the Solid fill drafting pattern.

To edit a fill pattern:

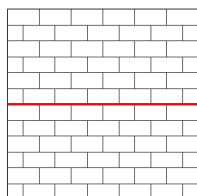
- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Fill Patterns.
- 2 In the Fill Patterns dialog, select the pattern to modify, and click Edit.
With a pattern name selected, you can also select Custom and import a new pattern from a PAT file; the imported custom pattern replaces the existing pattern, using the same name.
- 3 Follow the steps in [Creating a Simple Fill Pattern](#) on page 460.

Working with Model Patterns

Moving Model Pattern Lines

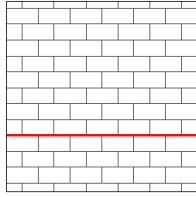
- 1 In the drawing area, highlight the element that has the model pattern.
- 2 Press **TAB** to highlight a pattern line shape handle. See [Controls and Shape Handles](#) on page 349.
The status bar indicates if you have highlighted a shape handle.
- 3 Click to select the shape handle.

Wall in elevation view with model pattern shape handle selected



- 4 Drag the shape handle, or use the Move tool to move the pattern lines. See [Moving Elements](#) on page 372.

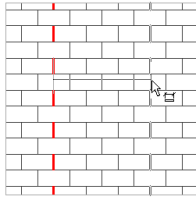
Pattern lines after dragging shape handle. Note the differences in the pattern lines at the top and bottom of the wall.



Creating Dimensions to Model Pattern Lines

- 1 Click Annotate tab ► Dimension panel ► Linear.
- 2 Place the cursor on the model pattern: the cursor snaps to the pattern line, which is a reference point. You can move the cursor toward another pattern line and press **TAB** to select a different reference point.
- 3 Place the dimension.

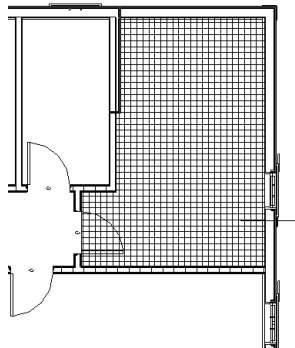
Surface pattern lines used as references for a linear dimension



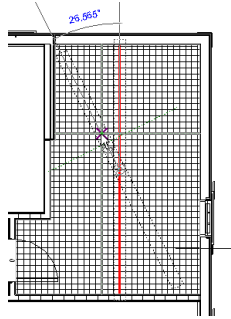
Rotating a Model Pattern

- 1 Place the cursor on the model pattern, and press **TAB** to highlight a shape handle. The status bar indicates if you have selected a shape handle.
- 2 Click to select the handle.
- 3 Click Modify <element> tab ► Modify panel ► Rotate.
- 4 Rotate the pattern. See [Rotating Elements](#) on page 379.

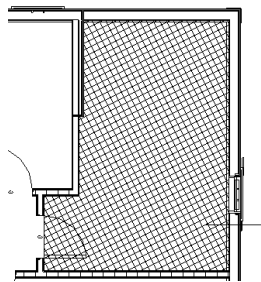
Floor with model pattern



Rotating pattern



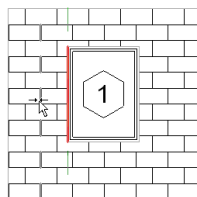
Floor pattern after rotation



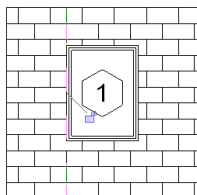
Aligning Model Pattern Lines to Elements

- 1 Click Modify tab ► Edit panel ► Align.
- 2 Click the line on the element that you want to align with the model pattern line.
- 3 Place the cursor on the element that has the model pattern. Check the status bar to confirm that you have highlighted a shape handle. If the desired pattern line is not highlighted, move the cursor near the line and press *TAB* again until it highlights.
- 4 Click to select the shape handle as the alignment reference.

Surface pattern aligning to a window



Completed alignment of window to pattern line



Custom Pattern Files

A pattern file is a text file that contains definitions for model or drafting patterns in a project. The file must be saved with a PAT extension. For information on using a custom pattern file, follow the procedure in [Creating a Custom Fill Pattern](#) on page 462.

Pattern File Format

Units:

```
;%UNITS=[value]
```

Header:

```
*pattern-name, [optional description]
```

Type declaration:

```
;%TYPE=MODEL
```

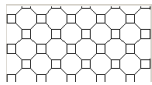
Pattern descriptors:

```
angle, x-origin, y-origin, shift, spacing
```

Creating a Custom Pattern

This example shows how to create a pattern of octagons and squares in the pattern file. You can use the description here to create other patterns.

The completed pattern contains octagons that are 8 inches at their widest point; both the octagon and the square are 3 5/16 inches on a side.



1 Open a text editor, such as Notepad, to begin creating the pattern file.

2 On the first line, enter the header in this format: ***Concrete Paver**.

3 On the next line, enter the type declaration: **;%TYPE=MODEL**.

The first value for a pattern descriptor is the angle at which the pen line is drawn. For example, a 0 angle indicates the line is horizontally straight; 90 angle indicates the line is drawn vertically straight.

4 Create the first pattern descriptor, using the following values:

■ Angle: 0

This value is the angle at which the pen line is drawn. For example, a 0 angle indicates the line is horizontally straight; a 90 angle indicates the line is drawn vertically straight.

■ Origin: 0, 0

These values are the x-origin and y-origin, which indicate the start point.

■ Shift: 5.656, 5.656

These values establish the x-shift and y-shift, which is the x and y distance between the start of any pass and the start of the next pass.

■ Pen down: 3.3125

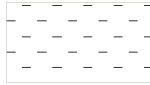
■ Pen up: -8

Pen down and pen up indicate how long the pen is down and how long the pen is up, respectively. A negative number indicates the pen is up.

The first pattern descriptor is complete:

0, 0, 0, 5.656, 5.656, 3.3125, -8

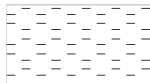
The pattern is as shown:



5 Create the second pattern descriptor, using the following values:

- Angle: 0
- Origin: 0, 3.3125
- Shift: 5.656, 5.656
- Pen down: 3.3125
- Pen up: -8

The pattern is as shown:

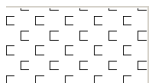


Because you changed the origin, the lines are drawn above the first set.

6 Create the third pattern descriptor, using the following values:

- Angle: 90
- Origin: 0, 0
- Shift: 5.656, 5.656
- Pen down: 3.3125
- Pen up: -8

The pattern is as shown:



Because of the 90 angle, the lines are drawn vertically, beginning to create a square pattern.

7 Create the fourth pattern descriptor, using the following values:

- Angle: 90
- Origin: 3.3125, 0
- Shift: 5.656, 5.656
- Pen down: 3.3125
- Pen up: -8

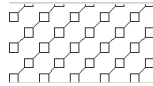
The pattern is as shown:



8 Create the fifth pattern descriptor, using the following values:

- Angle: 45
- Origin: 3.3125, 3.3125
- Shift: 8, 8
- Pen down: 3.3125
- Pen up: -4.6875

The pattern now looks like this:



A 45 angle has a positive slope and results in a slanted line effect.

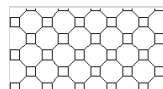
9 Create the sixth pattern descriptor, using the following values:

- Angle: -45
- Origin: 3.3125, 0
- Shift: 8, 8
- Pen down: 3.3125
- Pen up: -4.6875

The completed pattern file is:

```
*Concrete Paver,  
;%TYPE=MODEL  
0, 0, 0, 5.656, 5.656, 3.3125, -8  
0, 0, 3.3125, 5.656, 5.656, 3.3125, -8  
90, 0, 0, 5.656, 5.656, 3.3125, -8  
90, 3.3125, 0, 5.656, 5.656, 3.3125, -8  
45, 3.3125, 3.3125, 8, 8, 3.3125, -4.6875  
-45, 3.3125, 0, 8, 8, 3.3125, -4.6875
```

The completed pattern.



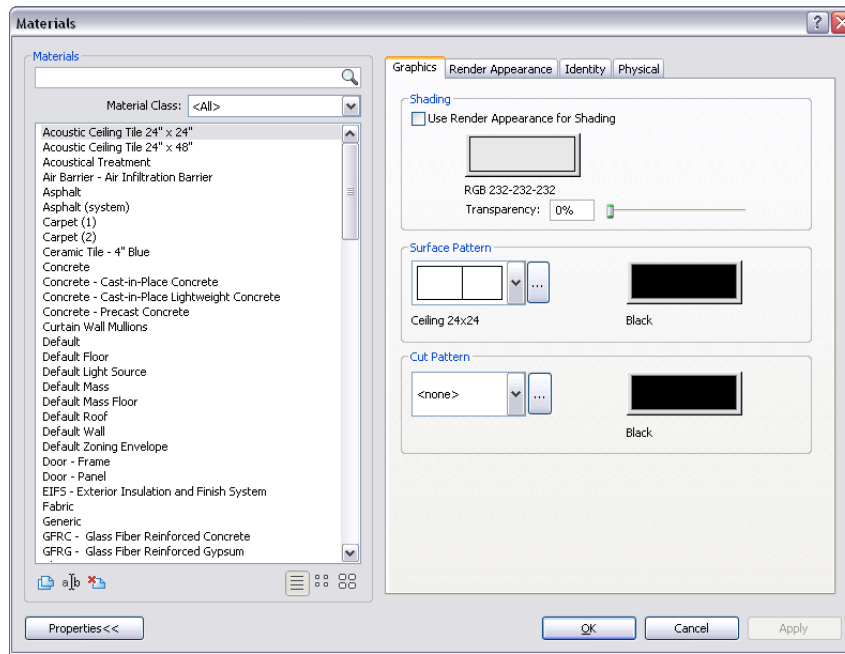
For information on using a custom pattern file, follow the procedure in [Creating a Custom Fill Pattern](#) on page 462.

Materials

Materials define the appearance of elements in the building model. Revit Architecture provides many materials that you can use, or you can create your own materials.

To search for materials to apply to model elements, or to change material properties, use the Materials dialog. You can access the Materials dialog by clicking Manage tab ► Project Settings panel ► Materials.

Use the left pane of the Materials dialog to find a material. Use the right pane to change properties of the selected material. To show or hide the right pane, click Properties at the bottom of the left pane.



Related topic

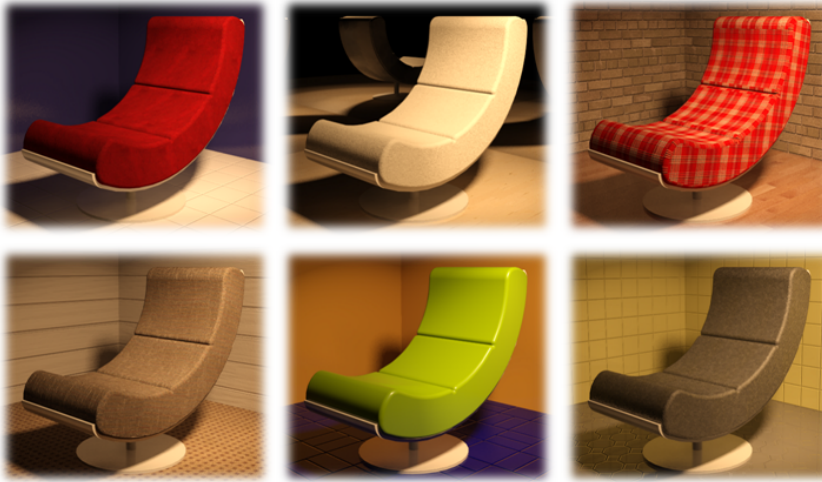
- [Material Takeoff Schedules](#) on page 174

Materials Overview

Materials specify how model elements should display in views and rendered images. They also provide descriptive and structural information. In Revit Architecture, you apply materials to elements in a building model in a project. You can also apply materials to elements when defining their families.

Materials define the following:

- The color that displays in a shaded project view
- The color and pattern that display on the surface of an element
- The color and fill pattern that display when the element is cut
- The render appearance that displays in a rendered image
- Information about the material's description, manufacturer, cost, and keynotes
- Structural information about the material (for structural analysis)



How Materials Are Stored

Materials are stored as part of a project file. When you create a project, Revit Architecture provides many default materials to choose from. If necessary, you can create custom materials or change the settings for existing materials. New and changed materials are also saved as part of a project file.

To share custom materials with team members, click Manage tab ► Project Settings panel ► Transfer Project Standards. (See [Transferring Project Standards](#) on page 446.) Be sure to also make available any custom bitmaps or image files used to define bump patterns or custom colors used by the render appearance. See [Best Practice for Storing Image Files](#) on page 519.

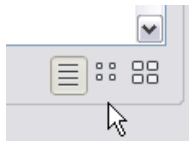
For information about how render appearances are stored, see [Render Appearance Library](#) on page 491.

Searching for a Material

- 1 Open the Materials dialog.

You can access the Materials dialog by clicking Manage tab ► Project Settings panel ► Materials, or from several other points in the software.

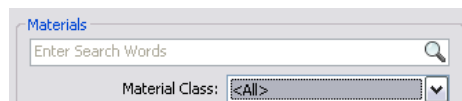
- 2 (Optional) To specify the type of list to display, at the bottom of the materials list, click Show list, Show small icons, or Show large icons.



- 3 (Optional) For Material Class, select the desired class (such as Concrete or Metal).

The Materials dialog displays only materials that belong to the selected class.

- 4 (Optional) Type text in the search field.



See [Entering Search Text](#) on page 493.

Revit Architecture searches each material for the specified text, checking the fields on the Identity tab of the Materials dialog. (See [Material Identity Parameters](#) on page 488.) If you selected a material class, Revit Architecture searches only materials in that class for the specified text. To search all materials for the specified text, reset Material Class to All.

The Materials dialog displays matching materials, sorted in order of relevance.

TIP To clear the search field, click the X that displays at the end of the field after you enter text.

5 If necessary, use the scroll bar to locate the desired material in the list.

6 Click the material to select it.

Revit Architecture displays properties of the selected material in the right pane of the Materials dialog.

Applying Materials to Elements

You can apply materials to model elements in any of the following ways:

By category or subcategory

In a project, you can apply a material to a model element based on its category or subcategory. For example, you can specify a material for the door category, and then specify a different material for a subcategory of the door, such as glass for a door panel.

By family

In the Family Editor, when creating or modifying a component, you can use family type parameters to apply a different material to each piece of geometry in the component.

By element parameter

In a project, you can select a model element in a view, and use element properties to apply a material.

By face

In a project, you can use the Paint tool to apply a material to selected faces of model elements. See [Applying a Material to the Face of an Element](#) on page 411.

Applying a Material by Category or Subcategory

1 In a project, click Manage tab ► Project Settings panel ► Settings drop-down ► Object Styles.

2 On the Model Objects tab or the Import Objects tab, click in the Material column of the category or subcategory.

3 Click  in the Material column.

4 In the Materials dialog, select a material, and click OK.

See [Searching for a Material](#) on page 470.

5 Click Apply.

6 To exit the Object Styles dialog, click OK.


In project views, all elements of the selected category or subcategory display the applied material.

Applying a Material by Family


1 In the Family Editor, open the family to modify.

See [Family Editor](#) on page 416.

2 Link a family parameter to the object, as follows:

- a In the drawing area, select the geometry to which you want to apply a material.
See [Selecting Elements](#) on page 339. You can assign a different material to each part of the component.
- b Click Modify <element> tab ► Element panel ► Element Properties.
- c In the Instance Properties dialog, for Material, click in the Value column, and click .
- d In the Associate Family Parameter dialog, select a parameter, or create a new one.
When creating a parameter, in the Parameter Properties dialog, do the following:
 - For Group parameter under, select Materials and Finishes.
 - Select Instance or Type depending on whether you want to be able to change the material for an element using instance parameters or type parameters in a project.
- e Click OK twice.

3 Apply a material to the family parameter, as follows:

- a Click Modify <element> tab ► Family Properties panel ► Types.
- b In the Family Types dialog, under Materials and Finishes, locate the parameter for the object.
- c Click in the Value column for the parameter.
- d Click .
- e In the Materials dialog, select a material, and click OK.
See [Searching for a Material](#) on page 470.
- f Click OK.

Applying a Material by Element Parameter

1 In a project, open a view that displays the model element to which you want to apply a material.

2 Select the model element.

3 Click Modify <element> tab ► Element panel ► Element Properties.

4 In the Instance Properties dialog, locate the material parameter, as follows:

- **If the material is an instance parameter:** Under Materials and Finishes, locate the material parameter to change. Click in the Value column for the parameter.
- **If the material is a type parameter:** Click Edit Type. In the Type Properties dialog, under Materials and Finishes, locate the material parameter to change. Click in the Value column for the parameter.
- **If the material is a structural parameter:** (for example, if the element is wall) Click Edit Type. In the Type Properties dialog, for Structure, click Edit. In the Edit Assembly dialog, click in the Material column for the layer whose material you want to change.

5 Click .

6 In the Materials dialog, select a material, and click OK.

See [Searching for a Material](#) on page 470.

7 Click OK.

Changing the Display Properties of a Material

To change the display properties of a material in project views, use the Graphics tab of the Materials dialog. You can change settings that define the way the material displays in shaded views, as well as the way its outer surfaces and cut surfaces display in other views.

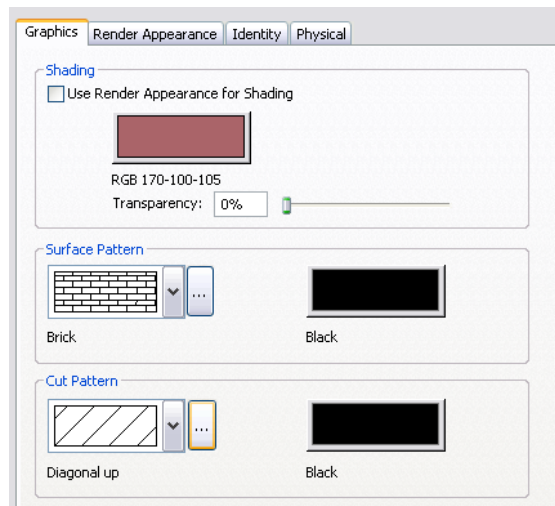
NOTE To change the appearance of a material in rendered images, change its render appearance. See [Changing the Render Appearance of a Material](#) on page 475.

To change the display properties of a material

1 Open the Materials dialog, and select the material to change.

Click Manage tab ► Project Settings panel ► Materials, or open the dialog from another point in the software. See [Searching for a Material](#) on page 470.

2 Click the Graphics tab.



3 To change how the material looks in shaded views (such as 3D views and elevations), under Shading, do the following:

- If you want to use the render appearance to represent the material in shaded views, select Use Render Appearance for Shading. Revit Architecture calculates an average color for the render appearance and uses it to represent the material in 2D and 3D views whose model graphics style is Shading or Shading with Edges.
- Click the color swatch. In the Color dialog, select a color. (See [Colors](#) on page 525.) Click OK.
- For Transparency, enter a value between 0% (completely opaque) and 100% (completely transparent), or move the slider to the desired setting.

4 To change how the outer surface of the material displays in views (such as plan views and section views), under Surface Pattern, do the following:

- To change the surface pattern, click the arrow, and select a pattern from the list.

- To change the color that is used to draw the surface pattern, click the color swatch. In the Color dialog, select a color. Click OK.

NOTE In the project, you can align the surface pattern to a model element. See [Aligning the Surface Pattern on a Model Element](#) on page 474.

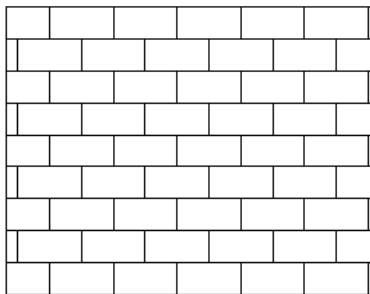
- 5 To change how the cut surface of the material displays in views, under Cut Pattern, do the following:
- To change the cut pattern, click the arrow, and select a pattern from the list.
 - To change the color that is used to draw the cut pattern, click the color swatch. In the Color dialog, select a color. Click OK.
- 6 Click Apply.
- 7 To exit the Materials dialog, click OK.

Aligning the Surface Pattern on a Model Element

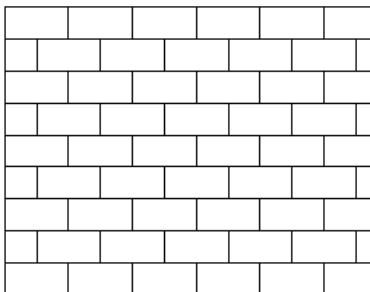
In a 2D view, you can align a surface pattern on a model element. For example, you can use this technique to align the following:

- ceiling tiles with a corner of a room
- masonry to the edge of an exterior wall
- wallpaper as desired to an interior wall
- carpet as desired on a floor

Surface pattern on wall before alignment



Surface pattern aligned to upper-left corner of wall



You can align the surface pattern for each surface of a model element (not just for the model element as a whole). For example, if you are adjusting the surface pattern of a free-standing stone wall, you can align its surface pattern on each exposed side individually.

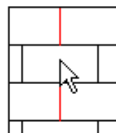
Suppose you align the texture of a render appearance to the surface pattern (see [Texture Alignment](#) on page 477), and you align the surface pattern with a model element. When you render a 3D view containing the element, the rendered image reflects the alignment of the surface pattern and the texture.

To align a surface pattern on a model element

- 1 Open a project view that displays the model element with the surface pattern to align.

To specify a surface pattern for the material of the model element, see [Changing the Display Properties of a Material](#) on page 473. If the surface pattern does not display in the view, you may need to change the view's detail level to fine, or zoom in on the model element.

- 2 Place the cursor over a line of the surface pattern.
- 3 Press TAB one or more times until the surface pattern line highlights.

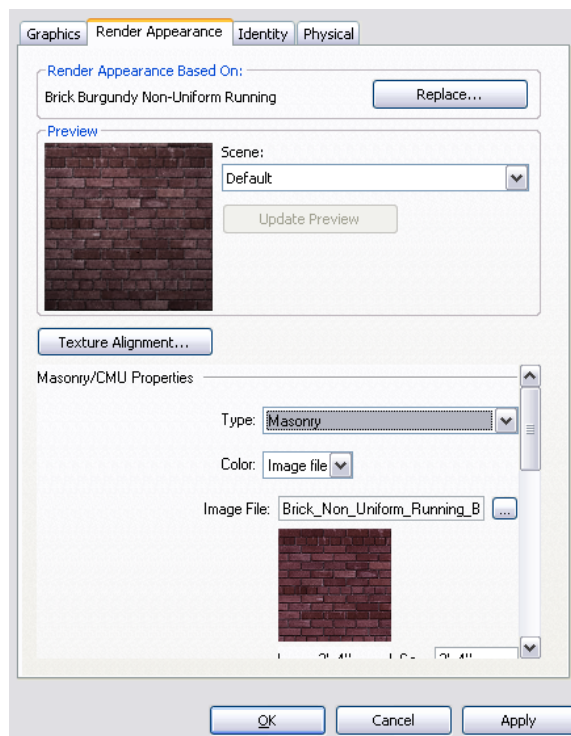


- 4 Click to select the surface pattern line.
- 5 Move the selected surface pattern line as desired, using one or more of the following techniques:
 - Press the arrow keys to nudge the surface pattern up, down, left, or right, in small increments.
 - Use the Move tool to move it a specified distance. See [Moving Elements with the Move Tool](#) on page 373.
 - Use the Rotate tool to rotate the surface pattern. See [Rotating Elements](#) on page 379.

Changing the Render Appearance of a Material

- 1 Open the Materials dialog, and select the material to change.

Click Manage tab ► Project Settings panel ► Materials, or open the dialog from another point in the software. See [Searching for a Material](#) on page 470.
- 2 Click the Render Appearance tab.



3 Do the following:

If you want to...

Then...

change the preview of the render appearance

For Scene, select the desired scene from the list. Click Update Preview. The preview is a rendered image of the material. Updating the preview takes a moment while Revit Architecture renders the preview scene.

select a different render appearance

Click Replace. Select a render appearance. (See [Searching for a Render Appearance](#) on page 491.) Click OK.

align the texture of the render appearance to the surface pattern of the material

Click Texture Alignment. See [Texture Alignment](#) on page 477 for further instructions.

change properties of the render appearance

In the lower part of the Render Appearance tab, change property values. The properties vary depending on the type of render appearance. See [Render Appearance Properties](#) on page 478 for further instructions.

NOTE The render appearance can affect the amount of time required to render an image. See [Render Performance and Materials](#) on page 1235.

update the preview to reflect changes

Click Update Preview. The preview is a rendered image of the material. Updating the preview takes a moment while Revit Architecture renders the preview scene.

4 Click Apply.

5 To exit the Materials dialog, click OK.

Texture Alignment

Use the Texture Alignment tool to align the texture of the render appearance to the surface pattern of the material (defined on the Graphics tab of the Materials dialog). When you render a 3D view, the rendered image displays the texture, positioned as specified using the Texture Alignment tool.

You access the Texture Alignment tool on the [Render Appearance tab](#) of the Materials dialog.

Aligning the Render Appearance to the Surface Pattern

The following procedure assumes that you have done the following:

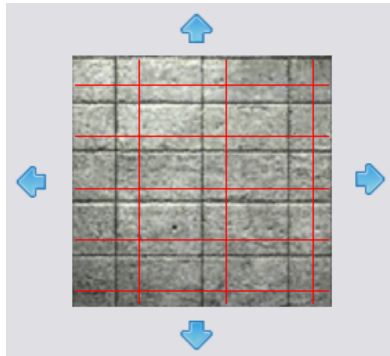
- Specified a surface pattern for the material. See [Changing the Display Properties of a Material](#) on page 473.
- Specified a texture for the render appearance of the material. See [Changing the Render Appearance of a Material](#) on page 475.

To align the render appearance to the surface pattern

- 1 On the Render Appearance tab of the Materials dialog, click Texture Alignment.

TIP If the Texture Alignment button is not active, click the Graphics tab and specify a surface pattern for the material.

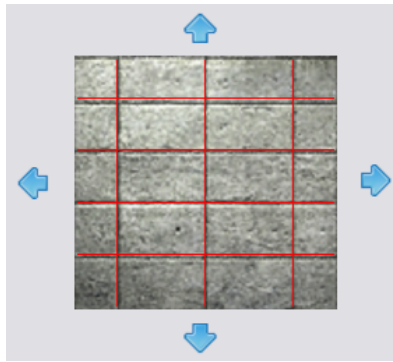
The Align Render Appearance to Surface Pattern dialog displays. The preview area displays the texture specified for the render appearance, overlaid with the surface pattern for the material.



NOTE If the render appearance is dark and the surface pattern uses black lines, it may be difficult to see the surface pattern. Try changing the color of the surface pattern lines to white or another light color to make them more visible.

- 2 Use the arrows to position the render appearance relative to the surface pattern as desired.

To rotate the texture or change its sample size, use the render appearance properties where you specify the image file for the texture. See [Specifying an Image File for a Render Appearance](#) on page 485.



3 Click OK.

In addition to aligning the rendering texture to the surface pattern, you can also align the surface pattern to faces of the model element, as desired. See [Aligning the Surface Pattern on a Model Element](#) on page 474.

Render Appearance Properties

The properties of render appearances vary depending on the mental ray® shaders used to render them. A shader is an algorithm that tells the program how to calculate surface rendering. Each shader requires different information to render the material accurately.

The following topics describe the render appearance properties for each shader.

NOTE The render appearance can affect the amount of time required to render an image. See [Render Performance and Materials](#) on page 1235.

Ceramic Properties

You can define the following properties for ceramic materials on the [Render Appearance tab](#) of the Materials dialog.

Property	Description
Type	Type of material: Ceramic or Porcelain.
Color	Color of the render appearance for the material. See Specifying a Render Appearance Color on page 485. TIP To specify a grout color, use an image file that shows both the tile color and the grout color.
Finish	Texture of the finished surface.
Finish Bumps	Bump pattern to use on the finished surface (for example, to represent the surface roughness). To define bumps using an image, select Custom. See Specifying an Image File for a Render Appearance on page 485.
Amount	Relative height or depth of the bumps only when Finish Bumps is Wavy or Custom. Enter 0 to make the surface flat. Enter higher decimal values (up to 1.0) to increase the depth of the surface irregularities.

Property	Description
Bump Pattern	An additional bump pattern, superimposed on the Finish Bumps pattern (for example, to define grout lines). To define bumps using an image, select Custom. See Specifying an Image File for a Render Appearance on page 485.

Concrete Properties

You can define the following properties for concrete materials on the [Render Appearance tab](#) of the Materials dialog.

Property	Description
Color	Color of the render appearance for the concrete. See Specifying a Render Appearance Color on page 485.
Finish	Texture of the finished surface. To define the finish using an image, select Stamped/Custom. See Specifying an Image File for a Render Appearance on page 485.
Sealant	Substance used to seal the surface.
Weathering	Discoloration due to weather. To define a weathering pattern using an image, select Custom. See Specifying an Image File for a Render Appearance on page 485.

Generic Material Properties

You can define the following properties for materials on the [Render Appearance tab](#) of the Materials dialog. In general, use a generic material when other types of rendering shaders do not provide the desired properties or controls.

Property	Description
Color	Color of the render appearance for the material. This color affects the diffuse reflection as well as the transmittance of light in the material. See Specifying a Render Appearance Color on page 485.
Glossiness	Measurement of the glossy quality of the surface (or its roughness), which affects both reflectivity and transparency. Enter a value between 0 (dull) and 1.0 (a perfect mirror). By changing the glossiness, you can change the size and intensity of highlights. Reduce glossiness to create matte surfaces or frosted glass.
Reflectivity	
When viewed directly	Measurement of how much light the material reflects when the surface is directly facing the camera. Enter a value between 0 (no reflections) and 1 (maximum reflections).
When viewed obliquely	Measurement of how much light the material reflects when the surface is at an angle to the camera. Enter a value between 0 (no reflections) and 1 (maximum reflections).
Transparency	
Transparency	Measurement of how much light passes through the material. Enter a value between 0 (completely opaque) and 1 (completely transparent). When Transparency is 0,

Property	Description
	Translucency and Index of Refraction are not available. See Transparency and Translucency on page 485.
Translucency	Measurement of how much of the Transparency light is scattered by the material, so that objects behind the material cannot be seen clearly. Enter a value between 0 (not translucent) and 1 (completely translucent, such as frosted glass). See Transparency and Translucency on page 485.
Index of Refraction	Measurement of how much a ray of light bends when it passes through the material. Select a predefined index, or select Custom to specify an index number between 0 (no refraction) and 5 (most refraction).
Cut-outs/Perforations	
Cut-outs	Shapes cut into the surface of the material. Select a shape, or select Custom to define cut-outs using a black-and-white image, leaving holes where the black areas occur. See Specifying an Image File for a Render Appearance on page 485.
Self-Illumination	
Luminance (cd/m ²)	Brightness of the light emitted by the material, measured in candelas per square meter. Select a predefined value, or select Custom to enter a value.
Color Temperature (Kelvin)	Color temperature (warmth or coolness) of the light emitted by the material, described in terms of degrees Kelvin (K). This is useful for describing color values that are close to white. Select a predefined value, or select Custom to enter a value.
Filter Color	Color transmitted through a transparent or semi-transparent material, such as glass. See Specifying a Render Appearance Color on page 485.
Bump	
Bump Pattern	Bump pattern to use on the finished surface. A bump pattern defines raised and lowered areas based on dark and light areas of an image file. To define a custom bump pattern, select Custom. See Specifying an Image File for a Render Appearance on page 485.
Amount	Relative height or depth of the specified bump pattern. Enter 0 to make the surface flat. Enter higher decimal values (up to 1.0) to increase the depth of the surface irregularities.

Glass Properties

You can define the following properties for glass materials on the [Render Appearance tab](#) of the Materials dialog. See also [Glass, glazing, and mirrors](#) on page 486.

Property	Description
Color (Transmittance)	Color of the glass. (Transmittance refers to the light that passes through the glass.) Select a predefined glass color, or select Custom to specify a color. See Specifying a Render Appearance Color on page 485.

Property	Description
Reflectance	Percentage of light striking the glass that bounces off rather than being absorbed or passing through (transmittance). Enter a value between 0% and 50%.
Index of Refraction	Measurement of how much a ray of light bends when entering the glass. Select a predefined index, or select Custom to specify an index number between 0 (no refraction) and 5 (most refraction).
Roughness	Relative amplitude of bumps in the surface of the glass. Enter 0 to make the surface flat. Enter higher decimal values (up to 1.0) to increase the depth of the surface irregularities.
Bump Pattern	Bump pattern to use on the finished surface. A bump pattern defines raised and lowered areas based on dark and light areas of an image file. To define a custom bump pattern, select Custom. See Specifying an Image File for a Render Appearance on page 485.

Glazing Properties

You can define the following properties for glazing materials on the [Render Appearance tab](#) of the Materials dialog. See also [Glass, glazing, and mirrors](#) on page 486.

Property	Description
Color (Transmittance)	Color of the glazing. (Transmittance refers to the light that passes through the glazing.) Select a predefined glazing color, or select Custom to specify a color. See Specifying a Render Appearance Color on page 485.
Reflectance	Percentage of light striking the glass that bounces off again (like a reflection) rather than being absorbed or passing through (transmittance). Enter a value between 0% and 50%.
Sheets of glass	Number of sheets of glass in the glazing system that are modeled in the geometry and rendered in images. Enter a number between 1 and 4.

Masonry/CMU Properties

You can define the following properties for masonry or CMU materials on the [Render Appearance tab](#) of the Materials dialog.

Property	Description
Type	Type of masonry material.
Color	Color of the material. See Specifying a Render Appearance Color on page 485.
Finish	Texture of the finished surface.
Bump Pattern	Bump pattern to use on the finished surface. A bump pattern defines raised and lowered areas based on dark and light areas of an image file. To define a custom bump pattern, select Custom. See Specifying an Image File for a Render Appearance on page 485.

Metal Properties

You can define the following properties for metal materials on the [Render Appearance tab](#) of the Materials dialog.

Property	Description
Type	Type of metal: aluminum, anodized aluminum, chrome, copper, brass, bronze, stainless steel, or zinc. Each type of metal displays different properties.
Color	Color of the metal when the Type value is Anodized Aluminum. Click the color swatch. In the Color dialog, select a color. (See Colors on page 525.) Click OK.
Patina	For copper or bronze, the degree of discoloration due to oxidation or the application of a chemical compound. Enter a value between 0 (none) and 1 (full), or use the slider.
Finish	Texture of the finished surface.
Relief Pattern	Decorative design pressed onto the surface of the metal. Select a pattern, or select Custom to define the relief pattern using an image. See Specifying an Image File for a Render Appearance on page 485.
Relief Pattern Height	Relative height of the relief pattern. Enter 0 to make the surface flat. Enter a value up to 2.0 to increase the depth of the relief pattern.
Relief Pattern Scale	Relative size of the relief pattern. Enter a value between 0 (smaller) and 5 (larger), or use the slider.
Cut-outs/Perforations	Shapes cut into the surface of the metal. Select a shape, or select Custom to define cut-outs using a black-and-white image, leaving holes where the black areas occur. See Specifying an Image File for a Render Appearance on page 485.

Metallic Paint Properties

You can define the following properties for metallic paint materials on the [Render Appearance tab](#) of the Materials dialog.

Property	Description
Color	Color of the metallic paint. Click the color swatch. In the Color dialog, select a color. (See Colors on page 525.) Click OK.
Finish	Texture of the finished surface.
With Flecks	Whether the paint contains flecks.
Fleck Color	Color of the flecks, when With Flecks is selected. Click the color swatch. In the Color dialog, select a color. (See Colors on page 525.) Click OK.

Mirror Properties

You can define the following properties for mirror materials on the [Render Appearance tab](#) of the Materials dialog. See also [Glass, glazing, and mirrors](#) on page 486.

Property	Description
Color	Color of the mirror surface. Click the color swatch. In the Color dialog, select a color. (See Colors on page 525.) Click OK.

Paint Properties

You can define the following properties for paint materials on the [Render Appearance tab](#) of the Materials dialog.

Property	Description
Color	Color of the paint. Click the color swatch. In the Color dialog, select a color. (See Colors on page 525.) Click OK.
Finish	Amount of glossiness of the paint.
Application	The method used to apply the paint to the surface. This value applies a bump map to the paint to define its texture. It affects the render appearance of the surface only for close-up views. The default value varies. Select the desired value: Roller, Brush, or Spray.

Plastic/Vinyl Properties

You can define the following properties for plastic or vinyl materials on the [Render Appearance tab](#) of the Materials dialog.

Property	Description
Type	Type of material: plastic (solid), plastic (transparent), or vinyl.
Color	Color of the material. See Specifying a Render Appearance Color on page 485.
Finish	Texture of the finished surface.
Finish Bumps	Bump pattern to use on the finished surface. To define bumps using an image, select Custom. See Specifying an Image File for a Render Appearance on page 485.
Bump Pattern	Additional bump pattern, superimposed on the Finish Bumps pattern. To define bumps using an image, select Custom. See Specifying an Image File for a Render Appearance on page 485.

Stone Properties

You can define the following properties for stone materials on the [Render Appearance tab](#) of the Materials dialog.

Property	Description
Image File	Image to use to represent the stone's surface. See Specifying an Image File for a Render Appearance on page 485.
Finish	Texture of the finished surface.
Finish Bumps	Bump pattern to use on the finished surface. To define bumps using an image, select Custom. See Specifying an Image File for a Render Appearance on page 485.
Bump Pattern	Additional bump pattern, superimposed on the Finish Bumps pattern. To define bumps using an image, select Custom. See Specifying an Image File for a Render Appearance on page 485.

Water Properties

You can define the following properties for water materials on the [Render Appearance tab](#) of the Materials dialog.

Property	Description
Type	Type of water source.
Color	Color of the water (available when Type is not Swimming Pool). Select a predefined water color, or select Custom to specify a color.
Wave Height	Relative height of waves in the water. Enter a value between 0 (no waves) and 5 (big waves), or use the slider.

Wood Properties

You can define the following properties for wood materials on the [Render Appearance tab](#) of the Materials dialog.

Property	Description
Image File	The image to use to represent the surface of the wood (the wood grain). See Specifying an Image File for a Render Appearance on page 485.
Stain	Whether the wood is stained.
Stain Color	Color of the wood stain (when Stain is Color). Click the color swatch. In the Color dialog, select a color. (See Colors on page 525.) Click OK.
Finish	Texture of the finished surface.
Used For	Purpose of the wood: Flooring or Furniture.
Bump	Bump pattern to use on the finished surface. To define bumps using an image, select Custom. See Specifying an Image File for a Render Appearance on page 485.

Property	Description
Amount	Relative depth of the wood grain, when Bump is Based on wood grain. Enter 0 for a flat surface, a positive number (between 0 and 10) to raise the grain, or a negative number (between 0 and -10) to reverse the grain.

Transparency and Translucency

When defining a render appearance that uses [Generic Material Properties](#), remember that reflections on a surface are created by light bouncing off it. Of the light that strikes a surface, the Transparency and Translucency properties specify the amount of light that bounces off the surface rather than passing through or being absorbed by it.

Transparency specifies the amount of light that strikes the surface at a 90-degree angle and bounces off. Translucency specifies the amount of light that strikes the surface at a very shallow angle (close to 0 degrees) and bounces off.

To determine the amount of light that bounces off the surface at any other angle, Revit Architecture interpolates between these 2 values. The effects of these values can be altered by the value of the Glossiness property.

Specifying a Render Appearance Color

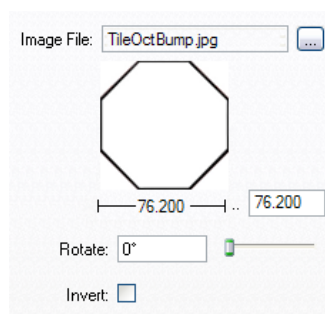
To specify a color for a render appearance property, use the Render Appearance tab of the Materials dialog. (See [Changing the Render Appearance of a Material](#) on page 475.) You can specify either a single color or an image file that defines a custom color, design, or pattern.

- **Single color:** For the Color property, select Single Color. Click the color swatch. On the Color dialog, select the color to use. (See [Colors](#) on page 525.) Click OK.
- **Image file:** For the Color property, select Image file. Specify the desired image file and its display properties. See [Specifying an Image File for a Render Appearance](#) on page 485.


Specifying an Image File for a Render Appearance

To use a unique color, design, pattern, texture, or bump map for a render appearance, you can specify an image file. You specify the file and its display properties (such as rotation and sample size) on the Render Appearance tab of the Materials dialog. (See [Changing the Render Appearance of a Material](#) on page 475.)

NOTE A complicated design or texture for a render appearance can increase the amount of time required to render an image. See [Render Performance and Materials](#) on page 1235.



To specify an image file

- 1 For Image File, click  (Browse), navigate to the file, and open it.
Revit Architecture supports image files of the following types: BMP, JPG, JPEG, and PNG. See [Best Practice for Storing Image Files](#) on page 519.
- 2 For Sample Size, specify the size that the image represents.
For example, if the image represents 100 mm, enter **100**.
- 3 For Rotate, specify degrees of rotation in a clockwise direction.
You can enter a value between 0 and 360, or use the slider.
- 4 If you are specifying an image file to define a custom color, for Brightness, specify a value.
Brightness is a multiplier, so a value of 1.0 makes no change. If you specify 0.5, the brightness of the image is reduced by half.
- 5 To reverse the image, click Invert.
For an image that defines a color, Invert reverses the light and dark colors in the image. For an image that defines a texture, Invert reverses the high and low points of the texture pattern.
- 6 For texture properties, such as Finish Bumps and Bump Pattern, specify a value for Amount.
This value specifies the amplitude of surface irregularities. Enter 0 to make the surface flat. Enter higher values to increase the depth of the surface irregularities.

Best Practices for Render Appearances

When modifying or creating render appearances for materials, consider the following strategies:

Start with something similar

To create a render appearance, first find an existing material and render appearance that are as close as possible to the new material and render appearance. For example, the existing render appearance should have the same class as the new render appearance. It should also have many properties that are the same as or similar to the new render appearance. This strategy reduces the amount of work you must perform to define the new render appearance. It also increases the likelihood that the new render appearance will perform as expected.

Glass, glazing, and mirrors

Revit Architecture provides the following render appearances for glass-like materials:

- **Glazing:** Use a glazing render appearance for windows, curtain walls, and other objects that require flat sheets of thin glass. These render appearances include the word glazing in their names and keywords.
- **Glass:** Use a glass render appearance for objects made of glass, such as vases and pitchers. For a solid glass block, use the render appearance named Glass Block.
- **Mirrors:** Depending on your needs, you can either use a mirror render appearance, or use a glazing or glass render appearance and specify a high Reflectance value.

To see these render appearances, in the [Render Appearance Library](#), for Class, select Glass.

Textures and bump maps

To specify a texture or bump map for a material, use a photo or a drawing. Revit Architecture uses the image to define the surface to give it texture. See [Specifying an Image File for a Render Appearance](#) on page 485.

Tileable textures

If you want to make your own texture that can be repeated like a tile (a tileable texture), take a high quality photograph of the material. Use this photograph to make it a tileable texture. (You can do this using a product like Adobe® Photoshop®, or use an application that is designed specifically for creating tileable textures.) Then specify this image file for the texture or bump pattern of the material. Specify the sample size so that it displays in the building model using the correct proportions.

Light bulbs

If you want the surface of a light bulb to display in a rendered image, create geometry for it in the lighting fixture family. Then apply a material to it whose render appearance is Glass Light Bulb On. This render appearance models the surface of a light bulb that is turned on. It is white, shiny, and emits the appropriate amount of light. See [Creating a Lighting Fixture with One Light Source](#) on page 1169.

Sunscreens

To create a material that renders like a semi-transparent fabric or sunscreen, start with the Fabric Mesh render appearance. Then define the render appearance properties as follows: Glossiness = 1, Transparency = 1, Translucency = 0, Luminance = No self-illumination.

Changing Material Identity Data

- 1 Open the Materials dialog, and select the material to change.
Click Manage tab ► Project Settings panel ► Materials. See [Searching for a Material](#) on page 470.
- 2 Click the Identity tab.
- 3 Edit the parameters as necessary.
See [Material Identity Parameters](#) on page 488 and [Adding a Material Class](#) on page 487.
- 4 Click Apply.
- 5 To exit the Materials dialog, click OK.

Adding a Material Class

You can add a material class when you want to make it easy to find a particular set of materials. For example, when you create a custom material, you can create a material class for it.

NOTE You cannot delete or change existing material classes. However, you can assign a different material class to a material.

To add a material class

- 1 In the Materials dialog, select the material that you want to assign to a new material class.
See [Searching for a Material](#) on page 470.
- 2 Click the Identity tab.
- 3 For Material Class, enter the new material class name.
- 4 Click Apply.
- 5 In the left pane of the Materials dialog, under Materials, click the list arrow for Material Class.
The new material class displays in the list.

You can assign the new material class to more materials, as appropriate. You can also use the new material class to narrow the scope of a material search.

Material Identity Parameters

When you enter search text to find a material, Revit Architecture searches the values of all parameters on the Identity tab of the Materials dialog. (See [Searching for a Material](#) on page 470.) Also, you can include most of these parameters in a material takeoff. (See [Material Takeoff Schedules](#) on page 174.)

Parameter	Description
Filter Criteria	
Material Class	Class assigned to the material. Assign an existing class, or create a new one. See Adding a Material Class on page 487.
Descriptive Information	
Description	Description of the material. This value displays in material tags for elements. See Material Tags on page 1128.
Comments	User-defined comments or other information about the material. If the value is Render appearance not upgraded, assign a new render appearance to the material. See Changing the Render Appearance of a Material on page 475.
Keywords	Words that may be useful when searching for the material, and that are not used in the material description, comments, or other fields. For example, you might include the keywords green and blue to ensure that turquoise is included in search results for blue paint or green paint.
Product Information	
Manufacturer	Name of the manufacturer of the material.
Model	Model number or code assigned to the material by the manufacturer.
Cost	Cost of the material.
URL	URL of the Web site for the manufacturer or vendor.
Annotation Information	
Keynote	Keynote for the material. Enter text or click the button to select a standard keynote. See Keynotes on page 1117.
Mark	User-defined identification number for the material.

Changing Material Physical Data

The Physical tab of the Materials dialog displays structural information about the selected material. This information is used in the structural analysis of buildings.

Creating a Material Physical Parameter Set

- 1 In the Materials dialog, select a material.
See [Searching for a Material](#) on page 470.

2 Click the Physical tab.

3 Select a Material Type.

Revit Architecture displays an additional category based on the selected material type.

4 Edit parameter values as needed for the new set.

5 Click Save As to save a set by name.

The name of the new set then becomes available in the Concrete Type list box (if you had selected concrete as the material type) or Wood Type list box (if you had selected wood as the material type) and so on.

Editing a Material Physical Type

1 In the Materials dialog, select a material.

See [Searching for a Material](#) on page 470.

2 Click the Physical tab.

3 Change the settings to the desired values.

Read-only parameters represent the natural material properties. Those that you can change represent standards of engineering practice.

Material Physical Type Parameters

Material physical type parameters are organized into the following types:

- Unassigned
- Generic
- Concrete
- Steel
- Wood

This family parameter controls the hidden view display of structural elements. If the Structural Material Type of an element is set to Concrete or Precast, then it will display as hidden. If it is set to Steel or Wood, it will be visible when another element is in front of it. If it is set to Unassigned, the element will not display if hidden by another element.

Creating a Material

To create a material, first find an existing material that is as close as possible to the new material. For example, the existing material should have the same material class as the new material. It should also have many properties that are the same as or similar to the new material. This strategy reduces the amount of work you must perform to define the new material. It also increases the likelihood that the new material will perform as expected in the building model.

To create a material

1 In the Materials dialog, select an existing material that is similar to the new material.

See [Searching for a Material](#) on page 470.

2 At the bottom of the left pane of the Materials dialog, click  (Duplicate).

Or you can right-click a material in the list, and click Duplicate.

3 In the Duplicate Revit Material dialog, for Name, enter a name for the new material, and click OK.

4 On the Graphics tab of the Materials dialog, specify display properties for the new material, and click Apply.

See [Changing the Display Properties of a Material](#) on page 473.

5 On the Render Appearance tab of the Materials dialog, specify a render appearance for the new material, and click Apply.

See [Changing the Render Appearance of a Material](#) on page 475.

6 On the Identity tab of the Materials dialog, enter information about the new material, and click Apply.

See [Changing Material Identity Data](#) on page 487 and [Adding a Material Class](#) on page 487.

7 (Optional) On the Physical tab of the Materials dialog, specify physical parameters for the new material, and click Apply.

See [Changing Material Physical Data](#) on page 488.

8 To exit the Materials dialog, click OK.

See [Applying Materials to Elements](#) on page 471.

Renaming a Material

1 Click Manage tab ► Project Settings panel ► Materials.

2 In the Materials dialog, select the material to rename.

See [Searching for a Material](#) on page 470.

3 At the bottom of the left pane of the Materials dialog, click  (Rename).

Or you can right-click a material in the list, and click Rename.

4 In the Rename dialog, enter a new name for the material, and click OK.


5 In the Materials dialog, click Apply.

Deleting a Material

1 Click Manage tab ► Project Settings panel ► Materials.

2 In the Materials dialog, select the material to delete.

See [Searching for a Material](#) on page 470.

3 At the bottom of the left pane of the Materials dialog, click  (Delete).

Or you can right-click a material in the list, and click Delete.

4 At the confirmation prompt, click Yes.

Revit Architecture deletes the material from the project. If the material was applied to elements in the building model, Revit Architecture applies a default material to them instead.

Render Appearance Library

The Render Appearance Library is a local, read-only library for render appearances. You assign render appearances to materials using the Materials dialog.

When you change the properties of a render appearance, the modified render appearance is stored as part of the project file. It is not stored in the read-only Render Appearance Library.

To share a modified render appearance with team members, click Manage tab ► Project Settings panel ► Transfer Project Standards. Be sure to also make available any custom bitmaps or image files used to define bump patterns or custom colors used by the render appearance.

Related topics

- [Changing the Render Appearance of a Material](#) on page 475
- [Transferring Project Standards](#) on page 446
- [Best Practice for Storing Image Files](#) on page 519
- [How Materials Are Stored](#) on page 470
- [Render Appearance Library Location](#) on page 518

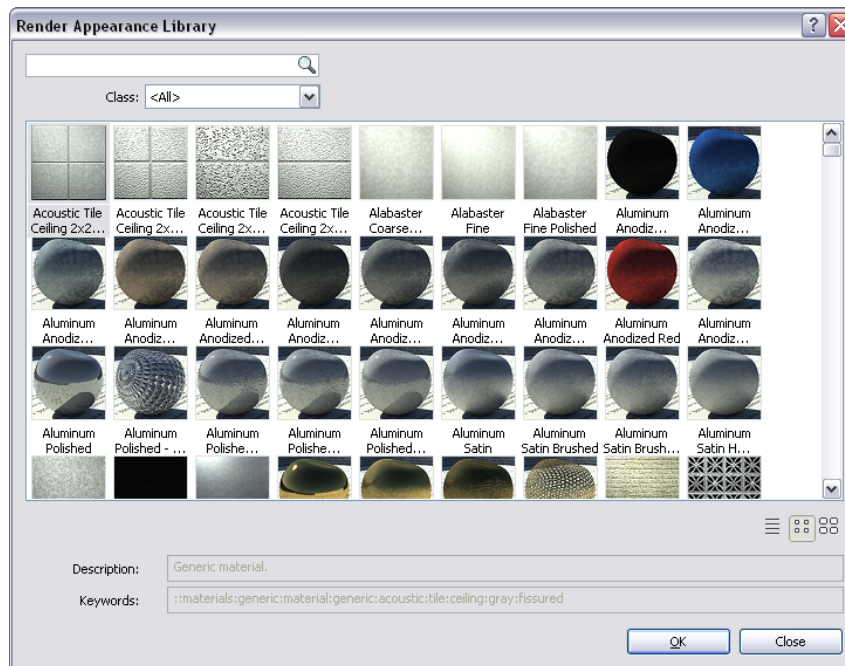
Searching for a Render Appearance

You can specify render appearances for materials and entourage. The following procedure assumes that you have already opened the Render Appearance Library as part of the following tasks.

- [Changing the Render Appearance of a Material](#) on page 475
- [Specifying a Render Appearance for an RPC Family](#) on page 1207

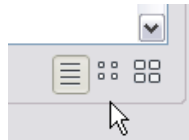
You can also open the Render Appearance Library to search for materials by clicking Manage tab ► Project Settings panel ► Settings drop-down ► Render Appearance Library.

Render Appearance Library for materials

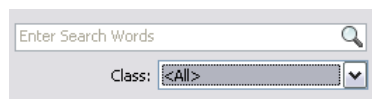


To search for a render appearance

- 1 (Optional) To specify the type of list to display, at the bottom of the render appearance list, click Show list, Show small icons, or Show large icons.



- 2 (Optional) For Class, select the desired class of render appearances.
The Render Appearance Library displays only render appearances that belong to the selected class.
- 3 (Optional) Type text in the search field.



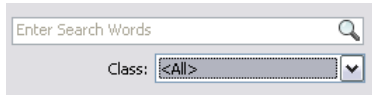
See [Entering Search Text](#) on page 493. The Render Appearance Library displays matching render appearances, sorted in order of relevance.

TIP To clear the search field, click the X that displays at the end of the field after you enter text.

- 4 If necessary, use the scroll bar to locate the desired render appearance in the list.
- 5 Click the render appearance to select it.
At the bottom of the Render Appearance Library, Revit Architecture displays a description and keywords for the selected render appearance.
- 6 Click OK.

Entering Search Text

When searching for materials or render appearances, you can enter search text in the box of the dialog.



The search is not case-sensitive. Use commas, spaces, or semi-colons as delimiters. Revit Architecture automatically performs an OR search on multiple words.

Revit Architecture searches each item for the specified text, checking its description and keywords. If you selected a class, Revit Architecture searches only items in that class for the specified text.

The dialog displays matching items, sorted in order of relevance. Items that match all of the search words display at the top of the list. Items that match fewer search words display near the bottom of the list.

TIP To clear the search field, click the X that displays at the end of the field after you enter text.

Related topics

- [Searching for a Render Appearance](#) on page 491
- [Searching for a Material](#) on page 470

Object Styles

The Object Styles tool specifies line weights, line colors, line patterns, and materials for different categories and subcategories of model objects, annotation objects, and imported objects in a project.

You can override project object styles on a view-by-view basis. For more information, see [Visibility and Graphic Display in Project Views](#) on page 198.

Creating Object Style Subcategories

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Object Styles.
- 2 Click the Model Objects, Annotation Objects, or Imported Objects tab.
- 3 In the Object Styles dialog under Modify Subcategories, click New.
- 4 In the New Subcategory dialog, enter a name.
- 5 Select the Category for Subcategory of.
- 6 Click OK.

Modifying Object Styles

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Object Styles.
- 2 Click the Model Objects, Annotation Objects, or Imported Objects tab.
- 3 Specify the projection, and, if applicable, cut line weights for the category.

This enables you to control the display of geometry when it is cut and not cut without having to create separate subcategories. For imported geometry layers, specify the appropriate line weight.
- 4 Click the color value to set the line color.
- 5 Select a line pattern.

- 6 Click the button in the Material field to open the Materials dialog. Select a material for the family category from the Material column. You can override the material for the family by changing its material type property. For imported geometry, specify a material for the layer. This is not available for annotation objects.
- 7 When you are finished, click OK.

Deleting an Object Style

You can delete any user-created object style.

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Object Styles.
- 2 Select the category name to delete.
- 3 Click Delete.
- 4 When prompted to confirm the deletion, click Yes.

Renaming an Object Style

You can rename any user-created object style.

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Object Styles.
- 2 Select the category name.
- 3 Click Rename.
- 4 In the Rename dialog, enter a new name.
- 5 Click OK.

Line Styles

Line styles are used to indicate different effects, such as a dashed (-----) line for reference planes. When you install and run Revit Architecture, several line styles are included. Each predefined line style has a name that describes either the line (for example, Dash dot), or where Revit Architecture uses the line style (for example, <Sketch> lines). Revit Architecture stores the line styles in the default template.

When you are in the Family Editor, you cannot create new line styles, but you can modify line weight, line color, and line pattern.

Creating a Line Style

NOTE You can only create line styles in the project environment. You can modify line weight, line color, and line pattern in the Family Editor. See [Modifying Line Styles in the Family Editor](#) on page 495.

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Line Styles.
- 2 In the Line Styles dialog, click New, and enter a new name for the line style.
The name displays under Category in the Line Styles dialog.
- 3 Click the value for Line Weight to choose a line weight.
- 4 Click the value for Line Color to choose a line color.
- 5 Click the value for Line Pattern to choose a line pattern.
- 6 Click OK.

The new line style is stored in the project only.

Deleting a Line Style

You can delete any user-created line styles.

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Line Styles.
- 2 In the Line Styles dialog, select the line style name.
- 3 Click Delete.
- 4 When prompted to confirm the deletion, click Yes.

Modifying Line Styles in the Family Editor

- 1 Click Manage tab ► Family Settings panel ► Settings drop-down ► Object Styles.
- 2 In the Object Styles dialog, click the Model Objects, Annotation Objects, or Imported objects tab.
- 3 Click in the Line Weight, Line Color, or Line Pattern cell for the category you want to modify and make changes as necessary.
- 4 When finished, click OK.

Line Weights

You can control line weights for model lines, perspective lines, and annotation lines.

For model lines, you can specify line weight for modeling components, such as doors, windows, and walls, in orthographic views. Line weight is dependent on the scale of the view.

For perspective lines, you can specify line weights for modeling components in perspective views. You may want to apply different line styles and line weights using the Linework tool. For more information, see [Changing the Line Style of Elements](#) on page 398.

For annotation lines, you can control the line weight of annotation objects, such as section lines and dimension lines. The weights of annotation symbols are not dependent on the scale of the design.

Specifying Line Weights

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Line Weights.
- 2 In the Line Weights dialog, click the Model Line Weights, Perspective Line Weights, or Annotation Line Weights tab.
- 3 Click a cell in the table and enter a value.
- 4 Click OK.

Adding Scales to Model Line Weights

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Line Weights.
- 2 In the Line Weights dialog, click the Model Line Weights tab, and then click Add.
- 3 In the Add Scale dialog, select a scale value, and click OK.
- 4 Click OK to close the Line Weights dialog.

Deleting Scales

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Line Weights.

- 2 In the Line Weights dialog, click the Model Line Weights tab, and then select the View Scale header.
- 3 Click Delete.
- 4 Click OK.

Line Patterns

You can specify the pattern for the line styles used in Revit Architecture. Several predefined line patterns are provided with Revit Architecture, or you can create your own. Line patterns are a series of dashes or dots alternating with blank spaces.

Creating a Line Pattern

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Line Patterns.
- 2 In the Line Patterns dialog, click New.
- 3 In the Line Pattern Properties dialog, enter a name for the pattern.
- 4 Click in the value for Type, and select either a dash or a dot.
- 5 If you selected a dash, click under Value, and enter a value. This is the length of the dash. Because dots are all drawn at 1.5 points, they do not require an associated value.
- 6 In the next row, select space for Type. Revit Architecture requires that you follow a dash or dot with a space.
- 7 Click under Value, and enter a value for the space.
- 8 Repeat the procedure until the pattern is complete.
- 9 Click OK.

In the Line Patterns dialog, the new line pattern displays in the list of available patterns.

- 10 Click OK.

The new line pattern is stored in the project only.

Editing a Line Pattern

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Line Patterns.
- 2 In the Line Patterns dialog, select the line pattern you wish to modify, and click Edit.
- 3 Make any necessary changes.
- 4 Click OK.


Deleting a Line Pattern

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Line Patterns.
- 2 In the Line Patterns dialog, select the line pattern.
- 3 Click Delete.
- 4 When prompted to confirm the deletion, click Yes.

Halftone/Underlay

Revit Architecture lets you control the line weight and pattern used for underlays, and the brightness of halftone elements. When printing views or sheets, you can specify that halftones print as thin lines to retain print fidelity.

To define Halftone/Underlay settings

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Halftone/Underlay.
- 2 In the Halftone/Underlay dialog, under Underlay, define the following settings:
 - **Weight:** Specifies the line weight for underlays. Select a value from the list. See [Line Weights](#) on page 495.
 - **Pattern:** Specifies the line pattern for underlays. Select a value from the list, or click  to modify an existing pattern or create a new one. See [Line Patterns](#) on page 496.
 - **Apply halftone:** Applies halftone to underlay graphics.
- 3 Under Halftone, for Brightness, enter a value or use the slider to specify a setting between Light and Dark.

This setting blends the line color of an element with the background color of the view to the specified amount.
- 4 Click OK.

To specify that halftones print as thin lines, use Print Setup options. See [Print Setup](#) on page 1081.

Structural Settings

For each project, you can control the symbolic representation of structural framing components. You can specify the symbolic cutback distance of beams and columns (see [Cutback](#) on page 865), brace symbols in plan, moment symbols, and analytical model adjustment. The values you specify are applied to structural framing components throughout the project. You can also save these settings as part of a template.

NOTE Most of the settings in the Structural Settings dialog are available if the project was created using the structural template.

Structural Settings Dialog

The Structural Settings dialog lets you modify settings that are specific to documentation and analysis of structural models, specifically Symbolic Representation Settings.

Symbolic Representation Settings Tab

The values that are entered on this tab reflect the plotted representation of the drawings. Therefore, the visible representations that are set with these values will change based on the view scale of the drawing.

Open Structural Settings dialog

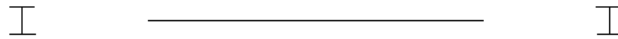
- 1 Click Home tab ► Structure panel ►  .

Modify symbolic cutback distance

- 2 On the Symbolic Representation Settings tab, enter a value for the symbolic cutback distance for brace, and beam/truss.

This setting affects the distance between steel beams and beams/trusses, and between beams and braces. Members must be joined to see the change in the cutback distance. Changes to this setting are applied only to the symbolic representation of structural framing components.

Cutback distance at larger setting in coarse mode



Cutback distance at smaller setting in coarse mode



- 3 Enter a value for the symbolic column cutback distance.

This setting affects the gap between symbolic representations of joined columns in an elevation view. The gap is visible only if the Top Connection Symbol instance property of the bottom column is set to a value other than None.

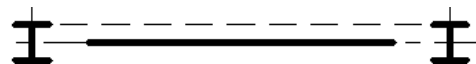
Plan representation options:

- 4 Under Brace Symbols, select a value for Plan representation.

Plan Representation options

■ Parallel Line:

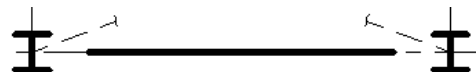
Symbolic representation of braces in a plan view are displayed with a line parallel to and offset from the brace at the value specified in the Structural Settings dialog. The line displays below, or to the right to vertical brace centerline if the brace is below the level and above, or to the left to vertical brace centerline if the brace is above the level.



NOTE The parallel line brace symbol displays in a symbolic plan view only when the structural usage of the brace is set to Vertical Bracing.

■ Line with Angle:

Symbolic representation of braces in a plan view are displayed with an angled line. Line with angle originates from the point of intersection of a brace and level if they intersect, and from the closest point to the level on the brace otherwise. The symbol goes upward (downward) for the portion of the brace which is above (below) the level.



NOTE The line with angle brace symbol displays in a symbolic plan view only when the structural usage of the brace is set to Vertical Bracing.

- 5 Under Brace Symbols, specify Parallel line offset.

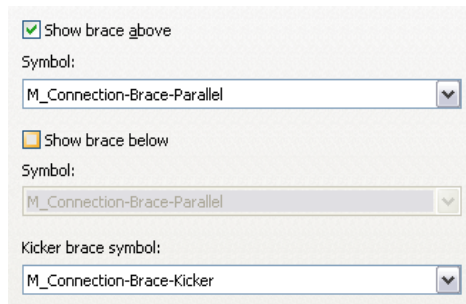
This value is available only after selecting Parallel Line for Plan representation. The parallel line is offset the specified value from the vertical brace centerline.

NOTE You can create new brace representation symbols using the generic annotation template. In the Family Category and Parameters dialog, set their Family Category to Brace in Plan View Symbols. Brace in Plan View symbols have a Representation Type parameter that can be either Parallel Line, Line with Angle, or Kicker Brace.

Show brace above

- 6 Under Brace Symbols, select Show brace above if you want the brace symbols representing the braces above the current view to display.

Show brace above



☒ Show brace above
Symbol: M_Connection-Brace-Parallel

☒ Show brace below
Symbol: M_Connection-Brace-Parallel

☒ Kicker brace symbol:
M_Connection-Brace-Kicker

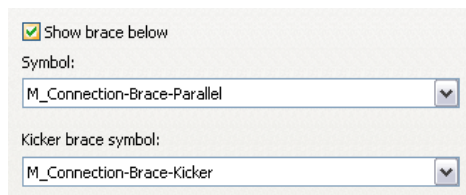
- 7 For Symbol, select the symbol that represents braces above the current view.

NOTE The brace above symbol changes automatically when you change the plan representation from parallel line to angle line.

Show brace below

- 8 Under Brace Symbols, select Show brace below if you want the brace symbols representing the braces below the current view to display.

Show brace below



☒ Show brace below
Symbol: M_Connection-Brace-Parallel

☒ Kicker brace symbol:
M_Connection-Brace-Kicker

- 9 For Symbol, select the symbol that represents braces below the current view.

NOTE The brace below symbol changes automatically when you change the plan representation from parallel line to angle line.

Kicker brace symbol

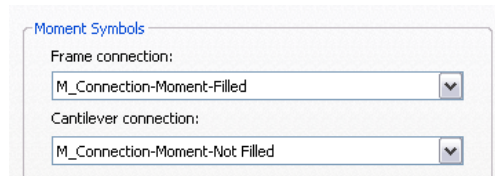
- 10 Under Brace Symbols, select the symbol that represents kicker bracing.

NOTE The kicker brace symbol displays in a symbolic plan view only when the structural usage of the brace is set to Kicker Bracing.

Specify moment symbols

- 11 Under Moment Symbols, select a symbol for Frame connection.

Specify moment symbols



Connection symbols may display at either end of the symbol of beams/braces. For each brace and beam, you can specify the symbol that displays for both the moment connection start and the moment connection end. The value of moment connection start/end can be moment frame, cantilever moment, or none.

- 12 Under Moment Symbols, select a symbol for Cantilever connection.

- 13 Click OK.

Annotation Styles

You can create or modify leader arrowhead, text note, dimension, and loaded tag styles in a project.

Specifying Arrowhead Styles

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Arrowheads.
- 2 In the Type Properties dialog, select the arrowhead type you want to work with from the Type list.
- 3 If desired, click Rename to rename the type, or click Duplicate to create a new arrowhead type.
- 4 Specify the properties for the display of leader arrowheads. See [Leader Arrowhead Properties](#) on page 1092 for property descriptions.
- 5 Click OK.

Specifying Text Note Styles

- 1 Click Annotate tab ► Text panel ► Text.
- 2 Click Place Text tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 In the Type Properties dialog, select the text properties you want to work with from the Type list.
- 4 If desired, click Rename to rename the type, or click Duplicate to create a new text type.
- 5 Specify the properties for the display of text notes.
See [Modifying Text Note Properties](#) on page 1091.
- 6 Click OK.

Specifying Dimension Styles

You can specify the style of linear, angular, or radial dimensions, as well as spot elevations, spot coordinates, and spot slopes.

- 1 Click Annotate tab ► Dimensions panel drop-down, and then a dimension style.
- 2 In the Type Properties dialog, select the dimension type you want to work with from the Type list.
- 3 If desired, click Rename to rename the type, or click Duplicate to create a new dimension type.
- 4 Specify the dimension display properties. See [Dimension Properties](#) on page 290 for property descriptions.

Related topics

- [Specifying Arrowhead Styles](#) on page 500
- [Placing Permanent Dimensions](#) on page 265
- [Spot Dimensions](#) on page 277
- [Dimensions](#) on page 263

Loading Tag Styles

- 1 Click Annotate tab ► Tag panel drop-down ► Loaded Tags.
The Tags dialog displays, listing the different family categories and any associated tags. Depending on the project template, some element categories may have default tags loaded.
- 2 Click Load.
You can load multiple tags for element categories.
- 3 Navigate to the location of the tag, and open the tag. You can select multiple tag files by holding either *SHIFT* or *CTRL* while selecting. The tag name displays adjacent to the element category.
- 4 When you are finished loading tags, click OK.
The last loaded tag for an element category becomes the default tag for that element.

Related topics

- [Tags](#) on page 1123
- [Applying a Tag](#) on page 1125
- [Tag All Not Tagged](#) on page 1126

Specifying the Default Tag for an Element Category

- 1 Click Annotate tab ► Tag panel drop-down ► Loaded Tags.
- 2 In the Tags dialog, click in the Value column for an element category, and then select a tag name.

NOTE You can also specify the default tag when you click Insert tab ► Load From Library panel ► Load Family to load a tag. This loaded tag becomes the default. See [Loading Families](#) on page 427.

Project Units

You can specify the display format of various quantities in a project. What you specify affects the look of quantities on the screen and in a printout. You can format data for informational or presentation purposes.

Project units are grouped by discipline, such as common, structural, or electrical. When you change the discipline, different unit types are available. In the Project Units dialog, each unit type has a preview of the display format. For example, length might have a display format of 1' 5 1/2".

NOTE The actual display of editable values that affect the size of the model may be different. For example, you might specify the display of dimensions to round to the nearest 1 inch; however, if you edit a dimension value in the drawing area, it may show a value that has fractional inches.

Setting Project Units

- 1 Click Manage tab ► Project Settings panel ► Project Units, or type the keyboard shortcut UN.
- 2 In the Project Units dialog, select the discipline.
- 3 Click the value in the Format column to change the display value for that unit type.
The Format dialog displays.
- 4 Specify Units, if necessary.
- 5 For Rounding, select an appropriate value. If you select Custom, enter a value in the Rounding increment text box.
- 6 For Unit symbol, select an appropriate option from the list.
- 7 Optionally select:
 - Suppress trailing 0's
When selected, trailing zeros do not display (for example, 123.400 displays as 123.4).
 - Suppress 0 feet
When selected, does not display the 0 foot value (for example, 0' - 4" displays as 4"). This option is available for Length and Slope units.
 - Show + for positive values
 - Use digit grouping
When selected, the Decimal symbol/digit grouping option specified in the Project Units dialog is applied to the unit value.
 - Suppress spaces
When selected, suppresses spaces around feet and fractional inches (for example, 1' - 2" displays as 1'-2"). This option is available for Length and Slope units.
- 8 Click OK.

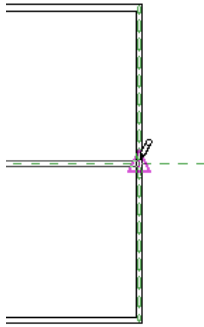
Changing Decimal Display and Digit Grouping

- 1 Click Manage tab ► Project Settings panel ► Project Units, or type the keyboard shortcut UN.
- 2 In the Project Units dialog, select a value from the Decimal symbol/digit grouping list.
- 3 In the Format column, click the button for the unit you want to use this setting.
- 4 In the Format dialog, select Use digit grouping.
- 5 Click OK 2 times.

Snaps

When you place an element or component, or sketch a line (straight, arc, or circle), Revit Architecture displays snap points and snap lines to assist in lining up elements, components, or lines with existing geometry. Snap points depend on the type of snap, but are represented in the drawing area as shapes (triangles, squares, diamonds, and so on). Snap lines are represented as dashed green lines in the drawing area.

The following illustration shows the green dashed snap line and a midpoint snap point (triangle).



You can enable or disable object snaps, and specify dimension snap increments. You can also override snap settings using keyboard shortcuts. You set snap settings in the Snaps dialog, and the settings are held for the duration of the Revit Architecture session. Snap settings apply to all files open in the session, but are not saved with a project.

Jump Snaps

Jump snaps are any snap points that are away from the current position of the cursor. For example, if you are resting the cursor on the midpoint of a wall, a jump snap might display at the endpoint of the wall.

Jump snaps occur when you clear the check box for the Nearest object snap in the Snaps dialog.

Setting Snap Increments

When you place an element or component in a project view, it snaps to set dimension increments. For example, when you are sketching a wall and move the cursor from left to right in the drawing area, you see the dimensions for the wall increase according to the defined length dimension snap increments. Likewise, when you place an element by an angle, angle snap dimensions increase according to the defined angle dimension snap increments.

You can define multiple length and angle snap increments because increments change as you change your zoom level (the closer you zoom in, the smaller the increment; the further you zoom out, the larger the increment).

To set snap increments:

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Snaps.
- 2 Select Length dimension snap increments and Angular dimension snap increments to turn on the snaps.
- 3 Enter the snapping increment values, separating increments with semicolons. There is no limit to the number of increments you can specify.
- 4 Click OK.

Enabling and Disabling Snaps

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Snaps.
- 2 Do one of the following:
 - Select Snaps Off to disable all snapping in the project.
 - Select or clear the appropriate object snaps. For object snap descriptions, see [Object Snaps and Snap Shortcut Key Combinations](#) on page 506.
- 3 Click OK.

You can also enable and disable snaps by right-clicking and selecting Snap Overrides ► Snaps Off after you have selected an element or component to place in the drawing area.

Temporarily Overriding Snap Settings

When you are working in a project, you can use shortcut key combinations or the right-click shortcut menu to temporarily override snap settings. Temporary overrides affect a single pick only.

For example, if you need a one-time snap to the center of an arc, you type *SC* or select Snap Overrides ► Centers from the context menu and only arc centers are recognized as a snap option. After you make a pick, snapping returns to the settings specified in the Snaps dialog.

To temporarily override snap settings:

- 1 Choose the component or element you want to place. For components or elements that require more than one pick (for example, a wall), select the component and make the first pick.
 - 2 Do one of the following:
 - Type the shortcut key combination.
 - Right-click, click Snap Overrides, and select an option.
- See [Object Snaps and Snap Shortcut Key Combinations](#) on page 506 for object snap descriptions and snap shortcut key combinations.
- 3 Place (or finish placing, for components or elements that require more than one pick) the component or element.

Snap Points

Components snap to reference planes and other components of the same category.

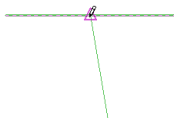
The following is a list of snap conditions for first and second points.

First or Second Point Snapping

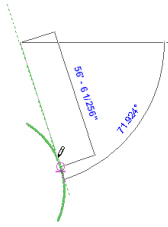
Snap Collinear to Existing Line—Snaps a point to be collinear to existing geometry.



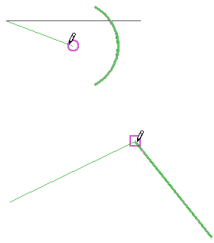
Snap to Line—Snaps point to an existing line or geometry. The cursor also snaps to the midpoint of a line.



Snap Tangent to an Arc—Snaps a point tangent to an existing arc end.



Snap to Endpoint or Center Point—Snaps a point to endpoint of straight or arc, or to arc or circle center.



Second Point or Whole Line Snapping Only

Horizontal or Vertical snap—When sketching a straight line, Revit Architecture snaps the line to be perfectly horizontal or vertical when the cursor approaches horizontal or vertical.

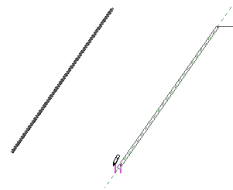


Horizontal snap

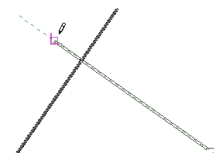


Vertical snap

Snap Parallel to Existing Line—Snaps a line parallel to existing geometry.



Snap Perpendicular to Existing Line—Snaps a line perpendicular to existing geometry.



TIP The status bar indicates the snap points when you move the cursor.

Object Snaps and Snap Shortcut Key Combinations

The following table defines the object snaps listed in the Snaps dialog (Manage tab ► Project Settings panel ► Settings drop-down ► Snaps) and the shortcut key combinations for these objects. Shortcut key combinations override snap settings for one pick.

Object Snap	Shortcut Key	Description
Endpoints	SE	Snaps to the endpoint of an element or component.
Midpoints	SM	Snaps to the midpoint of an element or component. When placing a wall insert, such as a window, door, or opening, you can use the midpoint override, SM, to snap the insert to the midpoint of the wall segment.
Nearest	SN	Snaps to the nearest element or component. If you turn off the Nearest object snap by clearing the check box or using the keyboard override, Revit Architecture allows jump snaps to endpoints, midpoints, and centers. A jump snap is a snap point that is more than 2 mm away from the cursor on the screen.
Work Plane Grid	SW	Snaps to a work plane grid.
Quadrants	SQ	Snaps to quadrant points. For arcs, jump snaps are enabled.
Intersections	SI	Snaps to intersections.
Centers	SC	Snaps to the center of an arc.
Perpendicular	SP	Snaps to perpendicular elements or components.
Tangents	ST	Snaps tangent to an arc.
Points	SX	Snaps to site points when editing points using the Move or Copy tool.
Snap to Remote Objects	SR	This is similar to jump snaps. When you select this option, snaps look for objects that are not near the element.
Close	SZ	Snaps to close valid open loops. See Closing an Open Loop on page 315.
Turn Override Off	SS	Turns off snap overrides.
Cycle through snaps	Tab key	Cycles through the available snap options.
Force Horizontal and Vertical	Shift key	Forces horizontal and vertical constraints.
Snaps Off	SO	Disables all snap settings.

Specifying Temporary Dimension Settings

You can specify the display and placement of temporary dimensions in the design. You can set temporary dimensions to:

- measure from wall centerlines, wall faces, center of core, or core faces
- measure from door and window centerlines or door and window openings

To specify temporary dimension settings:

- 1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Temporary Dimensions.
- 2 From the Temporary Dimension Properties dialog, select the appropriate settings.
- 3 Click OK.

View Templates

A view template is a collection of view properties, such as view scale, discipline, detail level, and visibility settings, that are common for a view type (such as plan or elevation). You specify the value for each property in the template. You can exclude properties from a view template. Excluded properties do not require a value and are not overridden when you apply a view template.

You can use view templates to:

- Apply a defined set of view properties to a specific view. For example, if you have a plan view that shows a furniture layout, you can create a view template that has the view properties you require for this type of plan view. If you create other plan views that require the same properties as the furniture plan, you can apply the same view template.
- Standardize the look of your project views before you print or export a view or a project. To do this, you define a default view template that you can then apply to multiple views simultaneously.

Project views and view templates are not linked. When a template changes, all views created from that template do not automatically update. You can reapply the modified template, which overrides previous view property settings.

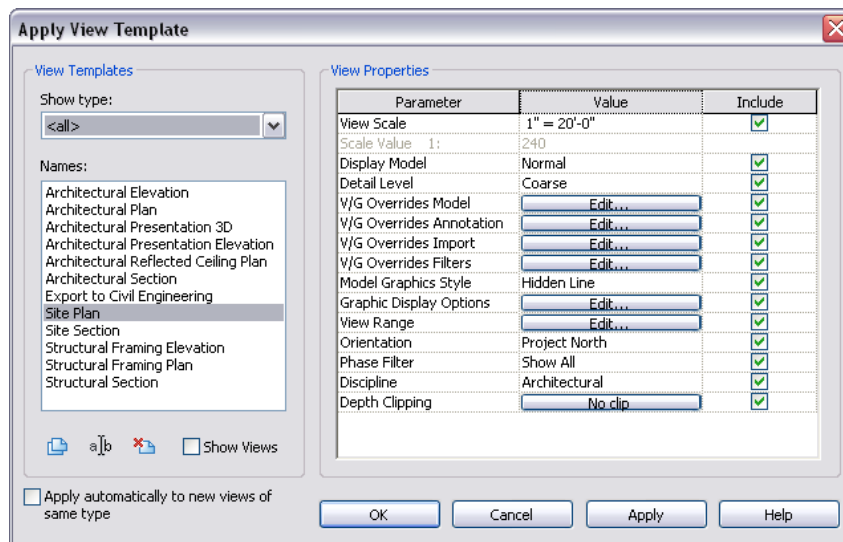
Several view templates are provided with Revit Architecture, or you can create your own based on these. View templates can be transferred from one project to another. See [Transferring Project Standards](#) on page 446.

Creating a View Template

You can create a view template by duplicating an existing view template and making necessary modifications. You can also create a view template from a project view.

To create a view template from an existing view template:

- 1 Click View tab ► Graphics panel ► View Templates drop-down ► View template settings.
The View Templates dialog displays.



2 In the View Templates dialog, select a view template type from the Show type list.

Each view template type contains a different set of view properties. Select a type that contains the view properties you want for the template you are creating.

3 In the Names list, select a view template.

4 Click  (Duplicate).

5 In the New View Template dialog, enter a name for the template, and click OK.

6 Modify view template property values as needed. See [View Template Properties](#) on page 510.

The Include option allows you to select the properties that will be included in the view template. Clear the Include option to remove properties. For properties that you do not include in the view template, you do not need to specify a value and these view properties will not be overridden when you apply the view template.

7 Click OK.

To create a view template from a project view:

1 In the Project Browser, select the view from which you want to create the view template.

2 Click View tab ► Graphics panel ► View Templates drop-down ► Create template from current view, or right-click and select Create View Template From View.

3 In the New View Template dialog, enter a name for the template, and click OK.

The View Templates dialog displays.

4 Modify view template property values as needed. See [View Template Properties](#) on page 510.

The Include option allows you to select the properties that will be included in the view template. Clear the Include option to remove properties. For properties that you do not include in the view template, you do not need to specify a value and these view properties will not be overridden when you apply the view template.

5 Click OK.

For information on applying a view template, see [Applying a View Template](#) on page 509 and [Applying a View Template to All Views on a Sheet](#) on page 509.

Specifying and Applying a Default View Template

Specifying default view templates allows you to apply standardized view properties to multiple views simultaneously. For example, you can use default view templates to ensure that all views have the desired view properties before printing or exporting.

When you apply the default view template to multiple views simultaneously, the default template that is specified in each view's properties (which can be different for each view) is applied.

To specify a default view template:

- 1 Right-click a project view in the Project Browser, and click Properties.
- 2 In the Instance Properties dialog, under Identity Data, select a value for Default View Template.
- 3 Click OK.

To apply a default view template:

- 1 In the Project Browser, select the view or views you want to apply the default view template to.

NOTE Use the *CTRL* key to select multiple views in the Project Browser.

- 2 Click View tab ► Graphics panel ► View Templates drop-down ► Apply default template to current view, or right-click and select Apply Default View Template.

The default view template that is defined in each view's properties is applied. For information on applying the default view template for all views on a sheet, see [Applying a View Template to All Views on a Sheet](#) on page 509.

Applying a View Template

- 1 In the Project Browser, select the view or views you want to apply a view template to.

NOTE Use the *CTRL* key to select multiple views in the Project Browser.

- 2 Click View tab ► Graphics panel ► View Templates drop-down ► Apply new template to current view, or right-click and select Apply View Template.
- 3 In the Apply View Template dialog, select a type from the Show type list.
- 4 In the Names list, select the view template you want to apply.
You can use the view properties of another project view as a view template. To do this, select Show Views and select the view name.
- 5 Optionally, select Apply automatically to new views of same type to apply this template to all new views of the same type.
- 6 Click Apply.
- 7 Click OK.

The selected view template is applied.

Applying a View Template to All Views on a Sheet

- 1 In the Project Browser, right-click a sheet view name, and click Apply View Templates to All Views or Apply Default View Template to All Views.

When you select Apply Default View Template to All Views, the default view template that is defined in each view's properties is applied and the task is complete. For information on

specifying the default view template for a view, see [Specifying and Applying a Default View Template](#) on page 509.

2 In the Apply View Template dialog, select a type from the Show type list.

3 In the Names list, select the view template you want to apply.

You can use the view properties of another project view as a view template. To do this, select Show Views and select the view name.

4 Click Apply.

5 Click OK.

The view template is applied to all views on the sheet.

Deleting a View Template

1 Click View tab ► Graphics panel ► View Templates drop-down ► View template settings.

2 In the View Templates dialog, select a type from the Show type list.

3 In the Names list, select the view template you want to delete.

4 Click  (Delete).

NOTE Because templates are not linked to views, deleting a view template has no impact on existing views.

View Template Properties

You can access view template properties from View tab ► Graphics panel ► View Templates drop-down ► View template settings. Not all properties are available for each view template type.

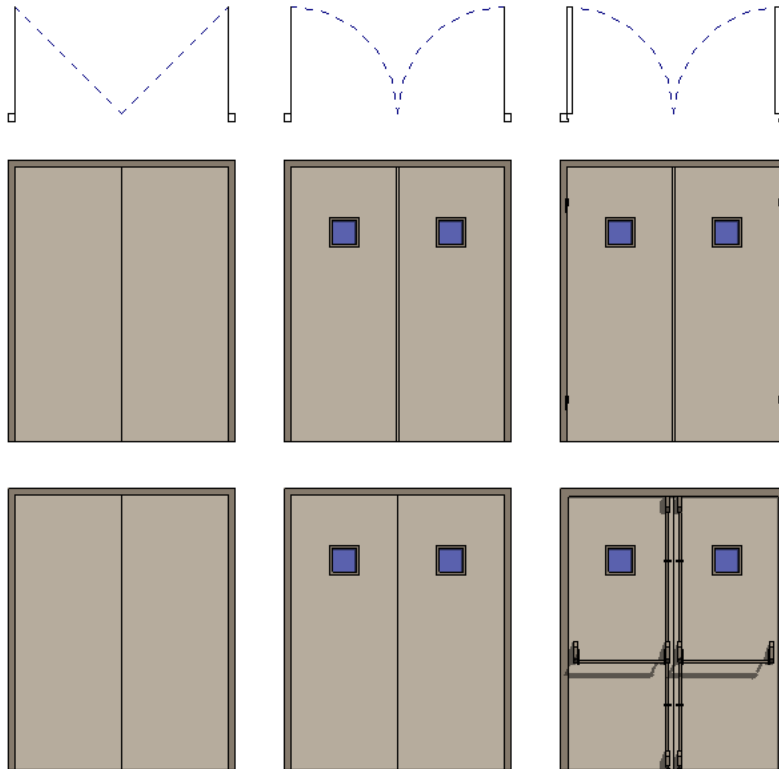
Name	Description
View Scale	The scale of the view. When you select Custom, you can edit the Scale Value property.
Scale Value 1:	A ratio derived from the view scale. For example, if the view scale is 1:100, the scale value is the ratio of 100/1 or 100. You can edit this value when you select Custom for the View Scale property.
Display Model	Hides the model in detail view. The Normal setting displays all elements normally. It is intended for all non-detail views. The Do Not Display setting shows only detail-view-specific elements. These elements include lines, regions, dimensions, text, and symbols. Elements in the model do not display. The As Underlay setting displays all detail-view-specific elements, while model elements are dimmed. You can use the underlay model elements as references for tracing lines, dimensioning, and aligning. (See Halftone/Underlay on page 497.)
Detail Level	Applies the detail level setting to the view. See Detail Level on page 511.
V/G Overrides Model	Click Edit to view and modify visibility options for model categories. See Visibility and Graphic Display in Project Views on page 198.
V/G Overrides Annotation	Click Edit to view and modify visibility options for annotation categories. See Visibility and Graphic Display in Project Views on page 198.

Name	Description
V/G Overrides Import	Click Edit to view and modify visibility options for imported categories. See Visibility and Graphic Display in Project Views on page 198.
V/G Overrides Filters	Click Edit to view and modify visibility options for filters. See Visibility and Graphic Display in Project Views on page 198.
V/G Overrides Design Options	Click Edit to view and modify visibility options for design options. See Checking the Design Option Settings for a View on page 1320.
Model Graphics Style	Indicates the view setting applied to the view.
Graphic Display Options	Click Edit to access the Graphic Display Options dialog. In this dialog, you can add shadows and silhouette edges. For more information, see Setting up Shadow Studies on page 253 and Applying or Removing a Line Style for a Silhouette Edge on page 254.
Far Clipping	Specify far clip plane settings. See Cutting an Elevation, Section, or Callout View by the Far Clip Plane on page 133.
View Range	Click Edit to access the View Range dialog. The Primary Range is defined by the Top and Bottom Clip Planes. Elements within the boundaries of the primary range are drawn according to their Object Styles. Elements that are not within the primary range yet fall within the specified view depth are drawn using the Beyond line style. The level at which the plan is cut is determined by the Cut plane offset from the current level value. Applicable only to plan and RCP views. For more details, see View Range Properties on page 250.
Orientation	Orients the project to project north or true north. For more information, see Rotating a View to True North on page 449.
Phase Filter	Applies the phase properties to the view. See Phase Filters on page 1333.
Discipline	Determines the visibility of non-bearing walls and discipline specific annotation symbols (such as framing elevations).
Color Scheme Location	Specify the display for the color scheme. Foreground colors all elements in the room or area; Background colors only the floor.
Depth Clipping	Specify depth clip plane settings. See Cutting a Plan View by the Back Clip Plane on page 127.
Rendering Settings	Specify settings to use when rendering an image from a 3D view. See Creating a View Template for Render Settings on page 1232.
Column Symbolic Offset	Specify the offset of a beam join to a slanted structural column. This only applies to coarse detail levels.

Detail Level

You can set the detail level for newly created views based on a view scale. View scales are organized under the detail level headings Coarse, Medium, or Fine. When you create a new view in your project and set its view scale, its detail level is automatically set according to the arrangement in the table.

By predefining detail levels, you can affect the display of the same geometry at different view scales. So, a custom door created in the Family Editor could display differently at coarse, medium, and fine detail levels (as shown in the following image).





You can override the detail level at any time by setting the Detail Level parameter in the view properties. See [View Properties](#) on page 259.

For information on detail levels and the display of structural components, see [Detail Levels and Display of Structural Components](#) on page 244.

Setting Detail Level Scale Values

1 Click Manage tab ► Project Settings panel ► Settings drop-down ► Detail Level.

2 Click  to move scale values to the right or click  to move detail levels to the left. You cannot select scales individually; they move in sequential order only.

3 To return to the original settings, click Default.

Related topics

- [Detail Level](#) on page 511
- [Specifying the Detail Level for a View](#) on page 513
- [Overriding Graphic Display of Element Categories](#) on page 201

Specifying the Detail Level for a View

Use one of the following methods:

- Click View tab ► Graphics panel ► View Properties. For Detail Level, select Coarse, Medium, or Fine.
- On the View Control Bar at the bottom of the drawing area, click the Detail Level icon, and select an option.



Related topics

- [Detail Level](#) on page 511
- [Setting Detail Level Scale Values](#) on page 512
- [Detail Levels and Display of Structural Components](#) on page 244

Managing Family Visibility and Detail Level

Visibility of a family determines in which view the family displays and what it looks like in that view. Typically, when an element is created by a family, the geometry of the element will change, depending on the current view. In a plan view, you may want to see a 2D representation of the element. In a 3D or elevation view, you may want a fully detailed 3D representation of the element. You have the flexibility to display different levels of geometry.

For example, you could create a door frame and use lines to represent it. Or you could extrude the door frame, so it has a 3D representation.

Detail Level determines the visibility of elements at different levels of detail. For example, you might create a door with certain embellishments. You then may decide that the embellishments should only appear at a certain detail level. You control the detail level in a project view with the Detail Level option on the View Control Bar.

You can set the visibility and detail level of any 2D and 3D geometry in the family before or after you create it.

Families are either cuttable or non-cuttable. If a family is cuttable, the family displays as cut when the cut plane of a plan view intersects that family in all types of views. If the family is non-cuttable, it displays in projection, regardless of whether it is intersected by the cut plane.

You can determine if a family category is cuttable in the Object Styles dialog (click Manage tab ► Family Settings panel ► Settings drop-down ► Object Styles). If the Line Weight Cut column is disabled, the category is non-cuttable.

For more information, see [The Families Guide](#) on page 418.

Setting Family Geometry Visibility

1 Do either of the following:

- To set the visibility before you sketch the geometry, click the tool that you want to use to create the geometry, and on the Visibility panel, click Visibility Settings.

- If you have already created the geometry, select it, and click Visibility Settings. The name of the panel this tool appears on varies depending on the type of geometry selected.
- 2 In the Family Element Visibility Settings dialog, select the views in which you want the geometry to display:
- Plan/RCP
 - Front/Back
 - Left/Right

NOTE All geometry automatically displays in 3D views.

- 3 If desired, select When cut in Plan/RCP (if category permits).
 If you select this option, the geometry appears cut if it is intersected by the cut plane of the view. If the element is cut by a section view, it also shows if you select this option.

- 4 Select the detail levels at which you want the geometry to display in a project:
- Coarse
 - Medium
 - Fine

Detail levels are dependent upon view scale.

NOTE The Family Element Visibility Settings dialog is different for families of profiles and detail components. For these families, you can set only the detail level.

- 5 Click OK.

TIP You can set family elements to be visible or not visible in the project by associating the Visible parameter of solid geometry tools with a family parameter for that element. The Visible parameter is available for solid and void geometry tools (blends, sweeps, swept blends, revolves, and extrusions). This lets you create one family type with optionally visible geometry on it. For example, you might create a door and have a coat hook or kick plate on that door be optional. Note that the family geometry still exists in the project, it is just invisible. For example, it may still be involved when you join geometry in the project.

- 6 If you set the visibility before you created the geometry, create the geometry.

Cuttable Families

If a family is cuttable, the family displays as cut when the cut plane of a view intersects that family in all types of views.

In the Family Element Visibility Settings dialog, there is an option called When cut in Plan/RCP. This option determines if family geometry is shown when the cut plane intersects that family. For example, in door families, the geometry for plan swing is set to be shown when the door is cut in plan views and not shown when the door is not cut.

This option is never made available and is never selected for non-cuttable families. For some cuttable families, the option is made available, and you can select it. For other cuttable families, the option is never made available, but it is always selected.

The following table lists cuttable families and whether the option is made available for that family.

NOTE Not Applicable means the category is a system family that cannot be made from a family template.

Family Category	Option Made Available
Casework	Yes
Ceilings	Not Applicable
Columns	Yes
Curtain Wall Panels	No
Doors	Yes
Floors	Not Applicable
Generic Models	No
Roofs	Not Applicable
Site	Yes
Structural Columns	Yes
Structural Foundations	Yes
Structural Framing	Yes
Topography	No
Walls	Not Applicable
Windows	Yes

Non-Cuttable Families

The following families are not cuttable and are always shown in projection in views:

- Balusters
- Detail Items
- Electrical Equipment
- Electrical Fixtures
- Entourage
- Furniture
- Furniture Systems
- Lighting Fixtures
- Mechanical Equipment
- Parking

- Planting
- Plumbing Fixtures
- Specialty Equipment


Options

You can configure global settings for your Revit installation. Global settings include

- General options: Save notifications, user name, and journal file clean-up.
- Graphics options: Enable hardware acceleration for improved display performance, configure colors for selection, highlight, background, and error messages, and enable anti-aliasing for 3D views.
- File location options: Specify paths for files and directories.
- Rendering options: Specify paths for files used for render appearances and decals, and specify the location of the ArchVision Content Manager (ACM), if needed.
- Spelling options: Specify options for the spell checker.
- SteeringWheels options: Specify options for the SteeringWheels view navigation tools.
- ViewCube options: Specify options for the ViewCube navigation tool.

You can specify options at all times, including when the drawing area is blank.

Setting Options

- 1 Click  ► Options.
- 2 Specify general, graphics, file location, rendering, spelling, SteeringWheels, and ViewCube options.
- 3 Click OK.

General Options

Click the General tab of the [Options dialog](#) to set notifications, user names, and journal file cleanup.

Notifications

- Specify a time value for the Save Reminder interval.
- Specify a time value for the Synchronize with Central Reminder interval.
- Set the ToolTip Assistance to the desired level. The default is normal. This affects how often tooltips display in the drawing area. See [Tooltips](#) on page 92.

Username

- Username is the identifier Revit Architecture associates with a particular session. The first time Revit Architecture is run on a workstation, it uses the Windows login name as the default Username. You can change and save the Username. In subsequent sessions on the same workstation, Revit Architecture defaults to the saved Username, not the Windows login name.

If team members are not consistently working on the same workstations day-to-day, they must be sure to reset the Username for each session because the default name will be that of the previous user.

In a multi-user (worksharing) Revit Architecture environment, editing permissions are based on the Username. Two (or more) active local files (or a local file and the central file) should never be edited under the same Username; doing so could cause the local files to be incompatible with the central file.

Journal File Cleanup

- Specifies the number of journal files to retain.
Journal files are text documents that record each step during your Revit Architecture sessions. These files are used primarily in the software support process. Journals can be run in order to detect a problem or recreate lost steps or files. They are saved at the termination of each Revit Architecture session. See [Journal Files](#) on page 117.

Graphics Options

Click the Graphics tab of the [Options dialog](#) to enable hardware acceleration for improved display performance. On this tab you can also configure colors for selection, highlighting, and alerts, and enable anti-aliasing for 3D views.

Graphics Mode

Use hardware acceleration. Some of the benefits of using hardware acceleration are:

- Faster display of large models upon refresh.
- Switching between windows of views occurs faster with 3D graphics acceleration.
- Creation and modification of annotations is faster.

Colors

- Select Invert background color to change the display of the background of the view and the elements in the view. For example, if you are drawing black elements in a white background, select this option so the background becomes black and the elements display in white.
- To define a new selection color, click the color button next to Selection Color. This option sets the color for items you select in the drawing area, either by clicking on them or using a pick box.
- To define a new highlight color, click the color button next to Highlight Color. This option sets the color of highlighted elements (when you move the cursor over an element in the drawing area).
- To define a different error color, click the color button next to Alert Color. This option sets the color for elements that are selected when a warning or error occurs.

Appearance Quality

- Use Anti-Aliasing for 3D views
When enabled, the quality of lines in 3D views is improved. For example, edges display smoother.

File Location Options

Click the File Locations tab of the [Options dialog](#) to set paths for files and directories.

Files and Directories

- Specify the path for the default template file. The Revit Architecture installation automatically sets this path; however, you may want to change it if you need to use either Imperial or Metric units for your project. There are default templates installed in either Revit Architecture\Imperial Templates\ or Revit Architecture\Metric Templates. Select whichever one is appropriate. Also, you can change this path to point to a custom template to use for all your projects.
- Specify the default project path where Revit Architecture saves the current file. This setting overrides the default path for saving files. When you specify a folder, Revit Architecture opens that folder by default when you save or open a file.
- Specify the path for the templates and libraries. The Revit Architecture installation automatically sets this path; however, you may want to change it if you need to use either Imperial or Metric families for your project. There are default templates installed in either Revit Architecture\Imperial Library\ or Revit Architecture\Metric Library.
- Add secondary libraries that may be specific to your company. To do this, click Places. In the Places dialog, enter the library name, click in the field for Library Path, and click the browse button. Navigate to the appropriate folder, and click OK.

Rendering Options

Click the Rendering tab of the [Options dialog](#) to specify paths for files used for render appearances and decals, and to specify the location of the ArchVision Content Manager (ACM), if needed.

Render Appearance Library Location

If you move the Render Appearance Library from its default location, use the Rendering tab of the [Options dialog](#) to specify its new location.

The Render Appearance Library is a read-only library that stores all render appearances for materials, the default RPC content provided with the software, and related rendering information.

When you install Revit Architecture, this library resides in the following default location:

C:\Program Files\<product name and version>\Data\Rendering\assetlibrary_base.fbx

If necessary, you can move the Rendering folder and its contents to another location, such as a second local hard disk or a partition on a local disk. After moving the Rendering folder, update the Render Appearance Library Location to point to the new location of assetlibrary_base.fbx.




Additional Render Appearance Paths

On the Rendering tab of the [Options dialog](#), specify the locations of files used for render appearances. For example, you can specify paths for the following:

- Image files used to define a custom color, design, texture, or bump map for a render appearance. See [Specifying an Image File for a Render Appearance](#) on page 485.
- Image files for decals. See [Creating a Decal Type](#) on page 1215.
- Additional RPC content that is stored in a common network location.

NOTE You only need to specify paths for additional RPC content that you license directly from ArchVision. You do not need to specify paths for the RPC content that Revit Architecture provides.

Suppose you specify image files for render appearances and decals. When Revit Architecture needs to access the image file, first it looks in the location specified for the file, using the absolute path. If it cannot find the file in that location, Revit Architecture then searches the paths that you specify in this list, in the order in which the paths are listed.

If you want to...	Then...
add a path	click  . Enter a path, or click  , navigate to the desired location, and click Open.
remove a path	select the path in the list, and click  .
change the order of the listed paths	select a path in the list, and click the arrows until the paths are listed in the desired order. Revit Architecture searches these paths in the order listed.

Best Practice for Storing Image Files

Store image files related to a project in one location. Specify this location on the [Rendering tab](#) of the Options dialog. If you need to send a project file to a team member, you can also send the directory containing its image files. This strategy ensures that the team member has all files required for the project, and that custom render appearances and decals display properly in the project.

ArchVision Content Manager Location

If your organization has licensed additional RPC content from ArchVision, specify the location of the ArchVision® Content Manager (ACM) on the Rendering tab of the [Options dialog](#). (This RPC content is licensed separately from the RPC content that is provided with Revit Architecture.)

You may also need to download and install the ACM. See [Using the ArchVision Content Manager](#) on page 1212.

Complete the fields as follows. For more information, see [Configuring Revit Architecture for Local Content](#) or [Configuring Revit Architecture for Networked Content](#).

Option	Description
Network	Select this option to indicate that the RPC plug-in should connect to the ACM on the network. Use this option when your organization stores additional RPC content in a network location so that multiple users can access it.
Address	Specify the network address where the ACM resides. You can enter a machine name or an IP address.
Port	Specify the port used by the ACM. The default is 14931.
Local	Select this option to indicate that the RPC plug-in should connect to the ACM on the local computer. Use this option when you store additional RPC content on the local computer.
Executable location	Specify the location of the local ACM executable file (rcpACMapp.exe). If the ACM is not running, the RPC plug-in starts it when needed. To navigate to the executable location, click Browse.


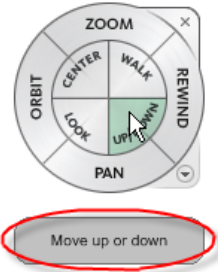
Option	Description
Get More RPC	Click to go to the ArchVision web site, where you can purchase additional RPC content to use in Revit projects.

Spelling Options

Click the Spelling tab of the [Options dialog](#) to set options for the spell checker. You can specify a language for the main dictionary. If desired, you can click Edit to add words to the additional dictionaries.

SteeringWheels Options

On the SteeringWheels tab of the [Options dialog](#), specify options for the SteeringWheels view navigation tools.

Option	Definition
Steering Wheel Visibility	
Show Tool Messages	<p>Show or hide tool messages.</p>  <p>Tool messages always display for Basic Wheels (View Object Wheel and Tour Building Wheel) regardless of this setting.</p>
Show Tooltips	<p>Show or hide tooltips.</p>  <p>Tooltips always display for Basic Wheels (View Object Wheel and Tour Building Wheel) regardless of this setting.</p>
Show tool cursor text	<p>Shows or hides the cursor text when the tool is active. Cursor text always displays for Basic Wheels (View Object Wheel and Tour Building Wheel) regardless of this setting.</p>
Big Steering Wheel Appearance	
Size	Specify the size of the big steering wheel.
Opacity	Specify the opacity of the big steering wheel.

Option	Definition
Mini Wheel Appearance	
Size	Specify the size of the mini wheel.
Opacity	Specify the opacity of the mini wheel.
Look Tool	
Invert Vertical Access	Inverts the up and down action of the Look tool. See Look Tool on page 233.
Walk Tool	
Move parallel to ground plane	<p>When walking through a model using the Walk tool, you can constrain the movement angle to the ground plane by selecting this option. You can freely look around while the current view moves parallel to the ground plane.</p> <p>When this option is deselected, the walk angle is not constrained and you will “fly” in the direction you are looking so that you can move around the model in any direction or angle.</p> <p>See Walk Tool on page 239.</p>
Speed Factor	<p>As you use the Walk tool to walk or “fly” through a model, you can control the movement speed. The speed of movement is controlled by the distance that the cursor is moved from the Center Circle icon. Set the movement speed here.</p> <p>See Walk Tool on page 239.</p>
Zoom Tool	
Zoom in one increment with each mouse click	Allows you to zoom the view with a single click. See Zoom Tool on page 240.
Orbit Tool	
Keep Scene Upright	<p>Keeps the sides of the view perpendicular to the ground plane.</p> <p>If you deselect this option, you can orbit the model in full 360 degree motion, which may be useful when you are editing a family.</p> <p>See Orbit Tool on page 234.</p>

For more information, see [SteeringWheels](#) on page 225.

ViewCube Options

On the ViewCube tab of the [Options dialog](#), specify options for the ViewCube navigation tool.

Option	Definition
ViewCube Appearance	

Option	Definition
Show the ViewCube	Show or hide the ViewCube in 3D views.
Show in	Specify which views to show the ViewCube.
On-screen position	Specify the position of the ViewCube in the drawing area.
ViewCube Size	Specify the size of the ViewCube.
Inactive Opacity	Specify the opacity of the ViewCube when not in use. If you select 0% the ViewCube will not display in the drawing area unless you move the cursor over the ViewCube on-screen position.
When Dragging the ViewCube	
Snap to closest view	When selected, snaps to the closest ViewCube view orientation. A ViewCube view orientation is one of the 26 view options (a face, edge, or corner of the ViewCube).
When Clicking on the ViewCube	
Fit-to-view on view change	If you have an element or component selected in the drawing area and click on the ViewCube, the view rotates accordingly and the view zooms to fit the element in the drawing area.
Use animated transition when switching views	Shows an animated action when you switch view orientation.
Keep scene upright	Keeps the sides of the ViewCube, and the view, perpendicular to the ground plane. If you deselect this option, you can orbit the model in full 360 degree motion, which may be useful when you are editing a family. See Orbit Tool on page 234.
Compass	
Show the compass with the ViewCube.	Shows or hides the ViewCube compass.

For more information, see [ViewCube](#) on page 217.

Keyboard Shortcuts

There are many predefined keyboard shortcuts for Revit Architecture tools. You can also configure your own keyboard shortcuts. If a shortcut key combination exists for a tool, it displays on the tooltip in parentheses, after the tool name.

You can create multiple shortcuts for each tool. The shortcut that displays on the tooltip is the first shortcut listed in the KeyboardShortcuts.txt file.

For example, you can configure multiple shortcuts for the Visibility/Graphics dialog.

```
"VG" "ribbon:"View-Graphics-Visibility/Graphics"
; "VV" "ribbon:"View-Graphics-Visibility/Graphics"
```


Both shortcuts will work but only the first shortcut listed, "VG", will display on the tooltip. Shortcuts are only available when their corresponding ribbon item is available.

Customizing Keyboard Shortcuts

- 1 Open the KeyboardShortcuts.txt file in a text editor. This file is typically located in the following directory: C:\Program Files\Autodesk Revit Architecture 2010\Program\.

The path may vary depending on your operating system or where you installed Revit Architecture.

At the top of the file you will see several paragraphs with each line preceded by a semi-colon. A list of commands begins after the text. Command lines are not preceded with semi-colons.

Command syntax is as follows:

```
shortcutkey(s) action_type:action_string
```

where:

- shortcutkey(s) is a quoted key sequence.
Any alphanumeric key may be used for a key sequence.
- action_type:action_string is the action to take.
Available actions are:
ribbon:"ribbon_string", where ribbon_string is a delimited path to the ribbon item to click.

For example, in the following command line, "AL" launches the Align tool (Modify tab ► Edit panel ► Align).

```
"AL" ribbon:"Modify-Edit-Align"
```

Function key (F2-F12) command syntax does not require the shortcut key in quotes. For example, in the following command line, the shortcut key F6 has no quotes. In this example, F6 launches the Align tool (Modify tab ► Edit panel ► Align).

```
F6 ribbon:"Modify-Edit-Align"
```

- 2 Insert a new line between any 2 existing commands.
- 3 Type the new command using the examples above, or modify existing lines.
- 4 Save and close the file.
- 5 Restart Revit Architecture.

The KeyboardShortcuts.log file (located in the same directory as KeyboardShortcuts.txt) contains any errors encountered while reading the KeyboardShortcuts.txt file.

Keyboard Accelerators

Revit Architecture features many preset keyboard commands to increase your efficiency. The following tables lists these commands.

Selecting

Key	Action
CTRL	Select multiple elements
TAB	Cycle through the highlighting of elements to select among ones that are close to one another.
	NOTE If you are selecting multiple elements and need to use the <i>TAB</i> key, do not hold the <i>CTRL</i> key while pressing <i>TAB</i> .

Key	Action
TAB	Highlight wall faces or wall centerlines when placing dimensions
TAB	Toggle between selecting a curtain wall or a glazed panel in a plan view
SHIFT+TAB	Reverse the order in which <i>TAB</i> cycles through the highlighting of elements
CTRL+A	Select all rows in the Worksets dialog.

Snapping

Key	Action
TAB	Cycle through different snaps while creating walls and lines, placing components, or moving or pasting elements.
SHIFT+TAB	Reverse the order in which <i>TAB</i> cycles through different snaps. Pressing <i>SHIFT+TAB</i> once suppresses all snap points.

File Management

Key	Action
CTRL+O	Open a project
CTRL+P	Print a page
CTRL+S	Save a project

Editing

Key	Action
Press and hold down CTRL while dragging an element	Make a copy of the element
CTRL+C	Copy a selected element
CTRL+V	Paste an element
CTRL+X	Cut an element
CTRL+Y	Redo a change
CTRL+Z	Undo a change
mv	Move an element
ro	Rotate an element
DEL	Delete a selected element

Canceling an Action or Clearing Temporary Dimensions

Key	Action
ESC	Cancel an action before a first click and return to modify mode
ESC	Cancel the first click of a multi-click placement, such as walls or lines. Press <i>ESC</i> again to return to modify mode.
ESC	Clear temporary dimensions that display after a single-click placement, such as doors, or after the second click of a multi-click placement, such as walls. Press <i>ESC</i> again to return to modify mode.

Views

Key	Action
F8	Activate the SteeringWheel navigation tool.
TAB	Create different interior elevation views as you place the Interior Elevation symbol

Controlling Element Placement

Key	Action
Press and hold SHIFT	Constrain the elevation of a window in a 3D view.
Press and hold SHIFT	Impose or relax the constraint on the movement of a wall or line.

Screen Refresh

Key	Action
F5	Refresh the screen

Colors

You set colors for many elements in Revit Architecture, such as objects, lines, annotation symbols, materials, rooms, and phasing. When you select colors, the standard Windows color dialog opens. If you click PANTONE from the Windows color picker, the PANTONE color dialog opens.

You can specify No Color in the Windows Color dialog to not associate a color with a particular item. This does not mean the item has no color. A component can assume its color from a parent category or use black. For example, if you specify No Color for Door Panel, but Doors are defined as brown, the Door Panel displays in brown.

Using the Windows Color Dialog

1 From the appropriate Revit Architecture dialog, access the Windows Color dialog.

For example, in the Materials dialog, on the Graphics tab or the Render Appearance tab, click a color swatch. (See [Materials](#) on page 468.)

2 In the Color dialog, select a color using one of the following methods:

- **Basic colors:** A table of 48 commonly used colors is available. Click one of the boxes containing the desired color.
- **Hue, Sat, Lum, Red, Green, Blue boxes:** Type values in these boxes to define the desired color.
- **Black and white settings box:** Move the slider up and down to alter the amount of white or black in the color. The result displays in the color/solid box.
- **Custom colors:** Add up to 16 custom colors. To add a custom color, click one of the 16 color squares under Custom Colors. Mix the new color by clicking one of the Basic Color squares or by choosing a PANTONE color. When you have finished mixing the color, click Add Custom.

3 When you have specified the desired color, click OK.

Using the PANTONE Color Picker

1 From the appropriate Revit Architecture dialog, access the Windows Color dialog.

For example, in the Materials dialog, on the Graphics tab or the Render Appearance tab, click a color swatch. (See [Materials](#) on page 468.)

2 In the Color dialog, click PANTONE.

3 Create a color in the PANTONE Color Picker.

4 Click a color in the pane to select it.

The PANTONE preview window displays the selected color.

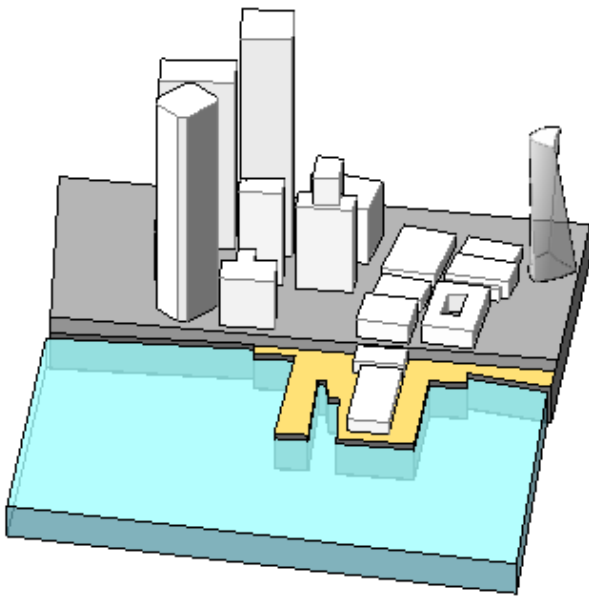
5 When you find the desired color, click OK.

6 Click OK to exit the Color dialog.

Revit Architecture assigns the PANTONE color to the dialog. Note that Revit Architecture uses the PANTONE name.

Conceptual Design Environment

11



The Revit conceptual design environment provides flexibility early in the design process for architects, structural engineers, and interior designers to express ideas and create parametric massing families that can be integrated into building information modeling (BIM). Use this environment to directly manipulate a design's points, edges, and surfaces into buildable forms.

The designs created in the conceptual design environment are massing families that can be used in the Revit project environment as the basis from which you create more detailed architecture by applying walls, roofs, floors, and curtain systems. You can also use the project environment to schedule floor areas, and to conduct preliminary spatial analysis.

Related topics

- [Revit Families](#) on page 415
- [Massing Studies](#) on page 589

Conceptual Design Environment Overview

The conceptual design environment is a type of family editor in which you create conceptual designs using in-place and loadable mass family elements. When a conceptual design is ready, it can be loaded into the Revit project environment (RVT file). Creating designs in this environment can accelerate the design process. (See [Massing Studies](#) on page 589.)

NOTE The standard Family Editor is used when working with families outside the conceptual design environment. When a family is loaded from the conceptual design environment into a project, the standard massing tools are available.

To enter the conceptual design environment, use one of the following methods:

- **Conceptual Design Environment**
Use the Revit user interface and create new massing families that reside outside the project environment. If desired, you can load these massing families into a project.
- **Revit Project Environment**
Use the In-Place Mass tool in a Revit project to create or manipulate massing families. When accessed through the In-Place Mass tool, the conceptual design environment does not have 3D reference planes and 3D levels.

NOTE The Revit conceptual design environment creates new masses. Masses created using a previous release of Revit Architecture use the same massing tools originally used to create them, and remain dedicated to these tools throughout the duration of the project.

Exploring Conceptual Designs

The Revit conceptual design environment is used for the following:

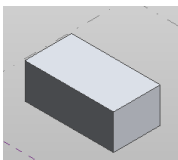
- Early conceptual study models. (See [Early Conceptual Study Models](#) on page 528.)
- Integrated study models. (See [Integrated Study Models](#) on page 529.)
- Intelligent sub-components. (See [Intelligent Sub-Components](#) on page 529.)

Early Conceptual Study Models

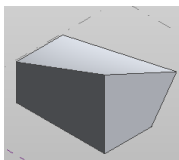
Create and explore models before committing to a particular design. If a decision is made to use one, integrate it into the main Revit project.

As conceptual designs are developed, they may go through several possible formations before meeting the desired project requirements. The conceptual design environment provides direct form creation and manipulation, making it easy to rapidly create different design possibilities.

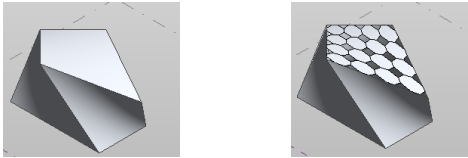
1. Create a form.



2. Manipulate the form shape.



3. Rotate the top surface.
4. Divide and pattern the top surface.



Integrated Study Models

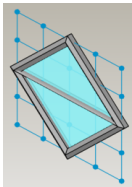
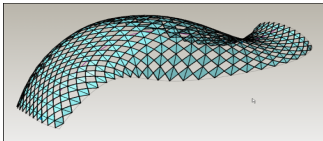
You can reference the conceptual design into a Revit project file, and continue to modify it. For example, a design can be used to provide important reference information for the building model. Conceptual designs that have been saved as Revit project files can continue to be developed in the conceptual design environment. (See [Switching between Conceptual Design and Project Environments](#) on page 530.)

Intelligent Sub-Components

Use conceptual designs as intelligent sub-components that are nested in other models. For example, when the conceptual design is referenced into a larger building model, it can be used in multiple locations and regenerated.

In the conceptual design environment, you can create parametric components that have the intelligence to adapt to a divided surface. (See [Rationalizing Surfaces](#) on page 569.)

The following table shows a parametric component that is added to a divided surface.

Parametric component	Divided surface with parametric component
	

Conceptual Design Environment Interface

The tools for developing conceptual designs are all accessed from the ribbon, which changes depending on what is required to accomplish an action. For example, if you draw a rectangle and select it, Create Form becomes available. The Create Form tool allows you to instantly extrude the drawing and make it a solid or void form. (See [Using the Revit Interface](#) on page 85.) If you then select a surface on the form, Divide Surface becomes available. This tool allows you to divide surface areas into buildable components. (See [Rationalizing Surfaces](#) on page 569.)

As you work on a conceptual design, you manipulate it directly in the drawing area, using several available controls. (See [Manipulating Forms](#) on page 566.)

Conceptual Massing Family Creation

As you create massing families in the conceptual design environment, many of the important tools are accessed from the Create tab and the Options Bar. (See [Creating Solid Forms](#) on page 552.)

This panel...	Contains tools that let you...
Selection	complete an action in the drawing area.
Draw	draw the shapes used to create forms and surfaces.
Datum	create 3D levels, and reference geometry.
Model	load families into the conceptual design environment.
Dimension	dimension lines and set their type properties.
Work Plane	set and show a work plane.
Form	create a solid or void form from selected lines.
Family Editor	load a massing family file into a Revit project file.
Family Properties	set the family category, parameter, and family type rules.

In the conceptual design environment, when forms or lines are selected, the Options Bar displays useful options. The Options Bar displays options for:

- selecting the work plane (See [3D Work Planes](#) on page 536.)
- making a surface from the lines (See [Surface Forms](#) on page 556.)
- enabling 3D snapping (See [3D Snapping](#) on page 533.)
- creating a chain of lines
- setting the offset value
- setting the radius


Switching between Conceptual Design and Project Environments

When a concept is ready, you can switch to the Revit project environment. For example, you may want to perform area analyses, evaluate floors, or add curtain walls. Then, if the evaluation indicates that you need more floor area on a level, you can move the design back into the conceptual design environment to make the adjustment.

The following procedures define:

- how to move a massing family between the conceptual design and project environments, and how to edit it in the conceptual design environment.

- how to move an in-place massing family between the conceptual design and project environments, and how to edit it in the conceptual design environment.

TIP An easy way to switch views is to click  ► Recent Documents, and select one of the views you have used.

Related topics

- [Loadable Families](#) on page 424
- [In-Place Elements](#) on page 434
- [Revit Families](#) on page 415

Moving Loadable Massing Families

Use the following procedure to move a loadable massing family from the conceptual design into a project. (See [Loading the Current Family into a Project](#) on page 429.)

- 1 In the contextual design environment, click Create tab ► Family Editor panel ► Load into Project. The family loads into the Revit project.

NOTE If the family has not been placed into the project before, drag the preview image to the desired location, and click to place it. If the family has been placed, you are prompted to specify whether you want to overwrite the existing version and its parameter values.

- 2 Analyze the mass. (See [Analyzing a Conceptual Design](#) on page 594.)

If necessary, return to the conceptual design environment and make adjustments to the mass, as explained in the following procedure.

(See [Conceptual Design Environment Overview](#) on page 528.)

Editing Loadable Massing Families

Use the following procedure to edit a massing family that has been loaded into the conceptual design environment from a project.

- 1 In the project, select the mass that needs to be adjusted.
- 2 Click Modify Mass tab ► Family panel ► Edit Family, and select Yes from the Revit dialog. The conceptual design environment opens.
- 3 Adjust the mass. For example, use the drag controls to make the mass larger.
- 4 Click Create tab ► Family Editor panel ► Load into Project. The project environment opens, and you can continue to develop the design.

(See [Conceptual Design Environment Overview](#) on page 528.)

Moving In-Place Massing Families

Use the following procedure to move an in-place massing family from the project environment to the conceptual design environment.

- 1 Open a Revit project.
- 2 Click Massing & Site tab ► Conceptual Mass panel ► In-Place Mass.
- 3 Name the in-place mass in the Name dialog. The conceptual design environment opens.
- 4 (Optional) Create a form or manipulate the mass in some way using the available tools. (See [Forms](#) on page 551.)
- 5 Click Modify Form tab ► In-Place Editor panel ► Finish Mass. The mass moves back to the project environment.

(See [Conceptual Design Environment Overview](#) on page 528.)

Editing In-Place Massing Families

Depending on how you access it, the editing tools for in-place mass manipulation are different. For example, the shape handles used while editing an in-place mass in the project environment are 2D. However, when you edit the in-place mass in the conceptual design environment, 3D controls allow you to further modify the mass by moving vertices, surfaces, edges, and points.

Use the following procedure to edit an in-place massing family that has been moved to the conceptual design environment from a project.

(See [Conceptual Design Environment Overview](#) on page 528.)

- 1 Open a project file.
- 2 Click Massing & Site tab ► Conceptual Mass panel ► Show Mass.
- 3 Select the mass.

NOTE 2D shape handles are available to modify the mass.

- 4 Click Modify Mass tab ► Model panel ► Edit In-Place. The conceptual design environment opens.

NOTE 3D controls are available to modify the mass.

- 5 Modify the mass.
- 6 Click Model In-Place Mass tab ► In-Place Editor panel ► Finish Mass.

Template Files for the Conceptual Design Environment

The conceptual design environment provides 2 standard family template files.

■ Mass.rft

This template is used to create new conceptual massing families. (See [Creating Solid Forms](#) on page 552.)

To create a new massing family, click  ► New ► Conceptual Mass. In the dialog, select Mass.rft.

■ Curtain Panel Pattern Based.rft

This template is used to create a component family. (See [Pattern Component Families](#) on page 578.)

To create a new component family, click  ► New ► Family, and select the template from New Family Select Template dialog.

Drawing in the Conceptual Design Environment

When you access the conceptual design environment, you can immediately start to draw a concept in 3D. Select a drawing tool, such as a line, and click anywhere in the drawing area to start creating a form. (See [Forms](#) on page 551.)

NOTE To draw in a 2D view, open it from the Project Browser.

Drawing Overview

You draw when you are placing lines and points to create a form. You can draw on the following elements:

- surfaces (See [Drawing on a Planar Surface](#) on page 534.)
- 3D levels (See [3D Levels](#) on page 536.)
- 3D reference planes (See [3D Reference Planes](#) on page 539.)
- reference points (See [Hosted Points](#) on page 541.)

3D levels and 3D reference planes are automatically detected. They highlight in the drawing area as the cursor moves over them. Click to select one of these to set it as the active work plane.

To draw in the conceptual design environment

- 1 Click Create tab ► Draw panel ► Line.

NOTE If you want to draw a reference-based form, click Create tab ► Draw panel ► Reference before selecting a drawing tool. (See [Unconstrained and Referenced-Based Forms](#) on page 554.)

Several options become available on the Options Bar. You can set the placement plane, create a surface by drawing closed profiles, draw a chain of lines, and set an offset or radius value. (See [Conceptual Design Environment Interface](#) on page 529.)

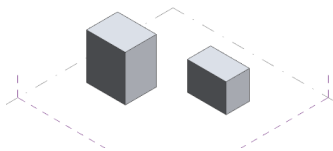
- 2 Click Modify Lines ► Draw panel ► Face to draw on a surface, or click Modify Lines ► Draw panel ► Work Plane to draw on a work plane.
- 3 Click in the drawing area, and draw a line.
- 4 Click Create tab ► Selection panel ► Modify.


3D Snapping

Use 3D snapping to ensure an exact location for placing points on a model vertex. For example, you can use 3D snapping to help place a surface on a mass that you can later use in the project as a floor or a roof. To enable 3D snapping, select 3D Snapping on the Options Bar.

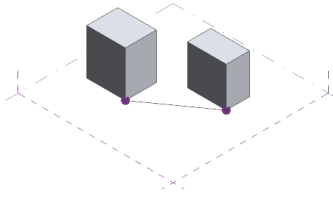
To create a surface using 3D snapping

- 1 Create 2 forms. (See [Forms](#) on page 551.)

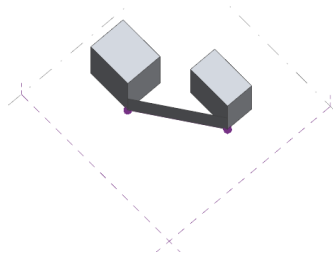


- 2 Click Create tab ► Draw panel ► Line ►  (Line).
- 3 On the Options Bar, select 3D snapping.
- 4 (Optional) On the Options Bar, select Chain and a named reference from the Placement Plane list.
- 5 Draw a line from one vertex to the another vertex.

NOTE The lines snap to the vertex.




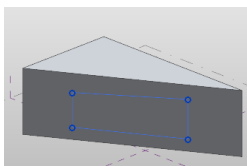
- 6 Select the line and click Modify Lines tab ► Create tab ► Make Form.



Drawing on a Planar Surface

You can draw on a planar surface to create unconstrained or reference-based forms. (See [Unconstrained and Referenced-Based Forms](#) on page 554.)

- 1 Click Create tab ► Draw panel ►  (Line).
- 2 Click Create tab ► Draw panel ► Face to indicate that you want to draw on a surface.
- 3 Click on a surface and draw the lines.
- 4 Click Create tab ► Selection panel ► Modify.



Related topics

- [Creating Solid Forms](#) on page 552
- [Creating Void Forms](#) on page 553
- [Rationalizing Surfaces](#) on page 569

Conceptual Design Model Line Instance Properties

You can modify many line properties for a conceptual design massing family. Lines have instance properties because they are not yet part of a family. When a line is selected, click **Modify Lines** tab ► **Element** panel ► **Instance Properties** to access the Model Lines Instance Properties dialog. (See [Model Line Properties](#) on page 808.)

Name	Description
Constraints	
Work Plane	The work plane to which the line is related.
Graphics	
Visible	Turns visibility on or off, and accesses the Associate Family Parameter dialog for viewing existing parameters and adding new ones.
Visibility/Graphics Overrides	Sets the 3D views for the View Specific Display and sets the Detail Levels to Coarse, Medium, or Fine.
Dimensions	
Length	The actual line length.
Identity Data	
Subcategory	Sets the line subcategory to Form [projection] or Void.
Is Reference Line	Changes the unconstrained reference line to a reference line. Displays the Associate Family Parameter dialog that lists existing parameters and adds new parameters.
Other	
Reference	Sets the reference type to Not a Reference, Weak Reference, or Strong Reference.
Model or Symbolic	The actual type of line.

Related topics

- [Drawing on a Planar Surface](#) on page 534
- [Creating Solid Forms](#) on page 552
- [Creating Void Forms](#) on page 553

3D Work Planes

When you select a drawing tool in the conceptual design environment, the available 3D work planes are automatically detected as the cursor passes over them in the drawing area. You can click to select one of these work planes, or explicitly set one from the named references listed in the Placement Plane list on the Options Bar. If you have several tiled 3D views, and you change the active work plane in one of the views, it changes for every 3D view.

NOTE Only named reference planes are available in the Placement Planes list.

When a drawing tool is selected, 2 tools become available:

- **Face:** allows a planar surface to be the work plane.
- **Work Plane:** allows a level or reference plane to be explicitly set as the work plane

Setting and Showing Work Planes

Use the Set and Show tools to set an active work plane and to display or hide the work plane. (See [Setting the Work Plane](#) on page 317.)

When the work plane is not automatically detected, use the Options Bar to explicitly set a work plane.

To set and show a work plane

- 1 Click Create tab ► Work Plane panel ► Set.
- 2 Move the cursor over the drawing area to highlight available work planes.
- 3 Click to select the work plane when it highlights.
- 4 Click Create tab ► Work Plane panel ► Show. The active work plane becomes visible.

To explicitly set a work plane

- 1 Click Create tab ► Work Plane panel ► Set.
- 2 On the Options Bar, select the work plane from the Placement Plane drop-down list. Alternatively, you can click a work plane in the drawing area.

TIP The Placement Plane list is also available when you select a new tool from the Draw panel.

(See [3D Work Planes](#) on page 536.)

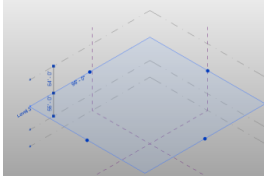
3D Levels

In the default view for the conceptual design environment, levels display in 3D as lines around the back side of a box.



When a level is selected, the following information displays in the drawing area:

- the level elevation
- the level name
- the distances between the selected level and its surrounding levels
- the drag handles used to change the level area



Creating 3D Levels

- 1 Click Create tab ► Datum panel ► Level.
- 2 Move the cursor in the drawing area until the desired elevation displays, and click to place the level. Continue to place levels, as needed.
- 3 Click Place Level tab ► Selection panel ► Modify to stop placing levels.

Changing the Height Between 3D Levels

To change the height between levels, drag it a level the desired height, or explicitly set the height by typing in a new height value. When you move a middle level, the top and bottom levels remain in place, and the heights of the other levels adjust between them.

- 1 Click a 3D level. The level highlights and displays the dimension length value.
- 2 Click the value.
- 3 Enter a new dimension in the text box.

The 3D levels adjust so that their dimensions equal the parameter value.

Changing 3D Level Elevations

- 1 Click a 3D level.
- 2 Click an elevation value in the drawing area.
- 3 Enter a new elevation value in the text box.
- 4 Press *Enter*.

The new 3D level elevations are set.

Changing 3D Level Names

- 1 Click a 3D level. The level name displays.

- 2 Click the level name. It displays in a text box.
- 3 Enter a new name.
- 4 Press *Enter*, or click outside the text box.
- 5 (Optional) If you clicked away from the text box, click Yes in the Revit dialog if you would like to rename corresponding views.


The new level name displays on the level.

Explicitly Changing the 3D Level Area

- 1 Click a 3D level. The level bounding box highlights and displays circle-shaped drag handles.
- 2 Drag the bounding box to the desired size.

The new 3D level area is set.

Switching between a 3D Level and its Corresponding View

- 1 Double-click the circle at the end of a 3D level. The floor plan view displays.
- 2 Click  (3D View) on the Quick Access toolbar. The 3D view displays.

3D Level Graphics

You can set the 3D levels to display a level head symbol by setting parameters through the Type Properties dialog. (See [Level Properties](#) on page 1104.)

To display a level head symbol

- 1 Select a level.
- 2 Click Modify Levels ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 Select Symbol at End 1 Default.
- 4 Select Symbol at End 2 Default.

3D Level Type Properties

You can modify many properties for 3D levels. Select a level, and click Modify Levels tab ► Element panel ► Element Properties drop-down ► Type Properties.

Name	Description
Graphics	
Line Weight	Controls the thickness of the level line by selecting from a list.
Color	Controls the color of the level line by setting the RGB value.

Name	Description
Line Pattern	Controls the level line pattern by selecting a value from a drop-down list
Symbol	Sets the level head to none or Level Head - Target.
Symbol at End 1 Default	Sets the control at the beginning of the level line by selecting a check box.
Symbol at End 2 Default	Sets the control at the end of the level line by selecting a check box.

3D Level Instance Properties

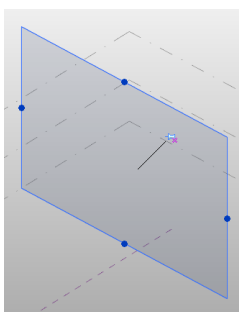
You can set 3D level instance properties. Select a level, and click Modify Levels tab ► Element panel ► Element Properties drop-down ► Instance Properties.

Name	Description
Constraints	
Elevation	Sets the elevation for the level.
Identity Data	
Name	Sets the level name.

3D Reference Planes

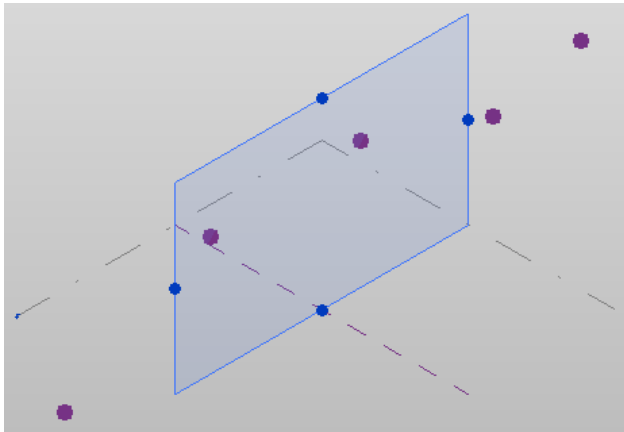
Reference planes are displayed in the conceptual design environment in the 3D view. These reference planes can be edited as 3D elements. For example, you can pin the 3D reference plane so that it cannot be moved, and you can unpin it and drag it to change its size. When selected, the name of the reference plane displays in the 3D view.

3D reference plane, pinned, and showing circular drag handles



Reference Points

A reference point is an element that specifies a location in the XYZ work space of the conceptual design environment. You place reference points to design and plot lines, splines, and forms. In the following example, 5 reference points have been placed to define the path of a spline.



There are 3 types of reference points:

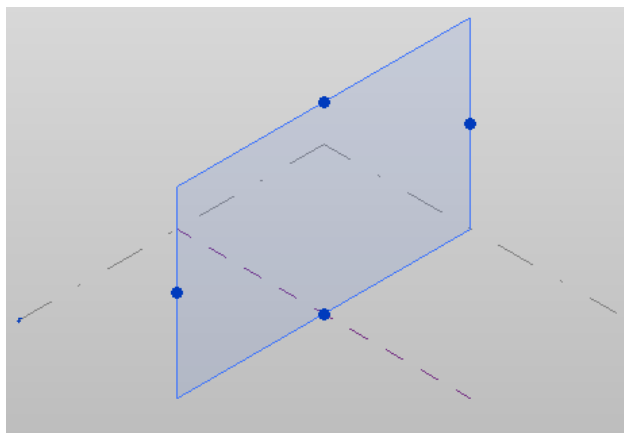
- Free
- Hosted on lines and surfaces
- Geometry-driving

Free Points

Unlike driving points and hosted points, free points are reference points that are placed on a work plane. Free points display 3D controls when selected, are moveable anywhere within the 3D work space, and maintain their reference to the plane on which it was placed.

To place points on a work plane

- 1 Open a 3D view to work in if you are drawing in the Z axis; otherwise, open a floor plan view.
- 2 If you are working in a 3D view, select a work plane in the drawing area of the conceptual design environment.



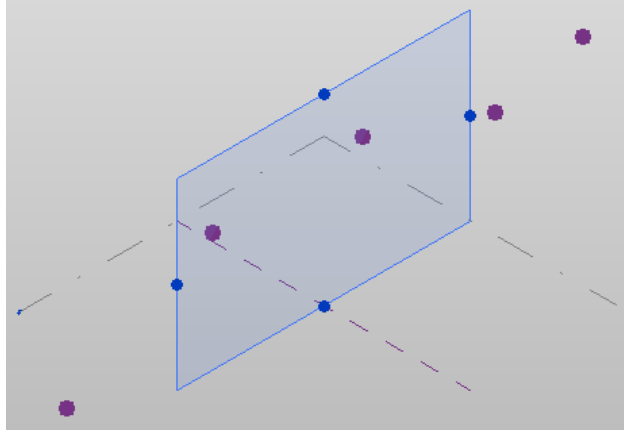
- 3 Click Create tab ► Datum panel ► Reference Point.

4 Click Place Reference Point tab ► Placement panel ► Place on Work Plane.

5 If it was not selected in step 2, select a work plane from the Placement Plane list on the Options Bar.

In 3D views, you can clear Relative to force the reference point along the bottom of vertical work planes.

6 Place points along the work plane.

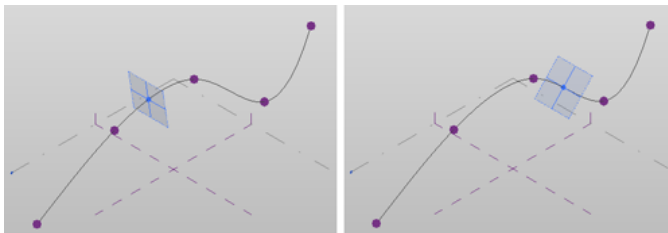


7 When you are finished placing points, click Place Reference Point tab ► Selection panel ► Modify.

The free points can be repositioned if needed.

Hosted Points

Hosted points are reference points placed on an existing spline, line, edge, or surface. They are smaller than driving points, and each one provides its own work plane for adding further geometry perpendicular to its host. The hosted point will move with and can move along the host element.



Hosted points are placed along any of the following elements:

- Model lines and reference lines, such as lines, arcs, ellipses, and splines (Bezier and Hermite)
- Form element edges and surfaces, including planar, ruled, resolved, cylindrical, and Hermite.
- Joined form edges (geometry combination edges and surfaces)
- Family instances (edges and surfaces)

As explained in the following topics, the procedure for placing hosted points varies depending what type of host element.

NOTE If a host is deleted, hosted points will be deleted as well.

Placing Hosted Points along a Spline

Hosted points create work planes to add additional geometry that move with the host element.

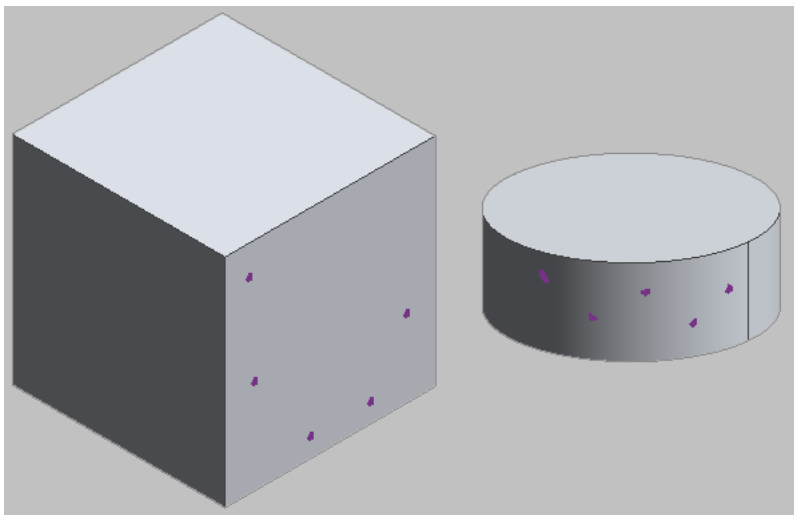
- 1 Open a 3D view to work in if you are drawing in the Z axis; otherwise, open a floor plan view.
- 2 Click Create tab ► Datum panel ► Reference Point.
- 3 Click Place Reference Point tab ► Placement panel ► Place on Work Plane.
- 4 Select a work plane from the Placement Plane list on the Options Bar.
In 3D views, you can clear Relative to force the reference point along the bottom of vertical work planes.
- 5 Place hosted points along a spline.
- 6 Click Place Reference Point tab ► Selection panel ► Modify when complete.

A hosted point can be repositioned along the spline if needed.

Placing Hosted Points along an Edge or Surface

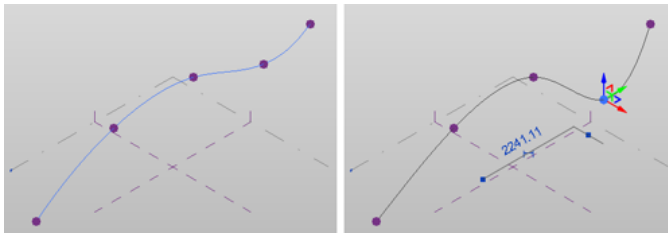
Surfaces and edges of forms can be used as an alternative work plane for placing hosted points.

- 1 Open a 3D view to work in if you are drawing in the Z axis; otherwise, open a floor plan view.
- 2 Click Create tab ► Datum panel ► Reference Point.
- 3 Click Place Reference Point tab ► Placement panel ► Place on a Face.
- 4 In the drawing area, place the cursor over an edge or a surface, and click to place hosted points.
- 5 Click Place Reference Point tab ► Selection panel ► Modify when complete.



Driving Points

Driving points are reference points that control the geometry of a dependent spline. Driving points are typically created automatically when free points are used to generate a line, curve, or spline.



When selected, driving points display 3D controls.

You create driving points from placed hosted points. See [Placing Hosted Points along a Spline](#) on page 542.

To place a driving point along a spline

- 1 Open a 3D view to work in if you are drawing in the Z-axis; otherwise, open a floor plan view.
- 2 Click Create tab ► Datum panel ► Reference Point.
- 3 Place the hosted point along a spline.
- 4 Click Place Reference Point tab ► Selection panel ► Modify.
- 5 Select the new hosted point.
- 6 On the Options Bar, click Make Point Driving.

The point is now a driving point and can be used to modify the geometry of the spline as needed.

Plotting Lines from Reference Points

There are several methods to create splines that use driving reference points. The first, most common way is to use the supplied drawing tools, which allow you to freehand splines into the design. If a more coordinate driven model is required, plotting splines from points may be preferable, because it provides the parametric relationships required to build forms.

Creating a Line from Reference Points

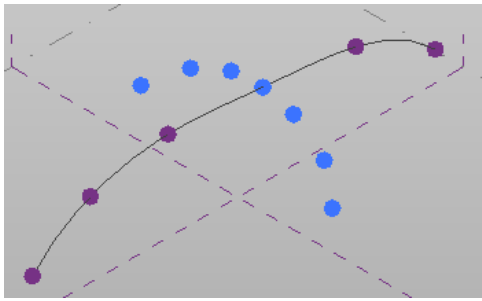
- 1 Select Create tab ► Selection panel ► Modify.
- 2 Select 2 points.
These points can be free, hosted, or driving.
- 3 Click Modify Reference Points tab ► Spline panel ► Spline Through Points.
- 4 Click Modify Reference Points tab ► Selection panel ► Modify.

A line is created between the 2 points. The points maintain their reference type (hosted or driving) and will modify the line when moved. Free points become driving points for the line.

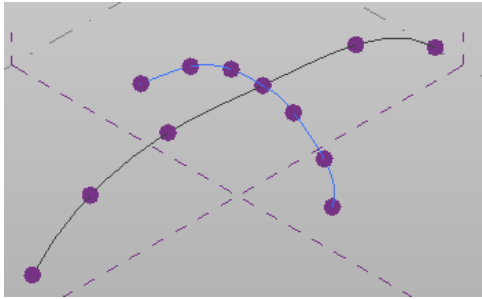
Creating a Spline from Reference Points

A spline can be created from existing points. These points can be free, hosted, or driving, and be part of an existing spline, edge, or surface.

- 1 Select Create tab ► Selection panel ► Modify.
- 2 Select the points that will comprise the spline.



3 Click Modify Reference Points tab ► Spline panel ► Spline Through Points.



4 Click Modify Reference Points tab ► Selection panel ► Modify.

A spline will be created from the selected points. Free points become driving points for the line.

NOTE The Spline Through Points tool on the Draw panel creates reference points as you freehand a spline.

Rehosting Reference Points

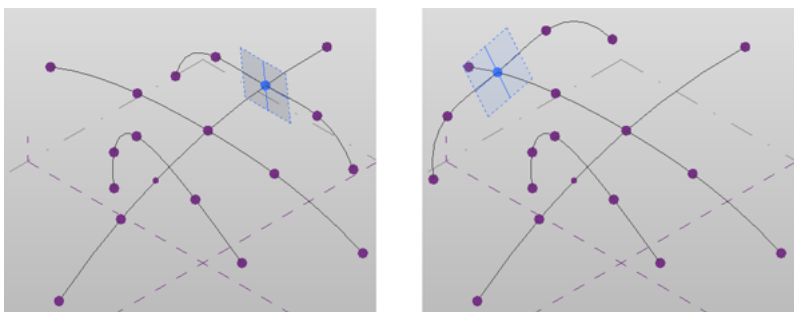
You can rehost placed reference points from and to splines, reference planes, edges, and surfaces.

- 1 Select the point to be rehosted.
- 2 Click Modify Reference Points tab ► Rehost Point panel ► Rehost Point.
- 3 Select Modify Reference Points tab ► Placement panel ► Place on Face or Place on Work Plane.
If you are rehosting to a work plane, select a work plane from the Placement Plane list.
- 4 Click to specify the location on a new host in the drawing area.

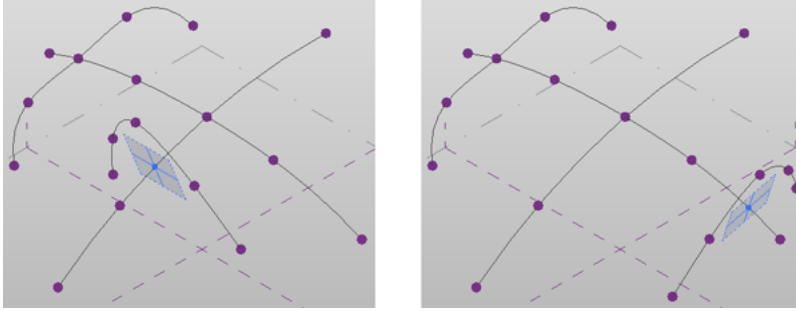
Rehosting Hosted Points

When you rehost a hosted point, any geometry that is applied to its work plane will move with the point.

Rehosting a hosted point that is part of a spline

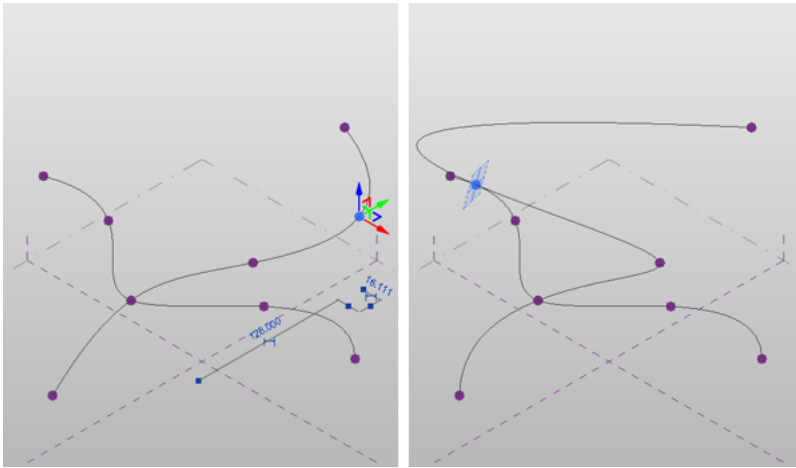


Rehosting a hosted point with splines applied to its work plane

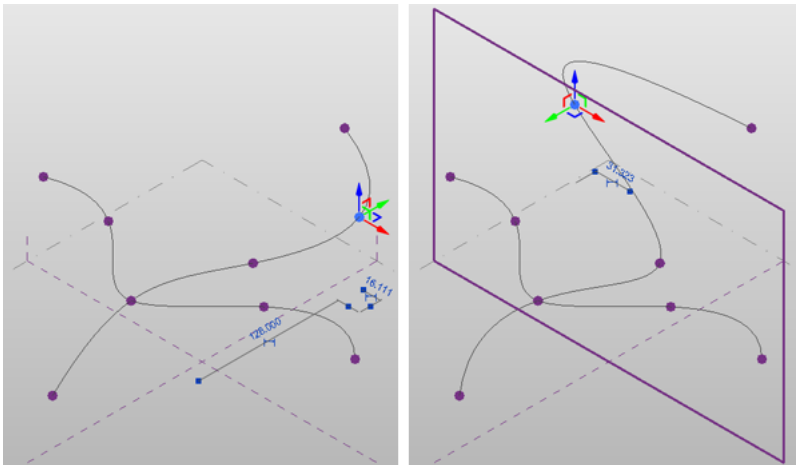


Rehosting Driving Points

When you rehost a driving point, any geometry that is dependent on it will adjust accordingly. If the new host is a spline, the driving point will become a hosted point along that spline. The spline that originally hosted the point will remain modifiable and adjust to the new host position.



When rehosting to a different plane, the point remains driving, and it only changes position and work plane orientation.



Modifying Reference Point Properties

Reference points do not have type properties, but you can modify many instance properties for reference points, such as constraints, graphics, and dimension data. The specific parameters available depend on whether the selected points are free, driving, or hosted.

- 1 Select the point.
- 2 Click Modify Reference Points tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 3 In the Instance Properties dialog, edit reference point instance parameters.
- 4 Click OK.

The following table lists the reference point instance properties.

Name	Description
Constraints	
Work Plane	For driving points only, the plane hosting the point.
Graphics	
Show Reference Planes	Specifies when the point's reference planes are visible: Always, When Selected, or Never.
Visibility/Graphics Overrides	Click Edit to display the Visibility/Graphics Overrides dialog for the reference point. See Visibility and Graphic Display in Project Views on page 198.
Show Normal Reference Plane Only	For hosted and driving reference points, specifies whether only the reference plane perpendicular to the geometry of the host will be visible.
Visible	When selected, the reference point will be visible when the mass is loaded into a project. It is also important to note that reference points must not be hidden by either Category or Visibility/Graphics Override settings if they are to be viewed in the project.
Dimensions	
Driving Curve(s)	When selected, the reference point is a driving point that affects geometry. When cleared, this parameter is read-only, and the reference point becomes free or hosted.
Driven by Host	When selected, the reference point is a hosted point that moves along its hosted

Name	Description
	geometry. When cleared, this parameter is read-only and the reference point is free.
Hosted Parameter	A ratio value (0 to 1) of the location of the reference point along a line, curve, or surface edge. This applies only to hosted reference points.
Hosted U Parameter	The location of the reference point along the U grid. The parameter is a distance in project units from the center of the surface. This applies only to reference points hosted on a surface.
Hosted V Parameter	The location of the reference point along the V grid. The parameter is a distance in project units of the surface. This applies only to reference points hosted on a surface.
Offset	The offset distance from the reference plane of the reference point. This applies only to driving and free reference points.
Other	
Name	User-defined name for the point. The name will appear in a tooltip when the point is highlighted by the cursor.

X-Ray Mode

X-Ray mode displays the underlying geometric skeleton of a selected form. In this mode, surfaces become transparent, allowing you to more directly interact with the individual elements that comprise the form. This mode is useful when you need to understand how a form is constructed, or when you need to select a specific part of the form element for manipulation.

X-Ray mode is available for only one form at a time in all model views. For example, if several, tiled views are displayed and you use X-Ray mode for a form in one view, the other views display X-Ray mode as well. Likewise, switching X-Ray mode off in one view switches it off in all others.

NOTE X-Ray mode does not persist between sessions.

Accessing X-Ray Mode

- 1 Select a form. X-Ray becomes available on the ribbon. (See [Selecting Forms](#) on page 555.)
- 2 Click Modify Form tab ► Modify Form Element panel ► X-Ray.

The form displays its geometry and nodes.

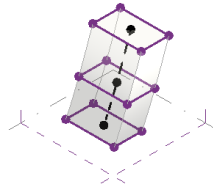
Display of Elements in X-Ray Mode

When X-Ray mode is enabled, it displays profiles, explicit and implicit paths, form axes, and the control nodes that were used to create a form.

X-Ray mode displays the following:

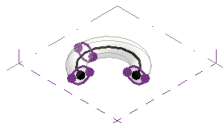
- **Profiles**

The closed loops you drew to define the shape of extrusions, lofts, revolves, and sweeps.



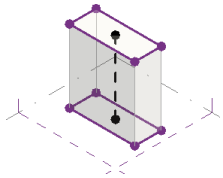
- **Explicit paths**

The line you drew to define a sweep.



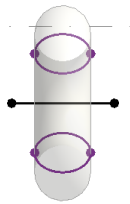
- **Implicit paths**

The line that the system creates to construct extrusions and lofts.



- **Axis**

The line you created to define the rotation of a revolve.



- **Control node**

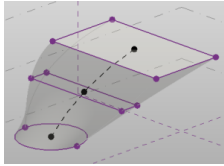
The points that the system creates on the path that hosts individual profiles.



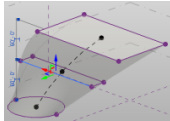
Manipulating Forms in X-Ray Mode

1 Select a form.

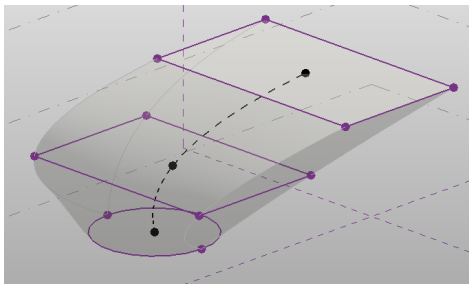
2 Click **Modify Form** tab ► **Modify Form Element** panel ► **X-Ray**. The form displays in X-Ray mode.



3 Double-click an element to select it. The 3D control displays.



4 Drag the 3D control arrow.



NOTE You can also select and delete profiles, edges, and vertices in X-Ray mode.

Profiles

A profile is a single line, chain of connected lines, or closed loop that can be used to generate a form. Profiles can be manipulated to change the geometry of a form.

Profiles can be added to the following forms types:

- extrusions
- lofts
- sweeps

(See [Adding a Profile to a Form](#) on page 562.)

Related topics

- [Locked Profiles](#) on page 550
- [Locking and Unlocking Profiles](#) on page 550

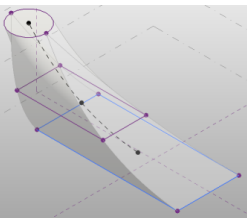
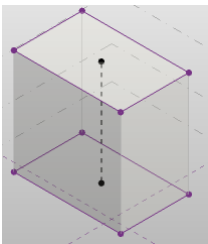
Locked Profiles

Profiles can be locked or unlocked. When profiles are locked, the form maintains a relationship between the top and bottom profiles, and is limited in the way it can be manipulated. When profiles are unlocked, the form can be manipulated in any way.

NOTE If the work plane is vertical, the constrained profile relationship would be between the left and right.

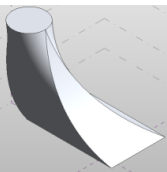
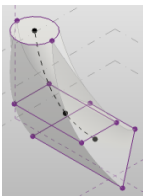
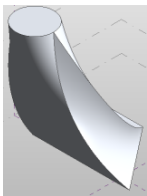
With locked profiles, when you manipulate one profile, it affects the other, and therefore, the entire shape. For example, if the top profile is selected, and you lock it, all the profiles take on the shape of the top profile.

The following graphics display an unconstrained form that locks to the selected, bottom (square) profile.

Unconstrained form	Resulting locked form
	

Click Modify Form tab ► Modify Form Element panel ► Lock Profiles to make the form-type unconstrained. (See [Unconstrained and Referenced-Based Forms](#) on page 554.)

With unconstrained profiles, the profile edge or vertex can be manipulated.

Initial unconstrained form	Lower-right vertex modified	Resulting unconstrained form
		

Related topic

- [Locking and Unlocking Profiles](#) on page 550

Locking and Unlocking Profiles

To unlock a profile

- 1 Select a locked form. (See [Selecting Forms](#) on page 555.)
- 2 Click Modify Form tab ► Modify Form panel ► Lock Profiles.

To lock a profile

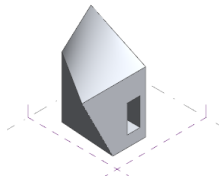
- 1 Select a form. (See [Selecting Forms](#) on page 555.)
- 2 Click Modify Form tab ► Modify Form Element ► Lock Profiles. The selected profile controls the locked shape.

All the form profiles are locked, including any additional profiles that may have been added after a previous unlocking of the profile.

NOTE Use X-Ray mode to view a form's profiles. (See [X-Ray Mode](#) on page 547.)

Forms

Start to explore a building concept by creating various geometric shapes, extrusions, sweeps, and lofts. Forms are always created by drawing lines, selecting them, and clicking Create Form. Use this tool to develop any surface, 3D solid, or void form, and then directly manipulate it using the 3D form manipulation controls.



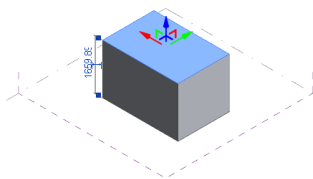
Line types that can be used to make a form include the following:

- Lines
- Reference lines
- Line by points
- Imported lines
- Edges of other form
- Lines or edges from loaded families

Solid and Void Forms

The Create Form tool provides 2 tools:

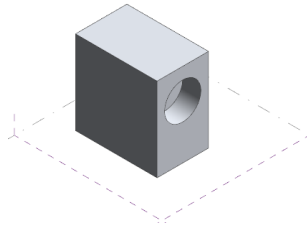
- **Form**
The Form tool is used to create solid geometry.



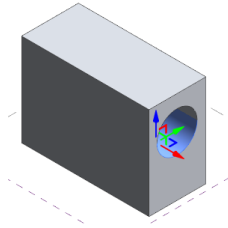
- **Void**

The Void tool is used to create negative shapes (voids) that cut into solid geometry.

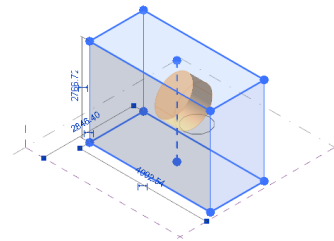
A void cut into a solid form



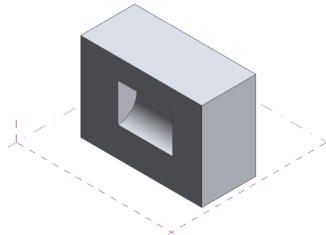
3D controls on a selected void.



A void dragged to the middle of the solid form (shown in X-Ray mode).



A void dragged from the middle of the solid form to a surface, and cutting the surface geometry.




Related topics


- [Profiles](#) on page 549
- [X-Ray Mode](#) on page 547

Creating Solid Forms

- 1 Click Create tab ► Draw panel, and select one of the drawing tools. (See [Drawing Overview](#) on page 533.)
- 2 Click in the drawing area, and draw a closed loop.
- 3 Click Modify.
- 4 Select the lines. The Create Form tool becomes available.

- 5 Click Modify Form tab ► Form panel ► Create Form drop-down ► Form. A solid form extrusion is created.
- 6 (Optional) Click Modify Form tab ► Modify Form Element panel ► Convert to Void to convert this form to a void.
- 7 Click  ► Save As ► Family.

Creating Void Forms

- 1 Click Create tab ► Draw panel, and select one of the drawing tools. (See [Drawing Overview](#) on page 533.)
- 2 Click in the drawing area, and draw a closed loop.
- 3 Click Modify.
- 4 Select the lines. The Create Form tool becomes available.
- 5 Click Modify Form tab ► Form panel ► Create Form drop-down ► Void. A void form extrusion is created.
- 6 (Optional) Click Modify Form tab ► Modify Form Element panel ► Convert to Solid to convert this form to a void.
- 7 Click  ► Save As ► Family.

Accessing Create Form Tool

The Create Form tool is available in the mass family template (Mass.rft), the curtain panel pattern based family template (Curtain Panel Pattern Based.rft), and through the In-Place Mass tool in a project. (See [Creating an In-Place Mass](#) on page 591.) The access to the Create Form tool varies depending on whether the conceptual design environment is accessed through the family mass template (RFT) or a project file (RVT).

To access Create Form from a mass family template (RFT)

- 1 Click Create tab ► Draw panel, and click one of the drawing tools to sketch any type of line.

NOTE You can also create a line by points. (See [Reference Points](#) on page 540.)

- 2 Draw the line and select it.

The Create Form tool becomes available on Modify Form tab ► Form panel. (See [Creating Solid Forms](#) on page 552.)

To access Create Form from a project file (RVT)

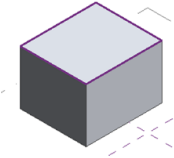
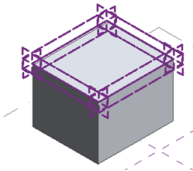
- 1 Click Massing & Site tab ► Conceptual Mass panel ► In-Place Mass.
- 2 Name the in-place mass in the Name dialog. The conceptual design environment tools become available.
- 3 Create a form. (See [Creating Solid Forms](#) on page 552.)
- 4 Click Modify Form tab ► In-Place Editor panel ► Finish Mass.

Unconstrained and Referenced-Based Forms

Depending on the tools used to create them, 2 types of form are created in the conceptual design environment.

- unconstrained form
- reference-based form

The behavior of these 2 forms may differ when they are modified.

Unconstrained form	Reference-based form
Displays a solid line when highlighted.	Displays a dashed line when highlighted.
	
Created when there is no need to rely on another form or type of reference.	Created when there is a need for a parametric relationship between the form and other geometry or references.
Created using any line in the Draw panel. Click Create tab > Draw panel > Line.	Created using reference lines, reference points, or any part of another form. Click Create Tab > Draw panel > Reference.
Not dependent on other objects.	Dependent on its references. When its dependent reference changes, the reference-based form changes.
Profiles are unlocked by default.	Profiles are locked by default for extrusions and sweeps.
The edges, surfaces, and vertices can be edited directly.	Edited by directly editing the reference element. For example, select a reference line and drag it using the 3D controls.

Related topic

- [Form Types](#) on page 556

Converting Reference-based Forms to Unconstrained Forms

- 1 Select the reference lines on a reference-based form.
- 2 Click Modify Reference Lines tab > Element panel > Element Properties drop-down > Instance Properties.
- 3 Clear Is Reference Line.

The form is unconstrained.

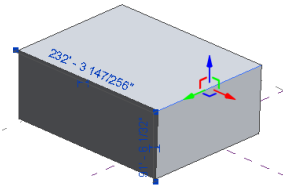
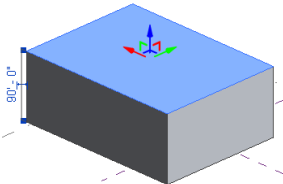
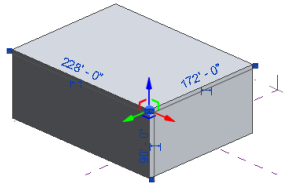
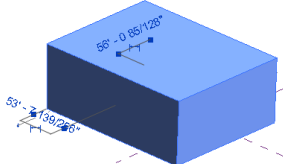
Related topics

- [Creating Solid Forms](#) on page 552
- [Creating Void Forms](#) on page 553

Selecting Forms

You can select an entire form, or any of its edges, surface or vertices. Move the cursor over any form element to highlight it, and either click to select it, or press *Tab* to highlight all the form's elements, and then click to select the entire form. Pressing *Tab* repeatedly cycles through the selectable elements, and you can click to select the desired one when it highlights.

The following graphics display what can be selected on a form.

Form Element	Selected Form Element
Edge	
Surface	
Vertex	
Entire form	

Related topics

- [Manipulating Forms](#) on page 566
- [Manipulating Forms in X-Ray Mode](#) on page 549

Form Types


The conceptual design environment lets you create many types of forms that are useful for developing a design concept. Every form type is created by accessing the Make Form tool. (See [Accessing Create Form Tool](#) on page 553.)

Surface Forms

In the conceptual design environment, surfaces are created from open lines or edges, rather than from closed profiles.

NOTE If the 2 lines are parallel, the result is a 2D surface that can be used to stitch together other models. (See [3D Snapping](#) on page 533.)

To create a surface using a line

- 1 Select a work plane for the surface. (See [Setting and Showing Work Planes](#) on page 536.)
- 2 Click Create tab ► Draw panel ►  (Line).
- 3 Draw a line on the work plane.
- 4 Select another work plane.
- 5 Draw a line on this work plane.
- 6 Select the lines.
- 7 Click Create Form.

To create a surface using the Options Bar

- 1 Click Create tab ► Draw panel ► Line.
- 2 On the Options Bar, select Make surface from closed loops.
- 3 (Optional) On the Options Bar, select Chain to create a chain of lines.
- 4 Draw a closed profile.


The surface is automatically created.

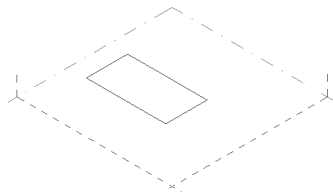
Related topics

- [Unconstrained and Referenced-Based Forms](#) on page 554
- [Creating Solid Forms](#) on page 552
- [Creating Void Forms](#) on page 553

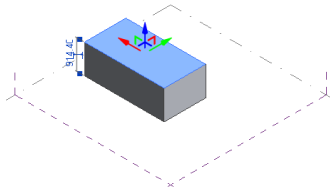
Extrusions

In the conceptual design environment, an extrusion is created from closed profiles, or the surfaces derived from closed profiles.

- 1 Draw a closed profile, for example, using Create tab ► Draw panel ►  (Rectangle).



- 2 Select the profile. The Create Form tool becomes available. (See [Accessing Create Form Tool](#) on page 553.)
- 3 Click Modify Form tab ► Create Form drop-down ► Form.



You can change the dimension of an extrusion by using the 3D drag controls or editing the temporary dimension in the drawing area. (See [Dimensioning Forms](#) on page 563.)

Related topics

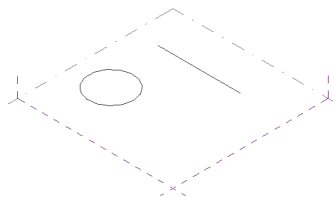
- [Creating Solid Forms](#) on page 552
- [Creating Void Forms](#) on page 553

Revolves

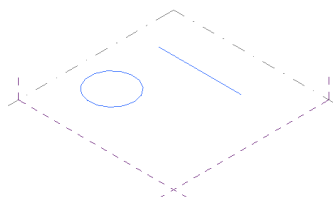
In the conceptual design environment, a revolve is created from a line and a 2D shape that are drawn on the same work plane. The line defines the axis around which the shape is revolved to create a 3D form.

NOTE In Step 2, you can create a surface revolve using lines that do not form a closed loop.

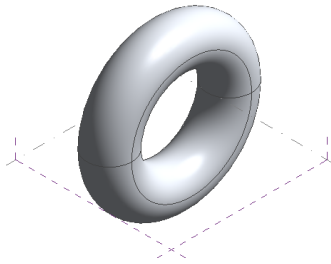
- 1 Draw a line on a work plane.
- 2 Draw a closed profile on the same work plane next to the line.



- 3 Select the line and the closed profile.



- 4 Select Create Form. (See [Accessing Create Form Tool](#) on page 553.)



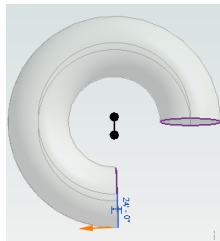
To open a revolve

-
- 1 **TIP** Using X-Ray mode helps identify the edge.
-

Select the outside edge of the revolve profile.



- 2 Drag the orange control arrow to a new position.



Related topic

- [Creating Solid Forms](#) on page 552

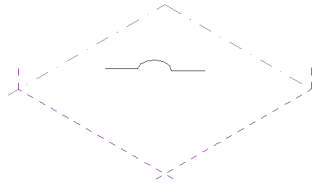
Sweeps

In the conceptual design environment, a sweep is created from a 2D profile that is swept along a path. The profile consists of linework drawn perpendicular to the line or series of lines that define the path. You create a sweep by selecting the profile and the path, and then clicking Create Form.

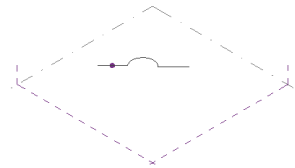
Multi-segmented paths can be used to create a sweep if the profile is formed from closed loops. If the profile is not closed, it does not sweep along a multi-segment path. If the path is a single-line segment, use an open profile to create the sweep.

To create a multi-segmented sweep

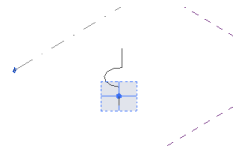
- 1 Click Create tab ► Draw panel ► Line, and draw a series of connected lines to form a path.



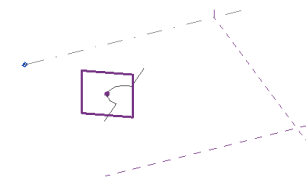
- 2 Click Create tab ► Datum panel ► Reference Point.
- 3 Click anywhere on the path to place the reference point.



- 4 Select the reference point. The work plane displays.



- 5 Draw a closed profile on the work plane.



- 6 Select the line and profiles.
- 7 Click Multi-Select tab ► Form panel ► Create Form. (See [Accessing Create Form Tool](#) on page 553.)



Related topics

- [Creating Solid Forms](#) on page 552
- [Creating Void Forms](#) on page 553

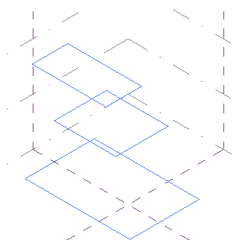
Lofts

A loft is a form that blends 2 profiles located on separate work planes.

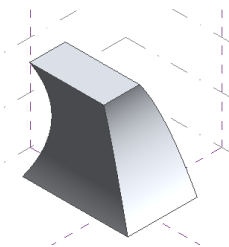
NOTE Profiles can be open or closed when making lofted geometry.

To create a solid loft

- 1 Draw a closed profile on a work plane.
- 2 Click a reference plane or a level to select a different work plane.
- 3 Draw a new closed profile.
- 4 Click a reference plane or a level, to select a different work plane.
- 5 Draw a closed profile on the third reference plane.
- 6 Select all 3 profiles.



- 7 Click Create Form. (See [Accessing Create Form Tool](#) on page 553.)



Related topics

- [Creating Solid Forms](#) on page 552
- [Creating Void Forms](#) on page 553

Modifying Forms

Forms can be modified directly by using the 3D control arrows, and by adding and deleting edges and profiles.

When a form is selected in the conceptual design environment, the following modification tools are available.

Panel	Tool	Description
Selection	Modify	Complete an action in the drawing area.

Panel	Tool	Description
Draw	Line tools	Create unconstrained and reference-based forms. (See Unconstrained and Referenced-Based Forms on page 554.)
Element	Element Properties	Defines instance and type properties.
Form	Make Form	Creates solid and void forms.
Divide	Divide Surface	Divides and patterns a surface. (See Rationalizing Surfaces on page 569.)
Modify Form Element		
	X-Ray	Shows/hides the underlying geometric skeleton of a form, making it easier to select form elements. (See X-Ray Mode on page 547.)
	Add Edge	Adds edges to a form. (See Adding an Edge to a Form on page 562.)
	Add Profile	Adds profiles to a form. (See Adding a Profile to a Form on page 562.)
	Convert to Solid	Changes a solid form to a void.
	Convert to Void	Changes a void form to a solid.
	Lock Profiles	Keeps the form locked to the top and bottom profiles. (See Profiles on page 549.)
	Unlock Profiles	Unlocks the form. (See Profiles on page 549.)
	Rehost Form	Moves the form to a new host. (See Rehosting Forms on page 563.)

Related topics

- [Manipulating Forms](#) on page 566

- [Selecting Forms](#) on page 555

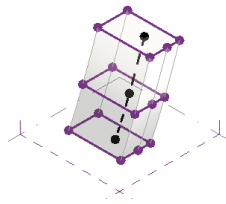
Adding Elements to a Form

Forms can be further modified by adding edges and profiles. The Add Edge tool is used to add edges to form elements.

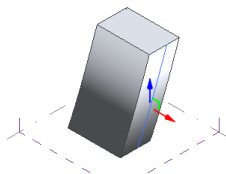
The Add Profile tool is used to add profiles to form elements. Profiles can be manipulated to change the form geometry. (See [Profiles](#) on page 549.)

Adding an Edge to a Form

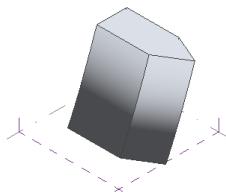
- 1 Select a form.
- 2 Click Modify Form tab ► Modify Form panel ► Add Edge.
- 3 Move the cursor over the form to display a preview image of the edge, and click to add the edge.
The edge displays on the form.



- 4 Select the edge.
The 3D controls become available.



- 5 Click a 3D control arrow to manipulate the edge. The form geometry changes.



Adding a Profile to a Form

- 1 Select a form.

TIP Using X-Ray mode helps view the form geometry. (See [X-Ray Mode](#) on page 547.)

- 2 Click **Modify Form** tab ► **Modify Form Element** panel ► **Add Profile**.
- 3 Move the cursor over the form to preview the position the profile.
- 4 Click to place the profile.

Deleting Form Elements

Surfaces, edges, and vertices can be deleted from a form. You can use *Ctrl* to select elements separately, or draw a pick box to select all the form elements.

NOTE Be careful not to select work planes when using a pick box, or they will be deleted.

- 1 Select a form.

NOTE Using X-Ray helps identify the form elements. (See [X-Ray Mode](#) on page 547.)

- 2 Move the cursor over the form, and press *Tab* to highlight the form elements.
- 3 Click to select the element.
- 4 Click **Modify Form** tab ► **Modify** panel ► **Delete**.

Rehosting Forms

Forms are hosted by the work plane, level, or surface on which they were drawn. You can view the hosted work plane by clicking **Create** tab ► **Work Plane** panel ► **Show**.

To rehost a form

- 1 Select a form.
- 2 Click **Modify Form** tab ► **Modify Form Element** panel ► **Rehost Form**.
- 3 Select a host from the **Placement Plane** list on the **Options Bar**. The host highlights in the drawing area, and the cursor is a purple circle shape.
- 4 Click to rehost the form to the work plane you selected.

Related topic

- [3D Work Planes](#) on page 536

Dimensioning Forms

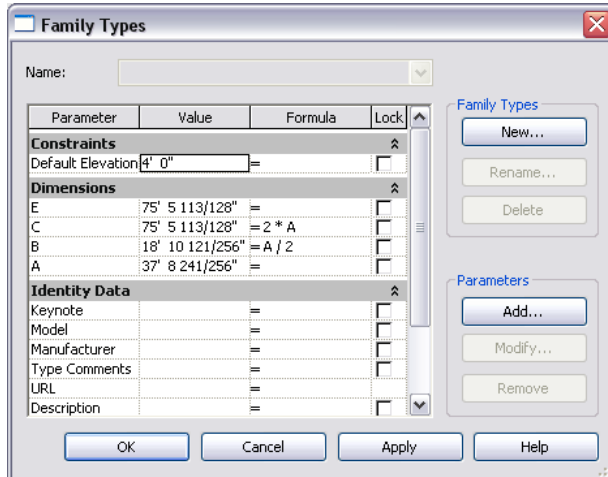
The dimensions for a form can be set in a number of ways:

- Use 3D direct manipulation controls.
Drag the 3D control arrows on a form until the dimension meets the required value. You can select an edge, point, or vertex to enable the 3D controls. Drag a 3D control arrow. As you drag the arrow, element dimension feedback is provided in the drawing area. (See [Manipulating Forms](#) on page 566.)
- Set temporary dimensions directly in the drawing area.
Temporary dimensions display on the surface of a selected form. You can make this dimension permanent by double-clicking the dimension and pressing *Enter*.
- Select **Show Dimensions** on the **Options Bar**.
- Set constraints in the **Model Lines Instance Properties** dialog. See [Conceptual Design Model Line Instance Properties](#) on page 535.

Loose-Labeled Dimensions

In the conceptual design environment, you can label dimensions by assigning parameters to them, and then use direct manipulation to explore design variations. As a labeled dimension is manipulated, all its related geometry adjusts, and the dimension labels change to reflect their new values. These dimension labels are referred to as loose-labeled dimensions because the dimension labels change dynamically as they are manipulated in the drawing area.

As the loose-labeled dimension values change, the family type parameter values also update in the Family Types dialog, where you can enter formulas that define relationships between dimensions as shown.




For example, drag a labeled dimension to a new position. All the lines that are associated by formulas move with respect to their parameter settings. For example if parameter $B = A/2$, the value of B is always half of the value of parameter A. If the value of B changes to 8, the value of A changes to 16. You can see the parameter values change in the drawing area when you directly manipulate these lines.

The formulas assigned to a parameter display in the Label drop-down list on the Options Bar. These can be selected and applied to the labeled dimensions. When applied to a dimension, the formula displays as the new label in the drawing area.

NOTE To display all the associated dimensions, on the Options Bar, click Related Dimensions, or select a parameter in the Family Type dialog.

Labeling Dimensions

- 1 Select a line in the drawing area. The line's temporary dimensions display.
- 2 Click  (Make this temporary dimension permanent) to create a permanent dimension.
- 3 Click the dimension.
- 4 On the Options Bar, select <Add parameter> from the Label drop-down list.
- 5 In the Parameter Properties dialog, for Name, enter a name.
- 6 For Group parameter under, select Dimensions.
- 7 Click OK.

Associating Parameters

- 1 Click Create tab ► Family Properties panel ► Types.

- 2 Under Dimensions, enter a formula for one of the parameters in the Formula column.
- 3 Click OK.


Displaying Parameter Values

- 1 Click a dimension in the drawing area.
- 2 On the Options Bar, select a desired parameter value from the Label drop-down list.

Removing Parameter Values

- 1 Click a dimension in the drawing area.
- 2 On the Options Bar, select <None> from the Label drop-down list.

Locking Loose-Labeled Dimensions

You can maintain the parametric relationships between loose-labeled dimensions by locking them. To lock a dimension directly in the drawing area, click  next to the dimension.

When a loose-labeled dimension is locked, all of the associated parameters also lock. This means that as the dimensions are moved in the drawing area, the associated parameters are constrained and the dimension value is preserved.

NOTE Locked dimensions and their associated parameters cannot be changed in the drawing area. Use the Lock column in the Family Types dialog to change them.

When a loose-labeled dimension is unlocked, all of the referenced geometry unlocks and is unconstrained.

To lock a loose-labeled dimension from the Family Types dialog

- 1 On the Family Properties panel, click Types.
- 2 Select Lock to constrain a parameter.

Referencing Imported Geometry

Imported ACIS solid and surface geometry can be referenced in the conceptual design environment to create a form, divide a surface, or host point elements.

The following table describes the available conceptual design environment tools that can reference imported ACIS geometry.

ACIS Geometry Type	Create Form Tool	Divide Surface Tool	Host Point Element
Edge	x		x
Curve	x		x
Surface	x	x	x

NOTE Unsupported references, such as a polymesh, cannot be used.

Related topics:

- [Importing ACIS Objects](#) on page 1391
- [Importing or Linking CAD Formats](#) on page 1387
- [Importing Massing Studies from Other Applications](#) on page 626
- [Forms](#) on page 551
- [Rationalizing Surfaces](#) on page 569
- [Reference Points](#) on page 540

Conceptual Design Environment Model Instance Properties

To view and modify the following instance properties of a selected form, click Modify Form tab ► Element panel ► Element Properties drop-down ► Instance Properties. (See [Model Line Properties](#) on page 808.)

In the conceptual design environment, forms can be specified as solid or void.

Name	Description
Graphics	
Solid/Void	Specifies whether the form to a solid or a void.

Manipulating Forms

Every reference point, surface, edge, vertex, or point in an unconstrained form has a 3D control that displays when it is selected. Use this control to directly manipulate a form by dragging it along the axes or planes defined by the local or global coordinate systems.



3D controls let you:

- switch between local and global coordinates.
- directly manipulate a form.

You can drag the 3D control arrows to adjust a form to a suitable size or location. The arrows are oriented relative to the selected form, but you can also switch this orientation between a global XYZ, and local, coordinate system by pressing the *Spacebar*.

Related topics

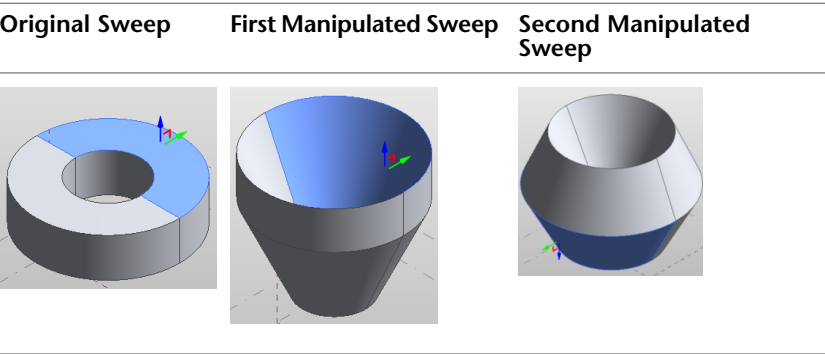
- [Modifying Forms](#) on page 560
- [Dimensioning Forms](#) on page 563
- [Solid and Void Forms](#) on page 551

Coordinate Systems

A form's global coordinate system is based on the ViewCube's North, East, South, and West coordinates. When a form is reoriented and has a different relationship with the global coordinate system, it is on the local coordinate system.

Use the...	To drag the object...
Blue arrow	along the global Z axis
Red arrow	along the global Y axis
Green arrow	along the global X axis
Red planar control	in the Y plane
Green planar control	in the X plane
Orange arrow	along a local axis
Orange planar control	in a local plane

The following graphic displays a sweep that was manipulated by dragging the control arrows to change its shape.



When forms are defined by the local coordinate system, the 3D form controls display in orange color. Only the coordinates that change to the local coordinate system display in orange color. For example, if you rotate a cube by 15 degrees, the X and Y arrows display in orange, but the Z arrow remains blue because it still has the same global Z coordinate value.

Related topics

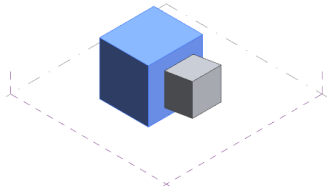
- [Manipulating Forms](#) on page 566
- [Sweeps](#) on page 558
- [Creating Solid Forms](#) on page 552
- [Creating Void Forms](#) on page 553

Manipulating Joined Forms

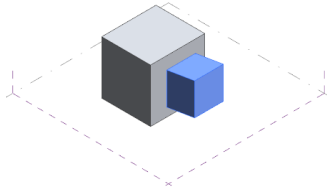
In the conceptual design environment, the surfaces, edges, or vertices of joined forms can be modified using the 3D controls.

To join forms

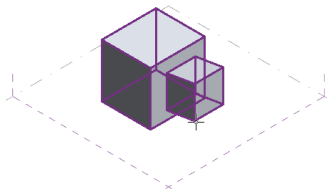
- 1 Click Modify tab ► Edit Geometry panel ► Join.
- 2 Click the first form.



- 3 Click the second form.

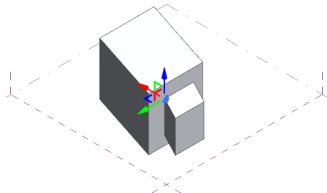


The form is joined. (See [Joining Geometry](#) on page 406.)

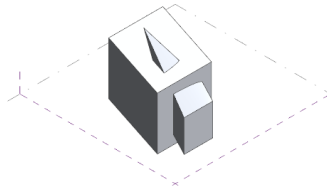


To manipulate joined forms

- 1 Click a joined surface, edge or vertex. The 3D control arrows display.



- 2 Drag a 3D control arrow in any direction.



The joined form remains as one unit.

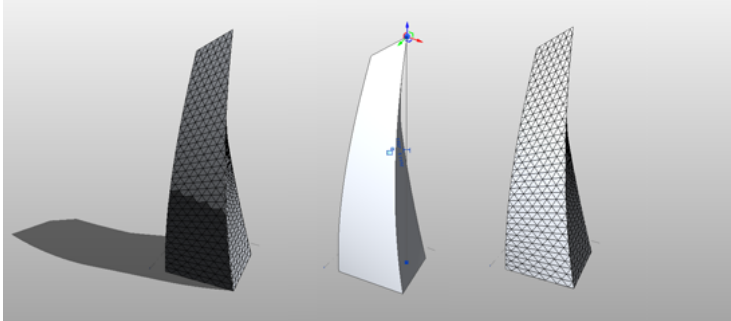
Related topics

- [Manipulating Forms](#) on page 566
- [Selecting Forms](#) on page 555

- [Creating Solid Forms](#) on page 552
- [Creating Void Forms](#) on page 553
- [Display of Elements in X-Ray Mode](#) on page 548
- [Joining Geometry](#) on page 406

Rationalizing Surfaces

You can divide a range of surfaces (planar, ruled surfaces, revolved surfaces, and double-curved surfaces) to rationalize the surface into parametric buildable components.



Use the following work flow to rationalize a surface.

- 1 Divide the surface. See [Dividing a Surface](#) on page 569.
- 2 Pattern the surface. See [Patterning Surfaces](#) on page 575.
- 3 Apply a pattern component family. See [Pattern Component Families](#) on page 578.

Dividing a Surface

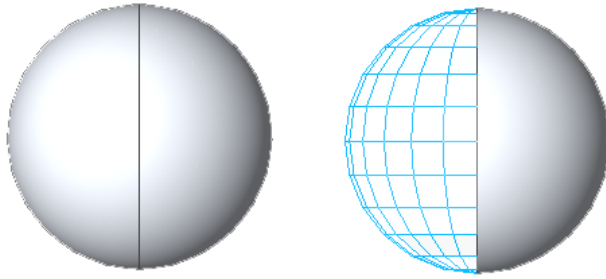
- 1 Select the surface.
- 2 Click Modify Form tab ► Divide panel ► Divide Surface.
- 3 Adjust the spacing of the divided surface on the Options Bar. See [Modifying the Spacing of UV Grids on Divided Surfaces](#) on page 571.

NOTE When dividing the surface, remember that applied patterns have footprint requirements that may affect how many divisions a surface needs in the conceptual design. See [Patterning Surfaces](#) on page 575.

- 4 If finer adjustments need to be made, open the Face Manager to adjust rotation and grid positioning. See [Adjusting UV Grids with the Face Manager](#) on page 571.

Understanding UV Grids

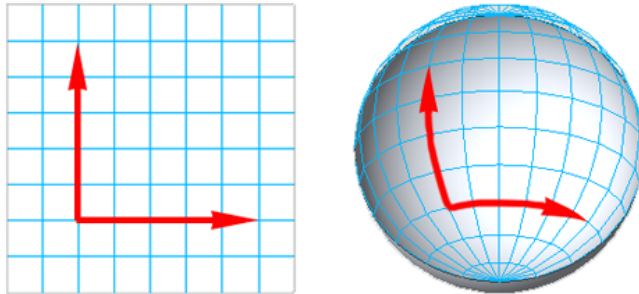
A surface can be divided by UV grids (the natural grid division of the surface). Patterns may be later applied to the divided surface. See [Patterning Surfaces](#) on page 575.



The UV grid acts as a guide in patterning the surface. Manipulating the divided surface also manipulates the parametrically dependant patterns and components. Certain parameters of the divided surface can be edited in the drawing area of the conceptual design environment.

Locations in 3D space are based on the XYZ coordinate system. This system can be applied globally to the modeling space or to a work plane.

Since surfaces are not necessarily planar, the UVW coordinate system is used to plot location. This maps a grid adjusting for the contours of a non-planar surface or form. UV grids, as used in the conceptual design environment, are comparable to XY grids.



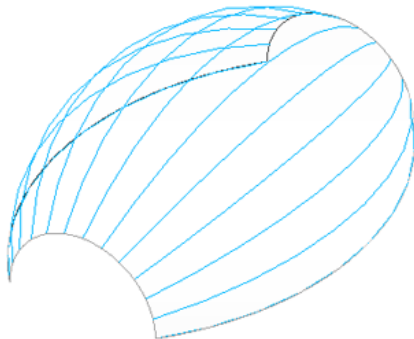
The default division of the surface is by number: 12x12 for imperial units and 10x10 for metric units.

Enabling and Disabling UV Grids

The UV grids are independent of one another and can be turned on and off as needed. By default, both U and V grids are on when a surface is initially divided.

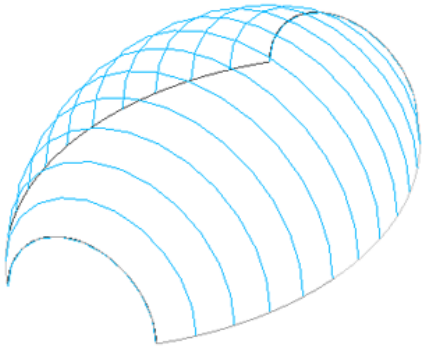
U grids

Click Modify Divided Surface tab ► UV Grids panel ► U Grid. Click again to enable.



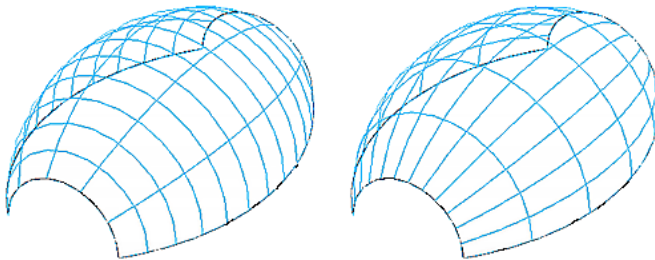
V grids

Click Modify Divided Surface tab ► UV Grids panel ► V Grid. Click again to enable.



Modifying the Spacing of UV Grids on Divided Surfaces

Surfaces can be divided by a number of divisions or by distances between divisions.



When the divided surface is selected, the Options Bar displays settings for both the U and V grids. These can be set independently of one another.

Spacing grids by a specific number of divisions

Select Number and enter the number of divisions that will distribute evenly along the surface.

NOTE The number of divisions can also be set in the Instance Properties dialog or the Face Manager. See [Pattern Element Instance Properties](#) on page 585 and [Adjusting UV Grids with the Face Manager](#) on page 571.

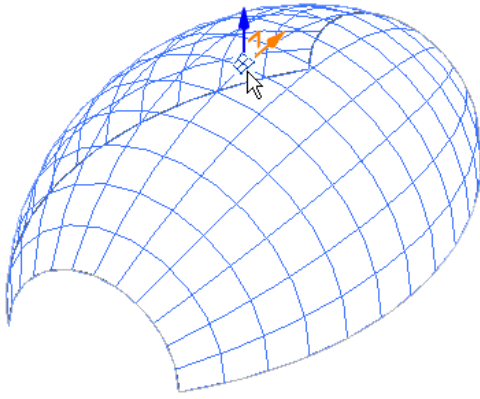
Spacing grids by a defined distance

Select Distance and enter the distance between grids along the divided surface. The Distance drop-down list also allows for a minimum or maximum distance, rather than an absolute distance.

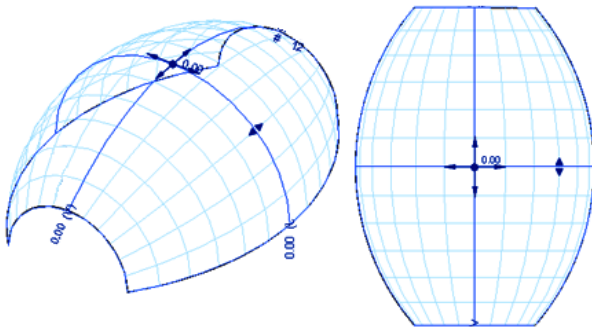
NOTE Spacing can also be set in the Instance Properties dialog or the Face Manager. See [Pattern Element Instance Properties](#) on page 585 and [Adjusting UV Grids with the Face Manager](#) on page 571.

Adjusting UV Grids with the Face Manager

The UV grids of the divided surface can be adjusted in the Instance Properties dialog (see [Pattern Element Instance Properties](#) on page 585) or the Face Manager. The Face Manager is an editing mode accessed by clicking the Face Manager icon at the center of the 3D Control Widget. To see this icon, select the divided surface.



Once selected, UV grid editing controls display on the surface.



Editing Spacing between Divisions

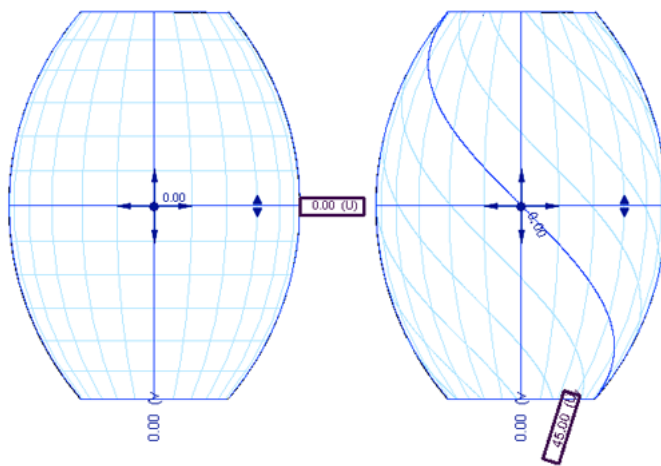
Spacing for the distance and number of divisions of both U and V grids are located at the ends of their respective belts. These parameters are the same as the spacing grids parameters previously seen on the Options Bar. See [Modifying the Spacing of UV Grids on Divided Surfaces](#) on page 571.

To change these, click on them and type new parameters.

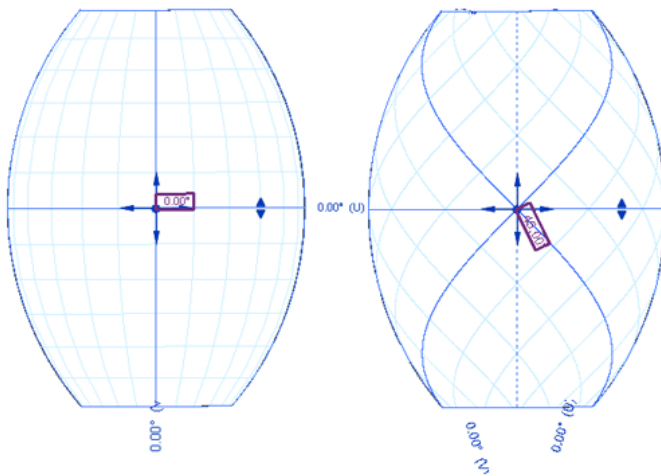
Rotating UV Grids

You can rotate the direction of each or both UV grids. Rotation angle controls are located at the ends of their respective belts. Changing the values of these parameters will rotate the grids.

To change the rotation of a grid, click on the value field and type a new rotation angle.



To rotate the direction of both grids, click on the angle value field located at the intersection of the UV grids and type a new rotation angle.

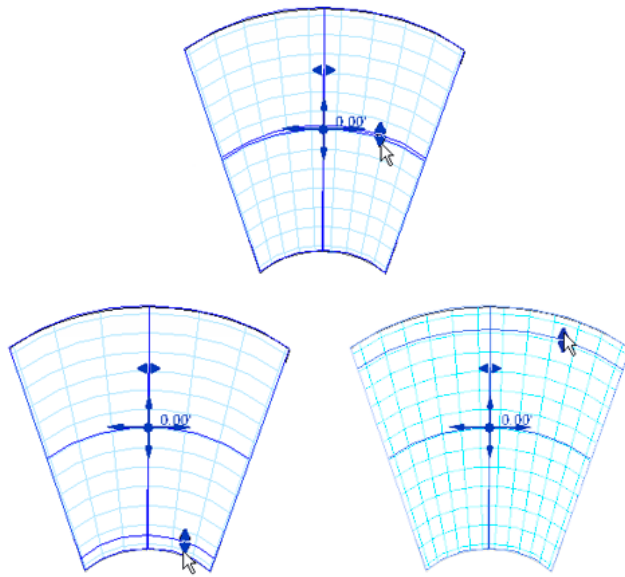


Adjusting UV Grid Belts

Each belt represents the line along the surface from which the distance between grids is measured. The distance is measured by chords, not curve lengths. You can move the belts along their respective grids to adjust where the distance is measured. Click and drag the belt handles to reposition them.

NOTE Clicking a belt handle will slightly nudge the belt position in the respective direction of the handle.

The following image shows repositioning of one belt along the U grid.

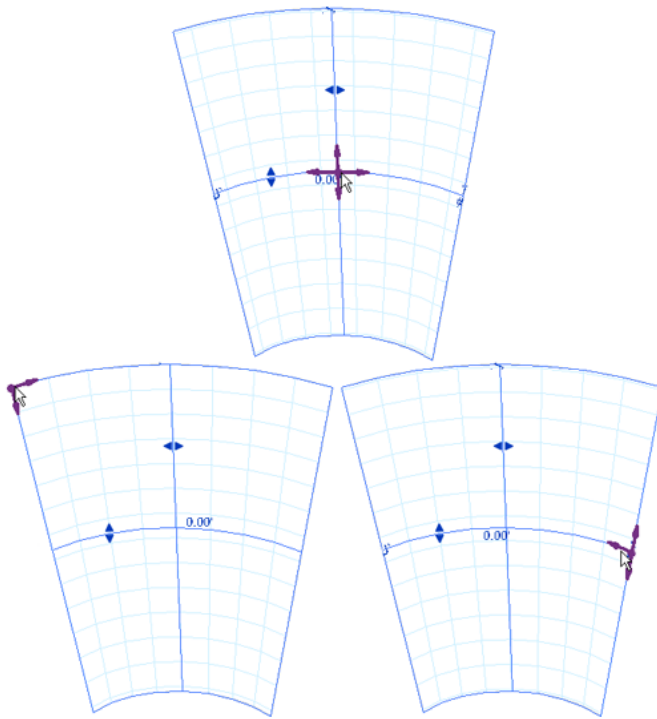


Justifying UV Grids to the Surface Borders

The Grid Justification tool defines the origin of the grids on the surface. Both U and V grids are centered in a surface by default, but each can be repositioned to the left and right, as well as top and bottom, resulting in the following 9 possible locations for grid justification.

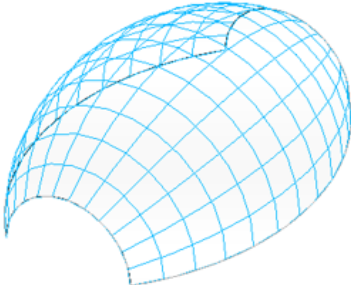
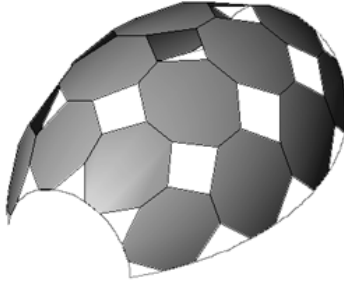
Top Left	Top Center	Top Right
Left Center	Center	Right Center
Bottom Left	Bottom Center	Bottom Right

The Grid Justification tool will snap to any of these locations on a surface. In the following illustration, notice how the positioning of the Grid Justification tool adjusts the location of the UV grids.



Patterning Surfaces

After a surface is divided, it can be patterned. Still part of the conceptual design phase of the project, this phase enables quick preview and editing of patterned surfaces. A collection of patterns are available in the Type Selector and can be applied onto a selected divided surface.

Divided Surface	Applied Octagon Pattern
	

Patterns are family-based and can be graphically previewed in the Type Selector before being applied.



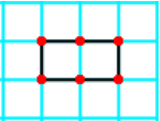

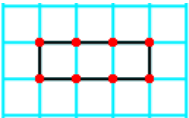

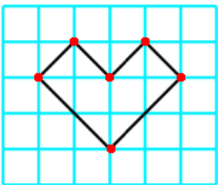

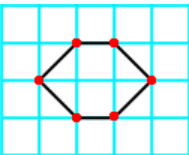

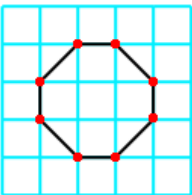

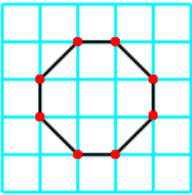
To pattern a surface


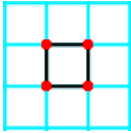

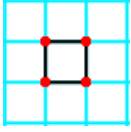

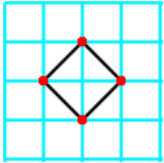

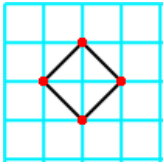

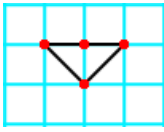

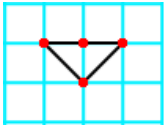

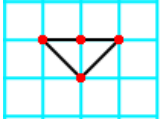

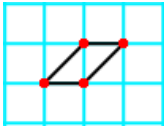
- 1 Select a divided surface.
- 2 Click Modify Divided Surface tab ► Element panel ► Type Selector drop-down, and select the desired pattern shape.

Note that the divided surface is hidden when a pattern is applied. To display it again, click Modify Divided Surface tab ► Surface Representation panel ► Surface.

Patterns become part of the surface and, depending on their shape, will require a specific number of surface cells when applied. This is an important consideration when planning divisions and patterns for component design. See [Pattern Component Families](#) on page 578.

The patterns available are as follows.

Pattern name	Required number of surface cells	Pattern layout
<div>  </div> <div>No Pattern</div>	0	Pattern is removed from the divided surface.
<div>  </div> <div>1/2 Step</div>	2 (1 x 2)	<div>  </div>
<div>  </div> <div>1/3 Step</div>	3 (1 x 3)	<div>  </div>
<div>  </div> <div>Arrows</div>	12 (3 x 4)	<div>  </div>
<div>  </div> <div>Hexagon</div>	6 (2 x 3)	<div>  </div>
<div>  </div> <div>Octagon</div>	9 (3 x 3)	<div>  </div>
<div>  </div> <div>Octagon Rotate</div>	9 (3 x 3)	<div>  </div>

Pattern name	Required number of surface cells	Pattern layout
 Rectangle	1 (1 x 1)	
 Rectangle Checkerboard	1 (1 x 1)	
 Rhomboid	4 (2 x 2)	
 Rhomboid Checkerboard	4 (2 x 2)	
 Triangle	2 (1 x 2)	
 Triangle Checkerboard	2 (1 x 2)	
 Triangle Step	2 (1 x 2)	
 Zig Zag	2 (1 x 2)	

Editing the Patterned Surface

Modify the patterned surface by changing patterns, adjusting properties with the Face Manager, and changing its border tiling.

Changing Patterns

Select the divided surface, and then select a new pattern from the Type Selector drop-down. If another component or a pattern component has been previously applied to the surface, it will be replaced by the new pattern.

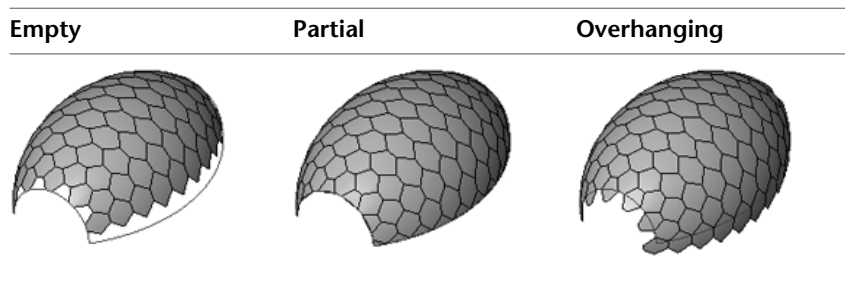
Modifying the Pattern with the Face Manager

Pattern spacing is controlled by the spacing of the divided surface. See [Modifying the Spacing of UV Grids on Divided Surfaces](#) on page 571.

Pattern orientation is controlled by the orientation of the direction of grids of the divided surface. See [Adjusting UV Grids with the Face Manager](#) on page 571.

Modifying Pattern Border Tiling

Patterned surfaces may have border tiles that intersect the edge of the surface and are not complete tiles. These border tile conditions can be set to be Partial, Overhanging, or Empty in the Border Tile instance property of the patterned surface. (See [Pattern Element Instance Properties](#) on page 585.) Partial border tiling is the default setting.



- 1 Select the patterned surface.
- 2 Click Modify Divided Surface tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 3 In the Instance Properties dialog, under Constraints, select Empty, Partial, or Overhanging.
- 4 Click OK.

When components are later applied to a surface, the border components inherit the condition of the border tile set when the surface was patterned.

Pattern Component Families

You can use the Curtain Panel by Pattern family template (Curtain Panel Pattern Based.rft) to create flexible parametric components. These parametric components can be loaded into a conceptual mass family and applied to divided and patterned surfaces to populate buildable architectural components across a large variety of geometric surfaces. When building a parametric component based on the Curtain Panel by Pattern template, you can apply the form-making tools to create variety of shapes. See [Forms](#) on page 551.

Pattern components are nested families, which are part of the larger conceptual mass family. When loaded in the conceptual design mass, they are available to be applied to a divided or a patterned surface. They may be modified individually after being applied to the divided surface.



To create and apply pattern components

- 1 Create a new pattern component family using the provided template family. See [Creating New Pattern Component Families](#) on page 579.

- 2 Determine the tile pattern for the component. See [Patterning Surfaces](#) on page 575.
- 3 Using the same modeling tools as used in the conceptual design mass, sketch and extrude geometry onto the pattern grid. See [Drawing Component Families](#) on page 580.
- 4 Load the pattern component family into the conceptual design mass. See [Loading a Pattern Component Family](#) on page 581.
- 5 Apply the pattern component family to the patterned surface. See [Applying a Pattern Component Family](#) on page 582.
- 6 Modify the pattern component family to meet the needs of the conceptual design mass. See [Modifying the Pattern Component Family](#) on page 582.

Creating New Pattern Component Families

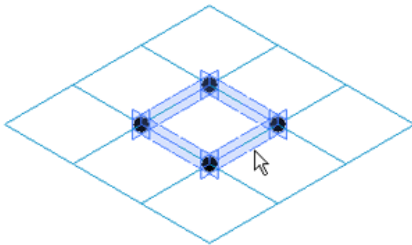
You create pattern component families from a provided family template file. The family can then be saved and edited as needed.

- 1 Click  ► New ► Family.
- 2 In the New Family dialog, navigate to the family templates directory.
- 3 Select *Curtain Panel Pattern Based.rft*, and click Open.
- 4 Click  ► Save As.
- 5 In the Save As dialog, navigate to the directory where you want to save your pattern component family, and click Save.

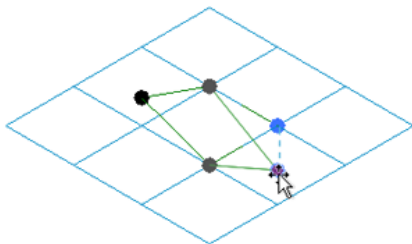
You can now design the pattern component family for the conceptual design mass.

The Pattern Component Family Template

The component template consists of a grid, reference points, and reference lines.



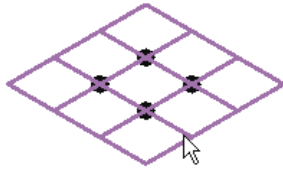
The default reference points are locked to allow only vertical movement as seen in the following image. This maintains the basic shape of the component so it will apply to the pattern proportionately.



Selecting the Tile Pattern Grid

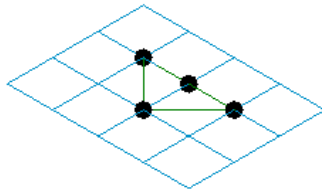
Before designing the pattern component, you may need to select a tile pattern grid that matches your patterned surface. These are grids on which you sketch and create 3D forms for your pattern component. The grid layouts for pattern components are shown in the chart in [Patterning Surfaces](#) on page 575.

- 1 Open your pattern component family file. A square tile pattern grid displays by default.
- 2 Select the tile pattern grid in the drawing area.



- 3 Click Modify Tile Pattern Grids tab ► Element panel ► Type Selector drop-down, and select the desired pattern shape.

The tile pattern grid is applied.



NOTE Many of the predefined tile pattern grids appear identical to others, such as the Rectangle and Rectangle Checkerboard, or Rhomboid and Rhomboid Checkerboard patterns. While they are designed similarly, they are configured differently when applied to the conceptual design mass.

- 4 Click  ► Save.

You can now design the pattern component family. See [Drawing Component Families](#) on page 580.

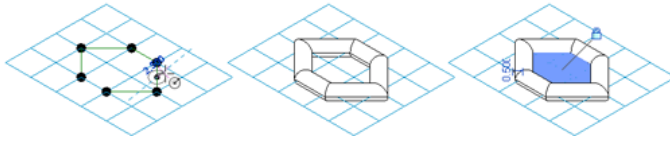
Drawing Component Families

Designing the pattern component is very similar to sketching the conceptual design mass. You use the same modeling tools that are used to design forms, though with the following limitations:

- There is only one floor plan (level) view, which is defined by the pattern tile grid.
- There are no elevation views.
- There are no default vertical reference planes, though reference planes can be defined by geometry.

Lines, Curves, and Splines

Draw reference points, lines, and closed loop geometry to design and modify a pattern component. While the template reference points will not move horizontally, the template reference lines can have driving points added to them to alter their geometry.



Related topics

- [Drawing in the Conceptual Design Environment](#) on page 533
- [Reference Points](#) on page 540
- [Forms](#) on page 551

Extrusions and Forms

Using sketched lines and geometry, create extrusions, forms and voids to give the component dimension.

Related topic

- [Forms](#) on page 551

Best Practices

- Divide and pattern a surface before applying components.
- Work with border tile conditions set to Empty or Overhanging when possible. When set to Partial, the size of the file and resulting memory requirements increase. Loading pattern components and modifying conceptual masses with applied pattern components in this state may take longer than anticipated.
- When working with closed forms, select patterns that will seamlessly interlock.
- Work with multiple windows to facilitate your pattern component family design workflow.

To design a pattern component

- 1 Open the pattern component family.
- 2 Open the conceptual design mass (3D view, floor plan view, or both).
- 3 Click View tab ► Windows panel ► Tile.

Designing in this manner allows you to work in the pattern component family and see how it displays in your conceptual design mass.

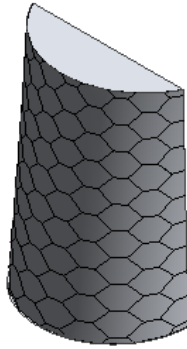
Loading a Pattern Component Family

- 1 Open the conceptual design mass.
- 2 Open the pattern component family.
- 3 Click Create tab ► Family Editor panel ► Load into Project.
- 4 If multiple projects are open, the Load into Projects dialog will open. Select which projects will receive the pattern component family, and click OK.

The new pattern component is now available to be applied to a patterned surface. See [Applying a Pattern Component Family](#) on page 582.

Applying a Pattern Component Family

1 Open the conceptual design mass.

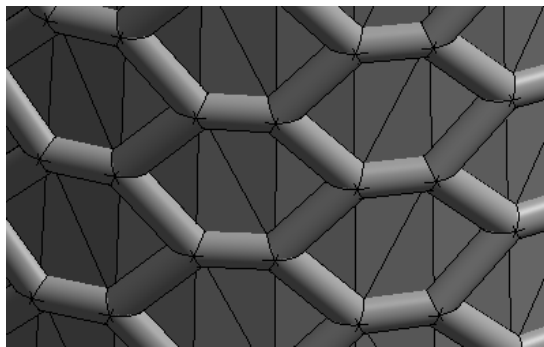


2 Select the patterned surface.

3 Click Modify Divided Surface tab ► Element panel ► Type Selector drop-down, and select the pattern component family.



The component is applied to the patterned surface.



NOTE The pattern component may take a few moments to load.

Modifying the Pattern Component Family

Pattern component families can be edited using the following tools.


- Change pattern component layout by adjusting the patterned surface. See [Editing the Patterned Surface](#) on page 577.

- Change pattern component family geometry by directly editing its family file. See [Drawing Component Families](#) on page 580.
- Change component family properties in the Instance Properties dialog. See [Pattern Element Instance Properties](#) on page 585.

Surface Representation


While editing a surface in the conceptual design environment, you can choose which surface elements to view with the Surface Representation tools. Select a divided surface and notice the Modify Divided Surface tab ► Surface Representation panel. The corresponding Surface, Pattern, and Component tools show or hide their surface elements in the conceptual design environment.

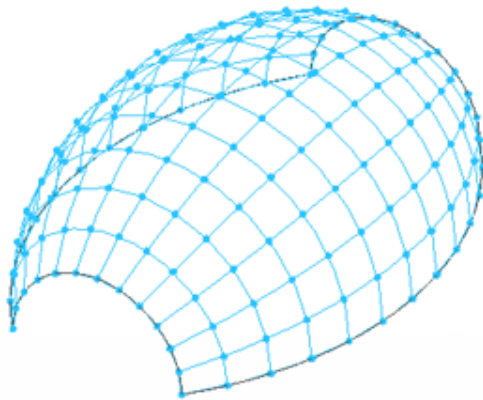
NOTE Changes made from the Surface Representation panel will not carry into a project. To globally show or hide surface elements, click View tab ► Graphics panel ► Visibility and Appearance. See [Visibility and Graphic Display in Project Views](#) on page 198.

Each surface element has a subset of display properties for Surface Representation. To access these properties, click Modify Divided Surface tab ► Surface Representation panel ► . The Surface Representation dialog opens with tabs for Surface, Pattern, and Component. Each tab has check boxes for surface element specific items. Clicking a check box shows the change in the drawing area. Click OK to confirm any changes.

Surface Properties Tab

These settings are used when the Surface tool on the Surface Representation panel is clicked.

- **Original Surface.** Displays the original surface that was divided. Click  (Browse) to change the surface material. See [Materials](#) on page 468.
- **Nodes.** Displays nodes located at the intersection of UV grids. By default, nodes are not enabled.




Notice that the surface immediately updates when a dialog check box is selected.

- **UV Grids** Displays the UV grids on a divided surface.

Pattern Properties Tab

These settings are used when the Pattern tool on the Surface Representation panel is clicked.

- **Pattern Line.** Displays the outlines of the pattern shapes.

- **Pattern Fill.** Displays the surface fill of the pattern. Click  (Browse) to change the surface material. See [Materials](#) on page 468.

Component Properties Tab

These settings are used when the Component tool on the Surface Representation panel is clicked.

- **Pattern Component.** Displays the applied pattern component of the surface.

Pattern Element Properties

Use the following procedure to modify many properties such as constraints, grids, and application.

- 1 Select the patterned surface.
- 2 Click Modify Reference Points tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 3 In the Instance Properties dialog, edit patterned surface instance parameters.
- 4 If you want to edit type properties, click Edit Type.
Type properties affect all instances (individual elements) of that family in the project and any future instances that you place in the project. Edit type parameters and click OK.
- 5 Click OK.

Pattern Element Type Properties

Name	Description
Construction	
Construction Type	The type of construction for the component.
Material and Finishes	
Finish	Texture of the finished surface of the component.
Identity Data	
Assembly Code	Unifomat assembly code for the component.
Keynote	The component keynote. Add or edit the value. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The manufacturer internal number.
Manufacturer	The component manufacturer.
Type Comments	A field for entering general comments about the component type. This information can be included in a schedule.

Name	Description
URL	A link to a web page that may contain type-specific information.
Description	Description of the component.
Assembly Description	Read-only description of the assembly based on the assembly code selection.
Type Mark	A value that designates the particular component; possibly the shop mark. This value must be unique for each element in a project. You are warned if the number is already used, but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Cost	The pricing of the component.
OmniClass Number	The number from Table 23 of the Omni-Class Construction Classification System that best categorizes the family type.
OmniClass Title	The name from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.

Pattern Element Instance Properties

Name	Description
Constraints	
Border Tile	Determines how a pattern intersects a surface border: empty, partial, or overhanging. See Editing the Patterned Surface on page 577.
All Grid Rotation	The rotation of both U and V grids. See Adjusting UV Grids with the Face Manager on page 571.
U Grid	
Layout	The spacing units of the U grid: Fixed Number or Fixed Distance. See Adjusting UV Grids with the Face Manager on page 571.
Number	The fixed number of divisions of the U grid. See Adjusting UV Grids with the Face Manager on page 571.

Name	Description
Distance	The fixed distance of divisions of the U grid. See Adjusting UV Grids with the Face Manager on page 571.
Justification	The position from which the U grid is measured: Beginning, Center, or End. See Adjusting UV Grids with the Face Manager on page 571.
Grid Rotation	The rotation of the U grid. See Adjusting UV Grids with the Face Manager on page 571.
V Grid	
Layout	The spacing units of the V grid: Fixed Number or Fixed Distance. See Adjusting UV Grids with the Face Manager on page 571.
Number	The fixed number of divisions of the V grid. See Adjusting UV Grids with the Face Manager on page 571.
Distance	The fixed distance of divisions of the V grid. See Adjusting UV Grids with the Face Manager on page 571.
Justification	The position from which the V grid is measured: Beginning, Center, or End. See Adjusting UV Grids with the Face Manager on page 571.
Grid Rotation	The rotation of the V grid. See Adjusting UV Grids with the Face Manager on page 571.
Pattern Application	
Indent 1	The number of U grid divisions by which the pattern is shifted when applied.
Indent 2	The number of V grid divisions by which the pattern is shifted when applied.
Component Rotation	The rotation of a pattern component family in its pattern cell: 0°, 90°, 180°, or 270°.
Component Mirror	Mirrors the component horizontally along the U grid.
Component Flip	Flips the component along the W grid.
Identity Data	

Name	Description
Comments	Comments on the pattern element.
Mark	A mark applied to a pattern element. This can be a label that appears in a multi-category tag with the pattern element. For complete information about multi-category tagging and setting up shared parameters, see Shared Parameters on page 451.
Area	
Divided Surface Area	The total area of the selected divided surface.

Conceptual Design Environment Glossary

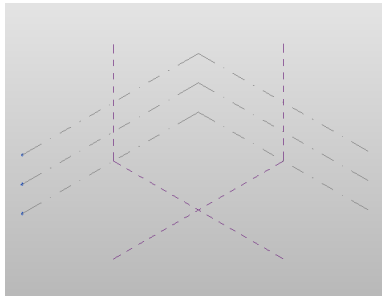
■ 3D control

A manipulation control that appears when surfaces, edges, or vertices are selected. This control also displays on a selected point. (See [Modifying Forms](#) on page 560.)



■ 3D level

A finite horizontal plane that acts as a reference for level-hosted forms and points. 3D levels display in the conceptual design environment as the cursor moves over them in the drawing area. These can be set as work planes.



■ 3D reference plane

A 3D plane used to draw lines that create a form. 3D reference planes display in the conceptual design environment. These can be set as work planes.

■ 3D work plane

A planar surface on which to draw lines for creating a form. 3D levels and 3D reference planes can be set as work planes. These automatically display in the conceptual design environment as the cursor moves over them in the drawing area.

■ Form

The 3D or 2D surface or solid created using the Make Form tool. (See [Forms](#) on page 551.)

■ Loft

The form derived from multiple lines (single segment, chain, or loop) drawn on parallel or non-parallel work planes.

■ **Profile**

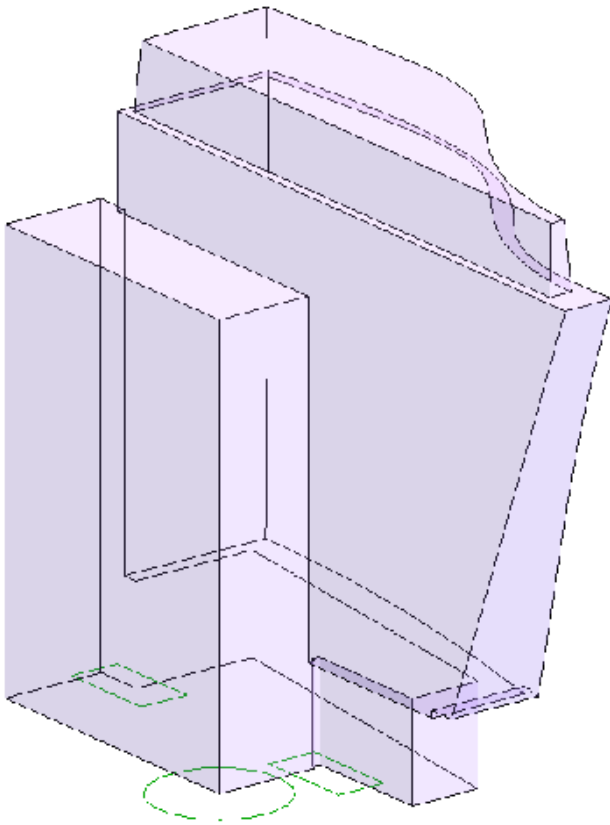
A single curve, or collection of end-connected curves which are used singly or in combination to construct form element geometry, using the supported geometry construction techniques: extrude, loft, sweep, revolve, and surface.

Massing Studies

12

Massing studies allow you to explore design ideas by using shapes to conceptualize a building model. When your conceptual design is complete, you can add building elements directly to these shapes.

The following image shows a sample massing study.



Typical Uses of Massing Studies

- Create in-place or family-based mass instances that are specific to individual options, worksets, and phases.
- Create mass families that represent the forms associated with often-used building volumes.
- Vary materials, forms, and relations between masses that represent major components of a building or development using design options.

- Abstractly represent phases of a project.
- Study zoning compliance, both visually and numerically, by relating a proposed building mass to the zoning envelope and floor area ratio.
- Assemble various complex masses from a library of predefined mass families.
- Generate floors, roofs, curtain systems, and walls from mass instances with control over element category, type, and parameter values. Fully control regeneration of these elements when the mass changes.

Related topic

- [Conceptual Design Environment](#) on page 527

Massing Studies Terminology

Term	Description
Massing	The process of visualizing, studying, and resolving building forms using mass instances.
Mass Family	A family of shapes, belonging to the mass category. An in-place mass is saved with the project; it is not a separate file.
Mass Instance or Mass	An instance of a loaded mass family or an in-place mass.
Conceptual Design Environment	A type of family editor that creates conceptual designs using in-place and loadable family mass elements. See Conceptual Design Environment on page 527.
Mass Form	The overall form of each mass family or in-place mass.
Massing Study	A study of one or more building forms made from one or more mass instances.
Mass Face	A surface on a mass instance that can be used to create a building element, such as a wall or roof.
Mass Floor	A horizontal slice through a mass at a defined level. Mass floors provide geometric information about the dimensions of the mass above the slice, up to the next slice or the top of the mass.
Building Elements	Walls, roofs, floors, and curtain systems that can be created from mass faces.
Zoning Envelope	A legally defined volume within which a building must be contained. Zoning envelopes can be modeled as a mass.

Massing Studies and Building Maker

Building Maker is a set of tools that draws a closer association between massing studies and building elements. It takes any overall building form described conceptually and maps it to real-world building elements (such as roofs, curtain walls, floors, and walls). Building Maker allows for a cumulative understanding of the relationship between expressive and built form as the design develops.

You can use Building Maker tools to create building elements from masses. See [Creating Building Elements from Mass Instances](#) on page 615.

Creating a Mass Family

You can create masses within a project (in-place masses) or outside a project (loadable mass families). In-place masses are used for mass forms that are unique to a project. Loadable mass families are typically used when you will be placing multiple instances of the mass in a project, or when you will use mass families in multiple projects.

To create in-place masses and loadable mass families, use the conceptual design environment. You can nest other mass families into the mass family that you are creating. (See [Conceptual Design Environment](#) on page 527.)

If you are importing geometry into a family, see [Considerations for Imported Geometry in Mass or Generic Model Families](#) on page 626.

Creating an In-Place Mass

1 Click Massing & Site tab ► Conceptual Mass panel ► In-Place Mass.

In order to create a mass, Show Mass mode must be activated. If Show Mass mode is not activated when you click In-Place Mass, Revit Architecture activates it for you.

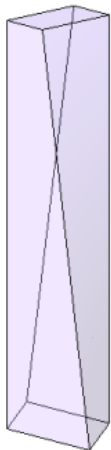
2 Enter a name for the in-place mass family, and click OK.

3 Create the desired shapes using the tools on the Draw panel. See [Forms](#) on page 551.

4 When you are finished, click Finish Mass.

Related topics

- [Conceptual Design Environment](#) on page 527
- [Using Multiple Mass Instances in a Project](#) on page 592
- [Controlling Visibility of Mass Instances](#) on page 626
- [Analyzing a Conceptual Design](#) on page 594



Creating a Mass Family Outside of a Project

1 Click  ► New ► Conceptual Mass.

2 In the New Concept Model dialog, select Mass.rft, and click Open.

The Conceptual Design Environment opens. For instructions, see [Conceptual Design Environment](#) on page 527 and [Forms](#) on page 551.

Mass Instance Parameters

You can view instance parameters for a selected mass element in the Instance Properties dialog. Loadable mass families and in-place masses have the following instance parameters in common:

- **Mass Floors.** Click Edit to open the Mass Floors dialog. The dialog displays all levels in the project. When you select levels, Revit Architecture generates a mass floor for each selected level that intersects the mass. After generating mass floors, the software calculates the mass floor area, perimeter, volume, and exterior surface area. See [Creating Mass Floors](#) on page 596.
When the mass changes its vertical extents, only previously selected levels that currently intersect the mass produce mass floors. Each previously selected level is retained even if it does not produce a mass floor until unselected.
- **Gross Volume.** This value is read only.
- **Gross Surface Area.** This value is read only. The gross surface area includes the sides, top, and bottom of the mass.
- **Gross Floor Area.** This read-only value changes when you add mass floors.

Gross Volume, Gross Surface Area, and Gross Floor Area are all parameters that can be scheduled.

Placing a Mass Instance from a Mass Family

- 1 Click Insert tab ► Load from Library panel ► Load Family.
- 2 Navigate to the mass family file, and click Open.
- 3 Click Massing & Site tab ► Conceptual Mass panel ► Place Mass.
- 4 In the Type Selector, select the desired mass type.
- 5 Click in the drawing area to place the mass instance.

Using Multiple Mass Instances in a Project

You can include multiple mass instances in a project. To eliminate overlap, each mass instance can be joined to other mass instances. As a result, their gross volume and gross floor area values are adjusted accordingly.

In the project, mass instances can be placed in worksets, included in phases, and added to design options.

Joining Mass Instances in a Project

- 1 Click Modify tab ► Edit Geometry panel ► Join drop-down ► Join Geometry.
- 2 Select the first mass instance, and then the second.

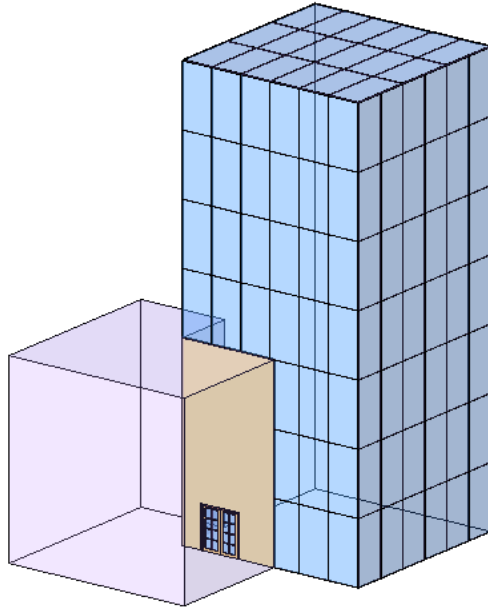
The overlapping form of the first mass cuts into the second mass. The mass floors of the second mass are adjusted to report accurately gross floor area in a mass schedule.

If you move the joined mass instances, their properties are updated. If you move the mass instances so that they no longer intersect, a warning message displays. You can unjoin them using the Unjoin Geometry tool.

Overlapping Mass Faces

In the project environment, any joined and overlapping mass faces split into 2 faces: interior and exterior. This allows you to create interior or exterior hosts by face.

In the following illustration, 2 masses are joined, and the overlapping faces have 2 different hosts. The exterior face has a curtain system by face. The interior face has a wall by face with a door.



When you join masses, the area of the inner wall shared by the masses is deducted from the gross surface area for each mass. If you create mass floors, this inner wall area is also deducted from the exterior surface area for each mass floor.

The perimeter of a mass floor, however, includes the entire perimeter, even when it overlaps the perimeter of a mass floor in an adjacent joined mass.

Mass Instances in Design Options, Phases, and Worksets

You can assign mass instances to any workset, range of phases, and design options. Consider the following limitations:

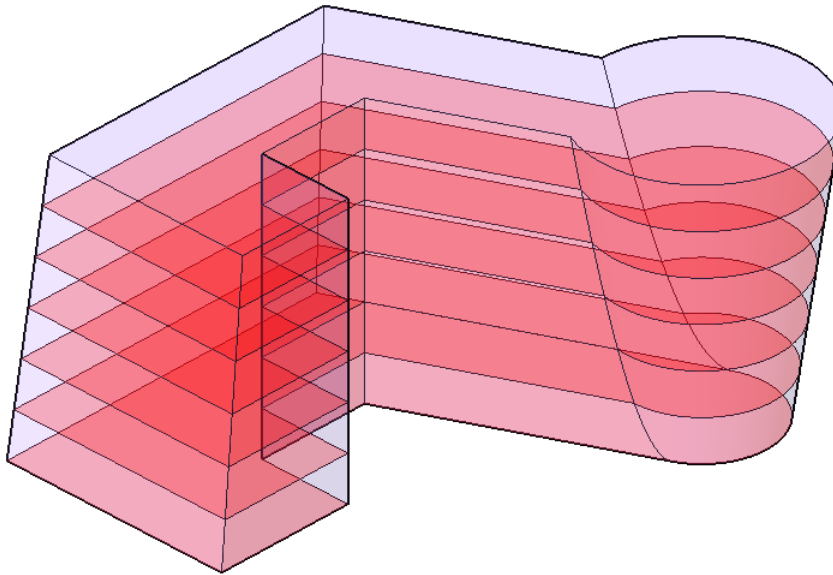
- If you want to join geometry of 2 masses and then vary the relationships in different options, you must copy both masses into each option.
- If you want to modify relationships between 2 masses and they are in different worksets, either both worksets must be editable, or you will need to borrow one or both of the masses from the owners of their worksets.
- If the relationships between masses vary from phase to phase, you may need to include each mass in each phase.

Analyzing a Conceptual Design

During the early planning stages of a building project, you can analyze the conceptual design to determine the following:

- The best mix of uses (such as retail, residential, and office space) for the building
- Rough cost estimates for the exterior of the building, based on linear dimensions or surface area
- HVAC (heating-ventilation-air conditioning) requirements for different levels of the building

To perform these types of analysis, you use mass floors to divide a mass based on defined levels. For each mass floor, Revit Architecture calculates the floor area, exterior surface area, volume, and perimeter. This information is stored in the instance properties for mass floors. You can include these values in schedules and tags.

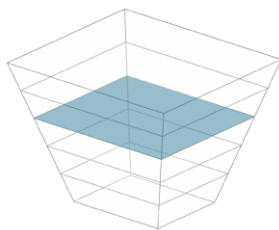


Mass Floors Overview

In Revit Architecture, you use mass floors to divide a mass. You can create a mass floor at each level defined in the project. Mass floors display graphically as a slice through the mass at a defined level. They provide geometric information about the dimensions of the mass above the slice, up to the next slice or the top of the mass.

For each mass floor, Revit Architecture calculates the following:

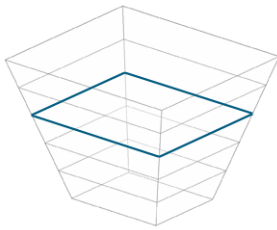
- **Area** of each mass floor, in square units. Use this information for rough cost estimates or determining usage ratios for the design.



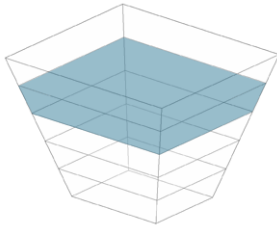
- **Exterior surface area** from the mass floor upward to the next mass floor. Use this information to create rough cost estimates for the exterior of the building based on square units.



- **Perimeter** of each mass floor. Use this information to create rough cost estimates based on linear dimensions.



- **Volume** of each mass floor, in cubic units. Use this information to estimate HVAC loads.

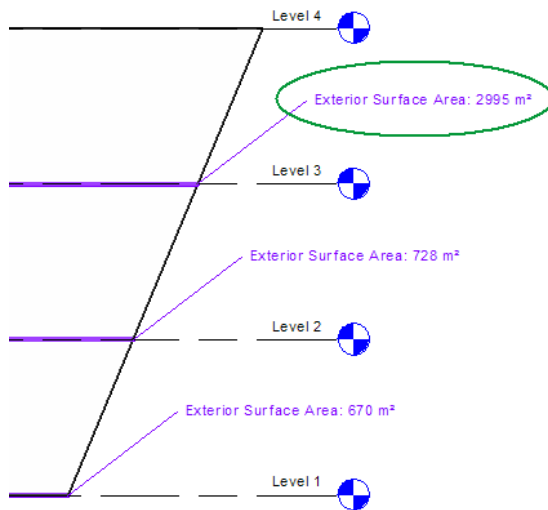


See [Examples of Conceptual Design Analysis](#) on page 600.

Mass Floors at the Top of a Mass

When you use mass floors to divide a mass, Revit Architecture creates a visible mass floor at each specified level that intersects the mass, except for any level that coincides with a top face of the mass.

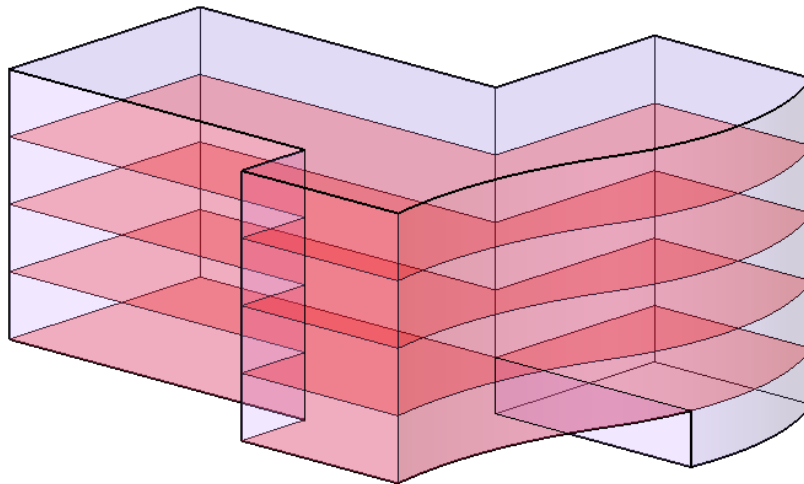
For example, suppose you create a mass that starts at level 1 and ends at level 4. In the Mass Floors dialog, you select levels 1, 2, 3, and 4. As a result, Revit Architecture creates mass floors at levels 1, 2, and 3. The software does not create a mass floor at level 4 because level 4 coincides with the top of the mass. It does not have exterior surface area (vertical surfaces extending upward from its perimeter) or volume (from level 4 upward). Instead, the exterior surface area for level 3 includes the vertical surfaces (walls) that enclose level 3 and also the top horizontal surface (roof) that occurs at level 4. As a result, the exterior surface area for the top floor of a mass may be disproportionately larger than lower floors.



Mass Floors at the Bottom of a Mass

To analyze a portion of a mass that occurs below the lowest mass floor, create a level and mass floor at the bottom-most boundary of the mass. Otherwise, Revit Architecture does not include that portion in the surface area or volume calculations for any mass floors. As an alternative, you can examine the Gross Surface Area and Gross Volume parameters for the mass.

NOTE The Gross Surface Area includes the bottom surface of a mass. However, the combined exterior surface areas of mass floors include the sides and top of the mass, but not its bottom surface.



Creating Mass Floors

1 If you have not already done so, add levels to the project.

Mass floors are based on levels defined in the project. See [Adding Levels](#) on page 1102.

2 Select the mass.

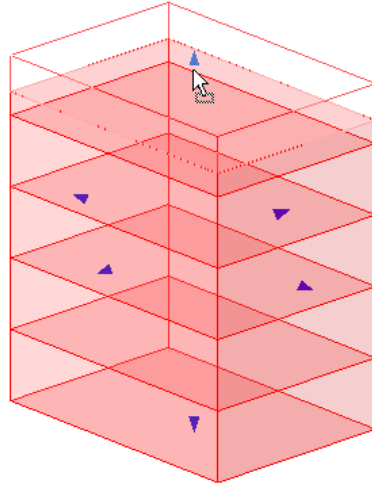
You can select the mass in any type of project view, including floor plan, RCP, elevation, section, and 3D views.

3 Click **Modify Mass** tab ► **Massing** panel ► **Mass Floors**.

4 In the **Mass Floors** dialog, select each level that needs a mass floor, and click **OK**.

Initially, if you select a level that the mass does not intersect, Revit Architecture does not create a mass floor for that level. However, if you later resize the mass so that it intersects the specified level, Revit Architecture creates a mass floor on that level.

Mass floors



After creating mass floors, you can do any of the following:

- Select a mass floor to view its properties (including area, perimeter, exterior surface area, and volume) and assign a usage. See [Selecting Mass Floors](#) on page 597 and [Mass Floor Properties](#) on page 612.
- Tag mass floors. See [Tagging Mass Floors](#) on page 599.
- Create building floors from mass floors. See [Creating Floors Using the Floor by Face Tool](#) on page 618.

Selecting Mass Floors

After creating mass floors, you can select each mass floor individually. When you move the cursor over a mass floor, the tooltip and status bar display the following:

Mass Floor : Mass Floor for <mass name> : <level>

If the status bar displays the name of the mass instead of the mass floor, press *Tab* to highlight the mass floor.

When the mass floor is highlighted, click to select it.

You cannot change the shape of a mass floor by manipulating it directly. Instead, change the shape of its mass. Revit Architecture automatically updates all affected mass floors and related information.

Creating a Mass Floor Schedule

After [creating mass floors](#), you can create a schedule for them. Use a mass floor schedule to assign usages or to analyze the design. If you change the shape of the mass, the mass floor schedule updates to reflect the changes.

Mass Floor Schedule							
Mass: Type	Level	Usage	Floor Area	Floor Area %	Floor Perimeter	Exterior Surface Area	Floor Volume
Offices							
Square	3	Offices	352 m²	5%	75	227 m²	1,061.61 m³
Square	4	Offices	356 m²	5%	76	552 m²	965.60 m³
Wedge	4	Offices	288 m²	4%	73	219 m²	846.24 m³
Wedge	5	Offices	277 m²	4%	72	216 m²	818.27 m³
Wedge	6	Offices	269 m²	4%	71	479 m²	799.55 m³
Offices: 5			1541 m²	22%	367	1694 m²	4,491.27 m³
Parking							
Square	1	Parking	342 m²	5%	74	224 m²	1,033.59 m³
Wedge	1	Parking	339 m²	5%	78	235 m²	985.75 m³
Rectangle	1	Parking	638 m²	9%	116	348 m²	1,935.24 m³
Parking: 3			1319 m²	19%	268	807 m²	3,954.57 m³
Residential							
Rectangle	2	Residential	652 m²	9%	116	348 m²	1,974.15 m³
Rectangle	3	Residential	664 m²	9%	116	348 m²	2,011.07 m³
Rectangle	4	Residential	676 m²	9%	116	347 m²	2,046.36 m³
Rectangle	5	Residential	688 m²	10%	115	408 m²	2,058.08 m³
Rectangle	6	Residential	620 m²	9%	101	783 m²	1,176.26 m³
Residential: 5			3300 m²	46%	563	2234 m²	9,265.93 m³
Retail							
Square	2	Retail	347 m²	5%	75	226 m²	1,048.83 m³
Wedge	2	Retail	319 m²	4%	76	229 m²	929.98 m³
Wedge	3	Retail	302 m²	4%	74	224 m²	883.48 m³
Retail: 3			968 m²	14%	225	678 m²	2,862.29 m³
Grand total			7129 m²	100%	1,423	5413 m²	20,574.06 m³

To create a mass floor schedule

- 1 Click View tab ► Create panel ► Schedules drop-down ► Schedule/Quantities.
- 2 In the New Schedule dialog, do the following:
 - a For Category, click Mass Floor.
If Mass Floor does not display by default, select Show categories from all disciplines.
 - b For Name, specify the schedule name.
 - c Select Schedule building components.
 - d Click OK.
- 3 In the Schedule Properties dialog, do the following:
 - a On the Fields tab, select the desired fields.
See [Selecting Fields for a Schedule](#) on page 176.
 - b Use other tabs to specify filtering, sorting, and formatting of the schedule.
See [Specifying Schedule Properties](#) on page 176.
 - c Click OK.

The schedule displays in the drawing area. If you included the Usage field in the schedule, you can assign a usage to each mass floor in the schedule.

Related topics

- [Examples of Conceptual Design Analysis](#) on page 600
- [Schedule Views](#) on page 172

Tagging Mass Floors

After [creating mass floors](#), you can tag them in 2D views. The tags can include information about the area, exterior surface area, perimeter, volume, and usage for each mass floor. If you change the shape of the mass, the tags update to reflect the changes. (For information about tags, see [Tags](#) on page 1123.)

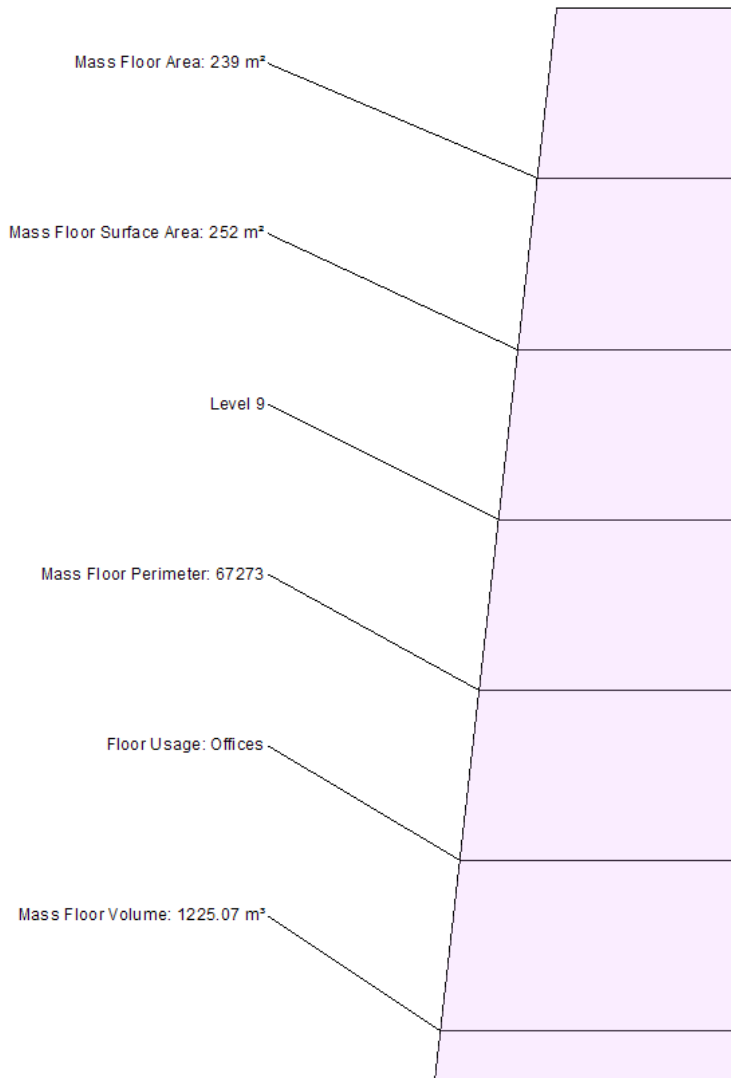
Revit Architecture provides the Mass Floor Tag and M_Mass Floor Tag families. These tags reside in the Annotations folder of the Revit Architecture library. They provide information about the usage and square units per mass floor.

To display other parameter values in a mass floor tag, create your own, or use the example provided in the Training folder: Mass Floor Tag-Complex.rfa or M_Mass Floor Tag-Complex.rfa. If you use the default installation location for tutorial content, these files reside in the following location:

C:\Documents and Settings\All Users\Application Data\Autodesk\<product name and version>\Training\<Imperial or Metric>\Families\Annotations

When applying these complex tags to mass floors, you can select a family type to display the desired information, as shown.

Sample tags for mass floors



To tag mass floors

- 1 Open a view in which you can apply tags.

You can tag elements in 2D views, including plans, sections, and elevations. You cannot tag elements in 3D views.

- 2 Apply tags to mass floors.

See [Applying a Tag](#) on page 1125 and [Tag All Not Tagged](#) on page 1126.

NOTE If you have trouble tagging a mass floor, move the cursor over the floor and press *Tab*. (Pressing *Tab* changes the focus from the mass to the mass floor.) Then click the mass floor to tag it.

- 3 (Optional) If the tag displays the Usage label, click the Usage text and enter a value.

When you enter usage values in tags, other areas of the project (such as element properties and mass floor schedules) update with the information.

Assigning a Usage to a Mass Floor

After [creating mass floors](#), you can assign usages to them. Then you can perform various types of analysis on the design. See [Examples of Conceptual Design Analysis](#) on page 600.

Assign a usage to a mass floor using any of the following methods:

- **Schedule:** Include the Usage field in a mass floor schedule. Then assign usages within the schedule. Open the schedule, click the Usage column for a row, and enter text. If you have already entered usage values for other mass floors, you can click in the field and select a value from a list. See [Creating a Mass Floor Schedule](#) on page 597.
- **Tag:** To tag mass floors in a view, use a mass floor tag that displays the usage assigned to each mass floor. Click the tag to change a usage value. See [Tagging Mass Floors](#) on page 599.
- **Properties:** Access the Instance Properties dialog of a mass floor to assign a value to the Usage parameter, as follows.

To assign a usage to a mass floor

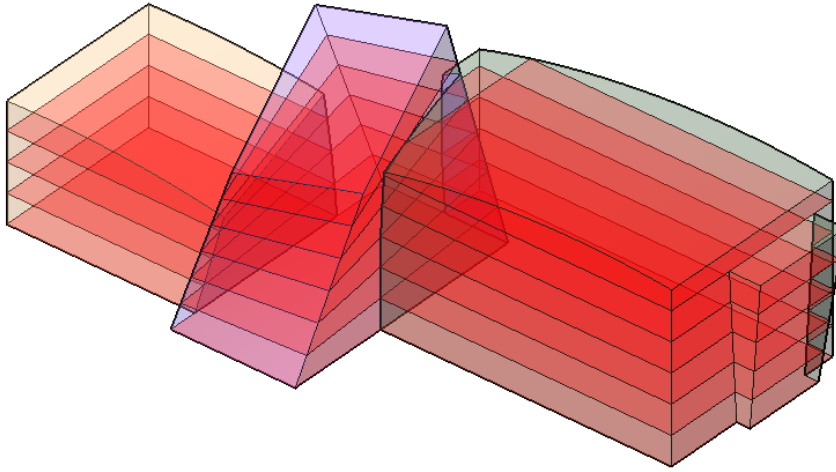
- 1 In a view, right-click a mass floor, and click Element Properties.
- 2 In the Instance Properties dialog, for Usage, enter a value.
- 3 Click OK.

Examples of Conceptual Design Analysis

The following topics provide examples of the different types of analysis that you can perform on conceptual designs.

The analysis examples use the following massing study.

Sample massing study



Area Analysis Example

In a sample scenario, you have designed masses to explore a conceptual design for a building. (See [Examples of Conceptual Design Analysis](#) on page 600.) You want to analyze the most cost-effective or profitable mix of uses for each floor of the building.

To perform this analysis, you must do the following:

- Assign a usage to each mass floor.
- Calculate the area of each mass floor.
- Calculate the percentage of floor space devoted to each usage.
- Use this information to determine the best mix of uses for the design.

Area Analysis				
Usage	Level	Mass: Type	Floor Area	Floor Area %
Offices	3	Square	352 m ²	5%
Offices	4	Square	356 m ²	5%
Offices	4	Wedge	288 m ²	4%
Offices	5	Wedge	277 m ²	4%
Offices	6	Wedge	269 m ²	4%
Offices: 5			1541 m ²	22%
Parking	1	Square	342 m ²	5%
Parking	1	Wedge	339 m ²	5%
Parking	1	Rectangle	638 m ²	9%
Parking: 3			1319 m ²	19%
Residential	2	Rectangle	652 m ²	9%
Residential	3	Rectangle	664 m ²	9%
Residential	4	Rectangle	676 m ²	9%
Residential	5	Rectangle	688 m ²	10%
Residential	6	Rectangle	620 m ²	9%
Residential: 5			3300 m ²	46%
Retail	2	Square	347 m ²	5%
Retail	2	Wedge	319 m ²	4%
Retail	3	Wedge	302 m ²	4%
Retail: 3			968 m ²	14%
			7129 m ²	100%

Creating an Area Analysis Schedule

Use the following procedure to create a schedule to perform area analysis of masses in a conceptual design, based on the scenario described in [Area Analysis Example](#) on page 601. Specific steps may vary depending on the information that you want to show in the schedule.

To create an area analysis schedule

- 1 Create mass floors.
See [Creating Mass Floors](#) on page 596.
- 2 Click View tab ► Create panel ► Schedules drop-down ► Schedule/Quantities.
- 3 In the New Schedule dialog, do the following:
 - a For Category, click Mass Floor.
If Mass Floor does not display by default, select Show categories from all disciplines.
 - b For Name, specify the schedule name.
 - c Select Schedule building components.
 - d Click OK.
- 4 On the Fields tab of the Schedule Properties dialog, do the following:
 - a For Scheduled fields (in order), add the following fields:
 - Usage

- Level
- Mass: Type
- Floor Area

- b Click Calculated Value.
- c In the Calculated Value dialog, for Name, enter **Floor Area %**.
- d Select Percentage.
- e For Of, select Floor Area.
- f For By, select Grand total.
- g Click OK twice.

5 In the schedule, assign a usage to each mass floor.

Enter text in the Usage column for each level. After entering initial values, for the remaining rows you can click in the field to select values from a list.

Area Analysis-1				
Usage	Level	Mass: Type	Floor Area	Floor Area %
Parking	1	Square	342 m ²	5%
Retail	2	Square	347 m ²	5%
Offices	3	Square	352 m ²	5%
Offices	4	Square	356 m ²	5%
Parking	1	Wedge	339 m ²	5%
Retail	2	Wedge	319 m ²	4%
Retail	3	Wedge	302 m ²	4%
Offices	4	Wedge	288 m ²	4%
Offices	5	Wedge	277 m ²	4%
Offices	6	Wedge	269 m ²	4%
Parking	1	Rectangle	638 m ²	9%
Residentia	2	Rectangle	652 m ²	9%
Residentia	3	Rectangle	664 m ²	9%
Residentia	4	Rectangle	676 m ²	9%
Residentia	5	Rectangle	688 m ²	10%
Residentia	6	Rectangle	620 m ²	9%

Next, sort and subtotal the schedule by usage, as follows.

- 6 Open the view properties for the schedule. (Right-click in the drawing area for the schedule, and click View Properties.)
- 7 For Sorting/Grouping, click Edit.
- 8 On the Sorting/Grouping tab of the Schedule Properties dialog, do the following:
 - a For Sort by, select the following:
 - Usage
 - Ascending
 - Footer
 - Title, count, and totals
 - Blank line
 - b For Then by, select both Level and Ascending.
 - c At the bottom of the dialog, select the following:
 - Grand totals
 - Title and totals

- Itemize every instance

9 Click the Formatting tab, and do the following:

- Under Fields, select Floor Area.
- For Alignment, select Right.
- Select Calculate totals.
- Specify formatting for Floor Area %: under Fields, select Floor Area %. For Alignment, select Right. Select Calculate totals.
- (Optional) Specify formatting for Usage, Level, and Mass: Type: under Fields, select a field name. Then for Alignment, select Center.

10 Click OK twice.

The schedule updates to sort and subtotal the rows accordingly. It shows the percentage of floor area planned for each usage, as well as square units.

Area Analysis				
Usage	Level	Mass: Type	Floor Area	Floor Area %
Offices	3	Square	352 m²	5%
Offices	4	Square	356 m²	5%
Offices	4	Wedge	288 m²	4%
Offices	5	Wedge	277 m²	4%
Offices	6	Wedge	269 m²	4%
Offices: 5			1541 m²	22%
Parking	1	Square	342 m²	5%
Parking	1	Wedge	339 m²	5%
Parking	1	Rectangle	638 m²	9%
Parking: 3			1319 m²	19%
Residential	2	Rectangle	652 m²	9%
Residential	3	Rectangle	664 m²	9%
Residential	4	Rectangle	676 m²	9%
Residential	5	Rectangle	688 m²	10%
Residential	6	Rectangle	620 m²	9%
Residential: 5			3300 m²	46%
Retail	2	Square	347 m²	5%
Retail	2	Wedge	319 m²	4%
Retail	3	Wedge	302 m²	4%
Retail: 3			968 m²	14%
			7129 m²	100%

Analysis Example for Exterior Surface Area

In a sample scenario, you have designed masses to explore a conceptual design for a building. (See [Examples of Conceptual Design Analysis](#) on page 600.) You want to determine exterior surface areas around the perimeter of each floor. This information will allow you to estimate costs for the building exterior using various materials.

Exterior Surface Area Analysis					
Usage	Comments	Level	Mass: Type	Exterior Surface Area	Exterior Surface Area %
Offices	Concrete/Glass	3	Square	227 m²	4%
Offices	Concrete/Glass	4	Square	552 m²	10%
Offices	Concrete/Glass	4	Wedge	219 m²	4%
Offices	Concrete/Glass	5	Wedge	216 m²	4%
Offices	Concrete/Glass	6	Wedge	479 m²	9%
Residential	Concrete/Glass	2	Rectangle	348 m²	6%
Residential	Concrete/Glass	3	Rectangle	348 m²	6%
Residential	Concrete/Glass	4	Rectangle	347 m²	6%
Residential	Concrete/Glass	5	Rectangle	408 m²	8%
Residential	Concrete/Glass	6	Rectangle	783 m²	14%
Concrete/Glass: 10				3928 m²	73%
Retail	Glass	2	Square	226 m²	4%
Retail	Glass	2	Wedge	229 m²	4%
Retail	Glass	3	Wedge	224 m²	4%
Glass: 3				678 m²	13%
Parking	Open	1	Square	224 m²	4%
Parking	Open	1	Wedge	235 m²	4%
Parking	Open	1	Rectangle	348 m²	6%
Open: 3				807 m²	15%
				5413 m²	100%

Creating a Schedule to Analyze Exterior Surface Area

Use the following procedure to create a schedule for analyzing the exterior surface areas of masses in a conceptual design, based on the scenario described in [Analysis Example for Exterior Surface Area](#) on page 604. Specific steps may vary depending on the information that you want to show in the schedule.

To create a schedule to analyze exterior surface area

1 Create mass floors.

See [Creating Mass Floors](#) on page 596.

2 Click View tab ► Create panel ► Schedules drop-down ► Schedule/Quantities.

3 In the New Schedule dialog, do the following:

a For Category, click Mass Floor.

If Mass Floor does not display by default, select Show categories from all disciplines.

b For Name, specify the schedule name.

c Select Schedule building components.

d Click OK.

4 On the Fields tab of the Schedule Properties dialog, do the following:

a For Scheduled fields (in order), add the following fields:

■ Usage

■ Comments

■ Level

■ Mass: Type

■ Exterior Surface Area

b Click Calculated Value.

c In the Calculated Value dialog, for Name, enter **Exterior Surface Area %**.

d Select Percentage.

e For Of, select Exterior Surface Area.

f For By, select Grand total.

g Click OK twice.

5 In the schedule, assign values to the Usage and Comments columns for each mass floor.

Use Comments to indicate the exterior building material. Use consistent values so that you can use this field for sorting.

Exterior Surface Area Analysis-1					
Usage	Comments	Level	Mass: Type	Exterior Surface Area	Exterior Surface Area %
Parking	Open	1	Square	224 m²	4%
Retail	Glass	2	Square	226 m²	4%
Offices	Concrete/Glass	3	Square	227 m²	4%
Offices	Concrete/Glass	4	Square	552 m²	10%
Parking	Open	1	Wedge	235 m²	4%
Retail	Glass	2	Wedge	229 m²	4%
Retail	Glass	3	Wedge	224 m²	4%
Offices	Concrete/Glass	4	Wedge	219 m²	4%
Offices	Concrete/Glass	5	Wedge	216 m²	4%
Offices	Concrete/Glass	6	Wedge	479 m²	9%
Parking	Open	1	Rectangle	348 m²	6%
Residential	Concrete/Glass	2	Rectangle	348 m²	6%
Residential	Concrete/Glass	3	Rectangle	348 m²	6%
Residential	Concrete/Glass	4	Rectangle	347 m²	6%
Residential	Concrete/Glass	5	Rectangle	408 m²	8%
Residential	Concrete/Glass	6	Rectangle	783 m²	14%

Next, sort and subtotal the schedule by exterior material (using the Comments field), as follows.

6 Open view properties for the schedule. (Right-click in the drawing area for the schedule, and click View Properties.)

7 For Sorting/Grouping, click Edit.

8 On The Sorting/Grouping tab of the Schedule Properties dialog, do the following:

a For Sort by, select the following:

- Comments
- Ascending
- Footer
- Title, count, and totals
- Blank line

b For Then by, select both Usage and Ascending.

c At the bottom of the dialog, select the following:

- Grand totals
- Title and totals
- Itemize every instance

9 Click the Formatting tab, and do the following:

a Under Fields, select Exterior Surface Area.

b For Alignment, select Right.

c Select Calculate totals.

d Specify formatting for Exterior Surface Area %: under Fields, select Exterior Surface Area %. For Alignment, select Right. Select Calculate totals.

e (Optional) Specify formatting for Comments, Usage, Level, and Mass: Type: under Fields, select a field name. Then for Alignment, select Center.

10 Click OK twice.

The schedule updates to sort and subtotal the rows accordingly. It shows the percentage of surface area for each exterior material, as well as square units.

In this example, the exterior surface areas for some mass floors (such as Square Level 4 and Wedge Level 6) are larger than those for other mass floors because they are calculated differently. See [Mass Floors at the Top of a Mass](#) on page 595.

Also, where the masses are joined, the inner surfaces between masses are deducted from the exterior surface area. See [Overlapping Mass Faces](#) on page 593.

Exterior Surface Area Analysis					
Usage	Comments	Level	Mass: Type	Exterior Surface Area	Exterior Surface Area %
Offices	Concrete/Glass	3	Square	227 m²	4%
Offices	Concrete/Glass	4	Square	552 m²	10%
Offices	Concrete/Glass	4	Wedge	219 m²	4%
Offices	Concrete/Glass	5	Wedge	216 m²	4%
Offices	Concrete/Glass	6	Wedge	479 m²	9%
Residential	Concrete/Glass	2	Rectangle	348 m²	6%
Residential	Concrete/Glass	3	Rectangle	348 m²	6%
Residential	Concrete/Glass	4	Rectangle	347 m²	6%
Residential	Concrete/Glass	5	Rectangle	408 m²	8%
Residential	Concrete/Glass	6	Rectangle	783 m²	14%
Concrete/Glass: 10				3928 m²	73%
Retail	Glass	2	Square	226 m²	4%
Retail	Glass	2	Wedge	229 m²	4%
Retail	Glass	3	Wedge	224 m²	4%
Glass: 3				678 m²	13%
Parking	Open	1	Square	224 m²	4%
Parking	Open	1	Wedge	235 m²	4%
Parking	Open	1	Rectangle	348 m²	6%
Open: 3				807 m²	15%
				5413 m²	100%

Perimeter Analysis Example

In a sample scenario, you have designed masses to explore a conceptual design for a building. (See [Examples of Conceptual Design Analysis](#) on page 600.) The design contains many angles, and it may be too expensive to build. You want to produce rough cost estimates, based on its linear dimensions, to check construction costs for the project.

Perimeter Analysis		
Mass: Type	Level	Floor Perimeter
Rectangle	1	116 m
Rectangle	2	116 m
Rectangle	3	116 m
Rectangle	4	116 m
Rectangle	5	115 m
Rectangle	6	101 m
Rectangle		679 m
Square	1	74 m
Square	2	75 m
Square	3	75 m
Square	4	76 m
Square		300 m
Wedge	1	78 m
Wedge	2	76 m
Wedge	3	74 m
Wedge	4	73 m
Wedge	5	72 m
Wedge	6	71 m
Wedge		445 m
Grand total		1,423 m

Creating a Perimeter Analysis Schedule

Use the following procedure to create a schedule for analyzing the perimeter of masses in a conceptual design, based on the scenario described in [Perimeter Analysis Example](#) on page 607. Specific steps may vary depending on the information that you want to show in the schedule.

To create a perimeter analysis schedule

- 1 Create mass floors.
See [Creating Mass Floors](#) on page 596.
- 2 Click View tab ► Create panel ► Schedules drop-down ► Schedule/Quantities.
- 3 In the New Schedule dialog, do the following:
 - a For Category, click Mass Floor.
If Mass Floor does not display by default, select Show categories from all disciplines.
 - b For Name, specify the schedule name.
 - c Select Schedule building components.
 - d Click OK.
- 4 On the Fields tab of the Schedule Properties dialog, for Scheduled fields (in order), add the following fields:
 - Mass: Type
 - Level
 - Floor Perimeter
- 5 Click the Sorting/Grouping tab, and do the following:
 - a For Sort by, select the following:
 - Mass: Type
 - Ascending
 - Footer
 - Title and totals
 - Blank line
 - b For Then by, select both Level and Ascending.
 - c At the bottom of the dialog, select the following:
 - Grand totals
 - Title and totals
 - Itemize every instance
- 6 Click the Formatting tab, and do the following:
 - a Under Fields, select Floor Perimeter.
 - b For Alignment, select Right.
 - c Select Calculate totals.

- d (Optional) Specify formatting for Level and Mass: Type: under Fields, select a field name. Then for Alignment, select Center.

7 Click OK.

The schedule shows total linear dimensions, based on the combined perimeters of the mass floors. Use this information to estimate building costs for the design.

NOTE Perimeter values include the entire perimeter of each mass floor, even when the mass floors in adjacent, joined masses overlap. See [Overlapping Mass Faces](#) on page 593.

Perimeter Analysis		
Mass: Type	Level	Floor Perimeter
Rectangle	1	116 m
Rectangle	2	116 m
Rectangle	3	116 m
Rectangle	4	116 m
Rectangle	5	115 m
Rectangle	6	101 m
Rectangle		679 m
Square	1	74 m
Square	2	75 m
Square	3	75 m
Square	4	76 m
Square		300 m
Wedge	1	78 m
Wedge	2	76 m
Wedge	3	74 m
Wedge	4	73 m
Wedge	5	72 m
Wedge	6	71 m
Wedge		445 m
Grand total		1,423 m

Volume Analysis Example

In a sample scenario, you have designed masses to explore a conceptual design for a building. (See [Examples of Conceptual Design Analysis](#) on page 600.) You want to do the following:

- Determine which floors of the building require air conditioning. (For example, parking levels are not air conditioned.)
- Calculate the volume of space to be air conditioned.
- Determine the resulting HVAC load.

Volume Analysis			
Usage	Level	Mass: Type	Floor Volume
Offices	3	Square	1,061.61 m ²
Offices	4	Square	965.60 m ²
Offices	4	Wedge	846.24 m ²
Offices	5	Wedge	818.27 m ²
Offices	6	Wedge	799.55 m ²
Offices			4,491.27 m ²
Parking	1	Square	1,033.59 m ²
Parking	1	Wedge	965.75 m ²
Parking	1	Rectangle	1,935.24 m ²
Parking			3,954.57 m ²
Residential	2	Rectangle	1,974.15 m ²
Residential	3	Rectangle	2,011.07 m ²
Residential	4	Rectangle	2,046.36 m ²
Residential	5	Rectangle	2,058.08 m ²
Residential	6	Rectangle	1,176.26 m ²
Residential			9,265.93 m ²
Retail	2	Square	1,048.83 m ²
Retail	2	Wedge	929.98 m ²
Retail	3	Wedge	883.48 m ²
Retail			2,862.29 m ²
Grand total			20,574.06 m ²

Creating a Volume Analysis Schedule

Use the following procedure to create a schedule for analyzing the volume of masses in a conceptual design, based on the scenario described in [Volume Analysis Example](#) on page 609. Specific steps may vary depending on the information that you want to show in the schedule.

To create a volume analysis schedule

1 Create mass floors.

See [Creating Mass Floors](#) on page 596.

2 Click View tab ► Create panel ► Schedules drop-down ► Schedule/Quantities.

3 In the New Schedule dialog, do the following:

a For Category, click Mass Floor.

If Mass Floor does not display by default, select Show categories from all disciplines.

b For Name, specify the schedule name.

c Select Schedule building components.

d Click OK.

4 On the Fields tab of the Schedule Properties dialog, for Scheduled fields (in order), add the following fields:

■ Usage

■ Level

■ Mass: Type

■ Floor Volume

5 Click OK twice.

6 In the schedule, assign a usage to each mass floor.

Enter text in the Usage column for each level. After entering initial values, for the remaining rows you can click in the field to select values from a list.

Next, sort and subtotal the schedule by usage, as follows.

7 Open the view properties for the schedule. (Right-click in the drawing area for the schedule, and click View Properties.)

8 For Sorting/Grouping, click Edit.

9 On the Sorting/Grouping tab of the Schedule Properties dialog, do the following:

a For Sort by, select the following:

- Usage
- Ascending
- Footer
- Title and totals
- Blank line

b For Then by, select both Level and Ascending.

c At the bottom of the dialog, select the following:

- Grand totals
- Title and totals
- Itemize every instance

10 Click the Formatting tab, and do the following:

a Under Fields, select Floor Volume.

b For Alignment, select Right.

c Select Calculate totals.

d (Optional) Specify formatting for Usage, Level, and Mass: Type: under Fields, select a field name. Then for Alignment, select Center.

11 Click OK twice.

The schedule shows the volume of each mass floor, volume subtotals by usage, and a grand total for the combined volumes of the mass floors. Use this information to estimate HVAC loads for the design based on the planned usage for each mass floor.

Volume Analysis			
Usage	Level	Mass: Type	Floor Volume
Offices	3	Square	1,061.61 m ²
Offices	4	Square	965.60 m ²
Offices	4	Wedge	846.24 m ²
Offices	5	Wedge	818.27 m ²
Offices	6	Wedge	799.55 m ²
Offices			4,491.27 m ²
Parking	1	Square	1,033.59 m ²
Parking	1	Wedge	985.75 m ²
Parking	1	Rectangle	1,935.24 m ²
Parking			3,954.57 m ²
Residential	2	Rectangle	1,974.15 m ²
Residential	3	Rectangle	2,011.07 m ²
Residential	4	Rectangle	2,046.36 m ²
Residential	5	Rectangle	2,058.08 m ²
Residential	6	Rectangle	1,176.26 m ²
Residential			9,265.93 m ²
Retail	2	Square	1,048.83 m ²
Retail	2	Wedge	929.98 m ²
Retail	3	Wedge	883.48 m ²
Retail			2,862.29 m ²
Grand total			20,574.06 m ²

Mass Floor Properties

You can modify some mass floor properties. Several values come from the originating mass. You can include these values in mass floor tags and schedules. Note that the calculated and mass-based values are read only.

Modifying Mass Floor Properties

- 1 Select a mass floor.
See [Selecting Mass Floors](#) on page 597.
- 2 Click Modify Mass Floor tab ► Element panel ► Element Properties.
- 3 In the Instance Properties dialog, view and edit instance parameters for the mass floor.
See [Mass Floor Instance Properties](#) on page 612.
- 4 Click OK.

Mass Floor Instance Properties

Parameter	Description
Dimensions	
Floor Perimeter	The total linear dimension for the outer boundaries of the mass floor. This value is read only.
Floor Area	The surface area for the mass floor, in square units. This value is read only.
Exterior Surface Area	<p>The surface area for the exterior vertical surfaces (walls) from the mass floor perimeter up to the next mass floor, in square units. For the uppermost mass floor, the Exterior Surface Area includes the area of the horizontal surface (roof) above it. (See Mass Floors at the Top of a Mass on page 595.) This value is read only.</p> <p>The combined exterior surface area of all mass floors in a mass includes the top and sides of the mass. However, it does not include the bottom of the mass. When you join masses, the area of the inner wall shared by the masses is deducted from the exterior surface area for each mass floor. See Overlapping Mass Faces on page 593.</p>
Floor Volume	The amount of physical space between the mass floor and the surface above it, bounded by exterior vertical surfaces between them. Floor volume is measured in cubic units. This value is read only.
Level	The level (horizontal plane) on which the mass floor is based. This value is read only.
Identity Data	
Usage	A description of the intended use for the mass floor. You can enter text, or click in the field to select an existing value.
Mass: Type	The type of mass to which the mass floor belongs. This value is read only.
Mass: Family	The family of the mass to which the mass floor belongs. This value is read only.

Parameter	Description
Mass: Family and Type	The family and type of mass to which the mass floor belongs. This value is read only.
Mass: Type Comments	Comments about the type of mass to which the mass floor belongs. This value is read only.
Mass: Comments	Comments about the mass to which the mass floor belongs. This value is read only.
Mass: Description	A description of the mass to which the mass floor belongs. This value is read only.
Comments	Text that describes the mass floor.
Mark	A user-specified identifier for the mass floor.
Phasing	
Phase Created	The phase during which the mass floor is created. See Project Phasing on page 1331.
Phase Demolished	The phase during which the mass floor is demolished. See Project Phasing on page 1331.

Troubleshooting Mass Floors and Conceptual Design Analysis

When using mass floors to analyze a conceptual design, you may encounter the following issues.

Cannot See the Mass in a View

Symptom: You opened a view, but you cannot see the mass.

Issue: The Show Mass tool is not active, or the view is zoomed in too close to the mass.

Solution: Try the following:

- Click Massing & Site tab ► Conceptual Mass panel ► Show Mass.
- Type **ZF** to Zoom to Fit.
- Type **VG** (Visibility/Graphics). On the Model Categories tab of the Visibility/Graphic Overrides dialog, expand Mass. Make sure that Mass and Mass Floor are selected. Click OK.

Cannot See Mass Floors in a View

Symptom: You opened a view and you can see the mass, but you cannot see mass floors.

Issue: The visibility/graphic setting for mass floors is turned off.

Solution: Do the following:

- 1 Type **VG** (Visibility/Graphics).
- 2 On the Model Categories tab of the Visibility/Graphic Overrides dialog, expand Mass.

- 3 Select Mass and Mass Floor.
- 4 Click OK.

Cannot Select or Tag a Mass Floor

Symptom: You cannot select or tag a mass floor.

Issue: In a drawing, the mass is the first selectable element.

Solution: With the cursor over the mass floor, press *Tab* to change the focus from the mass to the mass floor. (Check the status bar for confirmation.) Then click to select the mass floor or apply the tag to it.

Exterior Surface Area Is Too Large

Symptom: You used mass floors to divide a mass. In a schedule, tag, or instance properties, you notice that the exterior surface area for the uppermost mass floor of the mass is disproportionately larger than for the other mass floors.

Issue: The exterior surface area calculation for the uppermost mass floor includes the top surface. See [Mass Floors at the Top of a Mass](#) on page 595.

Solution: None required.

Exterior Surface Area Is Too Small

Symptom: You used mass floors to divide a mass. In a schedule, tag, or instance properties, you notice that the exterior surface area for the mass floors is not as large as you expect it to be.

Issue: The mass is joined to another mass. The area of the inner wall shared by the masses is deducted from the exterior surface area for each mass floor. It is also deducted from the gross surface area for the mass. See [Overlapping Mass Faces](#) on page 593.

Solution: None required.

Gross Floor Area Is Not Available for a Mass Floor Schedule

Symptom: You want to create a mass floor schedule that includes the gross floor area of the mass. However, the Gross Floor Area field is not listed on the Fields tab of the Schedule Properties dialog.

Issue: Gross Floor Area is a parameter of the mass, not the mass floor.

Solution: Create a mass schedule that shows Gross Floor Area.

Mass Gross Surface Area Is Too Small

Symptom: In a schedule, tag, or instance properties, you notice that the gross surface area for a mass is not as large as you expect it to be.

Issue: The mass is joined to another mass. The area of the inner wall shared by the masses is deducted from the gross surface area for each mass. If you create mass floors, this inner wall area is also deducted from the exterior surface area for each mass floor. See [Overlapping Mass Faces](#) on page 593.

Solution: None required.

Creating Building Elements from Mass Instances

You can create building elements from the faces of mass instances, and from the faces of generic models. Use mass instances when you want to model a building abstractly, or if you want to schedule gross volume, surface, and floor area. Use generic models if you must create a unique, unusual shape but do not need to model the entire building abstractly.

To create building elements from mass instances, use Building Maker tools. Building elements created with Building Maker tools do not automatically update when the mass face changes. You can update the element to adjust to the current size and shape of the mass face. For more information, see [Updating Face-Based Host Shapes](#) on page 625.

Massing and Imported Geometry

You can create building elements from imported solids and polymeshes.

- **Imported solids:** To create elements from faces of imported solids, they must be imported into the conceptual design environment while you are creating a mass family (see [Referencing Imported Geometry](#) on page 565), or into the Family Editor while you are creating a generic model.
- **Polymeshes:** You can import polymesh objects from various file types. Generic model families are recommended for polymesh geometry, because mass families cannot extract volumetric information from polymeshes.

For more information about Revit Architecture import capabilities, see [Importing Massing Studies from Other Applications](#) on page 626 and [Suitability of Imported Geometry](#) on page 1387.

TIP You can import AutoCAD Architecture mass elements into Revit Architecture after they are exploded in AutoCAD Architecture. As Revit Architecture import symbols, they are polymesh objects. Optionally, you can convert mass elements to solid AutoCAD objects before importing into Revit Architecture.

Creating Walls from Mass Faces

You create walls from mass instances by picking lines or faces using the Wall by Face tool. This tool places walls on non-horizontal faces of a mass instance or generic model.

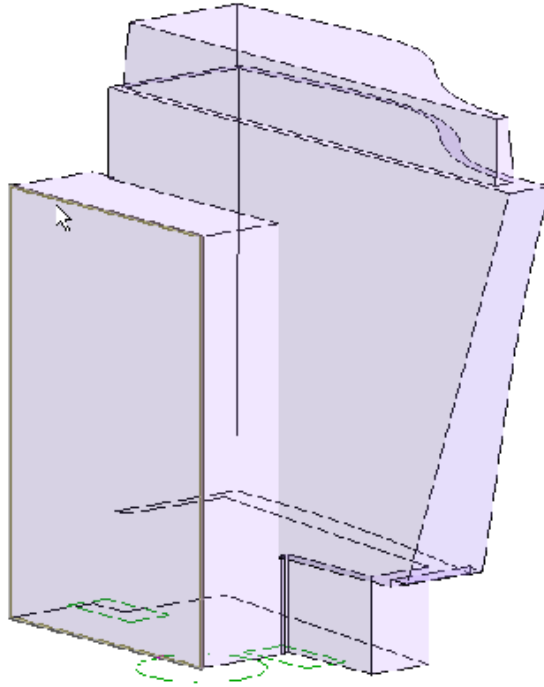
If you change the mass face, walls created with the Wall by Face tool do not automatically update. To update the wall, use the Update to Face tool. See [Updating Face-Based Host Shapes](#) on page 625.

To create walls from mass faces

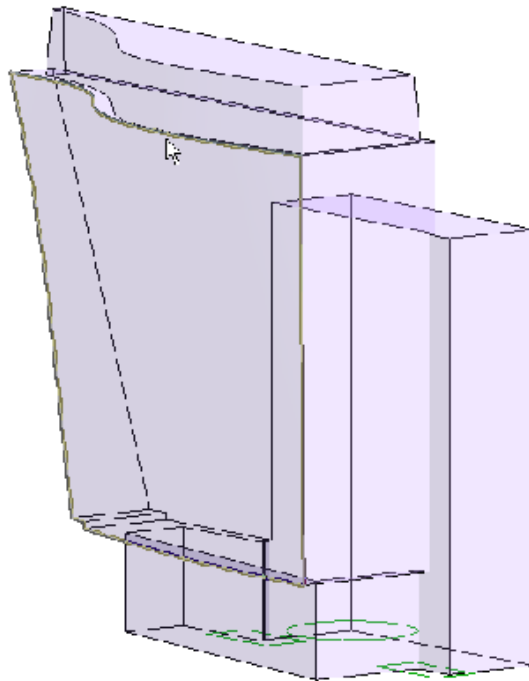
- 1 Click Massing & Site tab ► Conceptual Mass panel ► Model by Face drop-down ► Wall.
- 2 In the Type Selector, select a wall type.
- 3 On the Options Bar, specify the level, height, location line, and any property values for the wall. For more information on these settings, see [Adding Interior and Exterior Walls](#) on page 634.
- 4 Place the cursor on a non-horizontal face to highlight it.

TIP After you highlight a face, you can press *Tab* to highlight all faces on the mass. Then with one click, all walls are placed simultaneously on each highlighted face.

Cursor highlighting planar vertical face



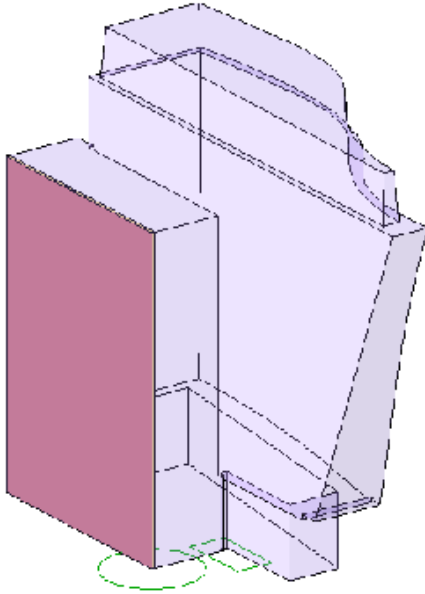
Cursor highlighting non-vertical face



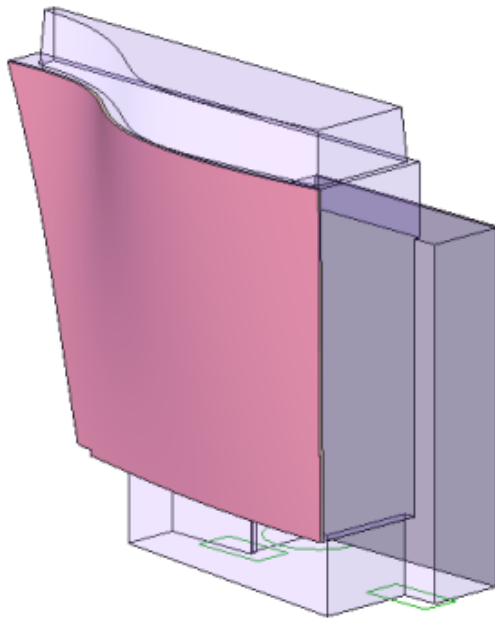
5 Click to place the wall.

TIP To create a non-rectangular wall on a vertical cylindrical face, use openings and in-place cuts to adjust its profile.

Placed wall on vertical face



Placed wall on non-vertical face



Related topic

- [Walls](#) on page 633

Creating Floors from Mass Floors

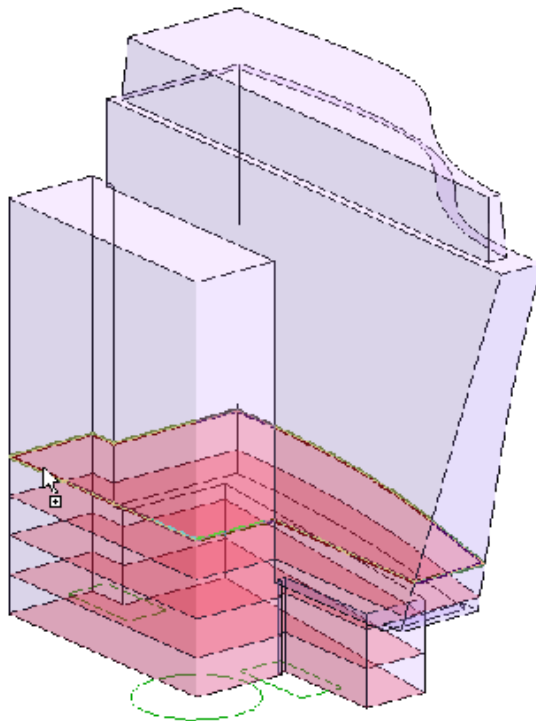
To create floors from a mass instance, use the Floor by Face tool or the Floor tool. To use the Floor by Face tool, you first create mass floors. Mass floors calculate floor areas in a mass instance.

For more information on the Floor tool, see [Floors](#) on page 709.

Creating Floors Using the Floor by Face Tool

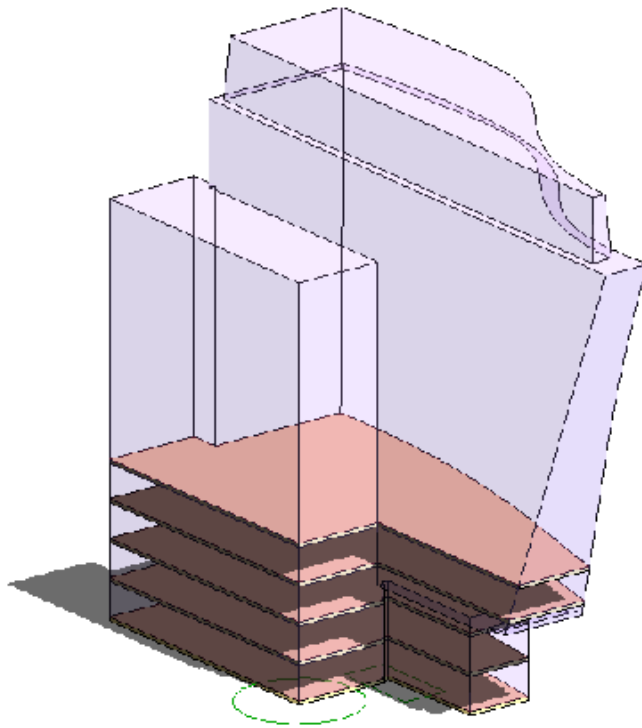
- 1 Create mass floors for the mass instance. For instructions, see [Creating Mass Floors](#) on page 596.
- 2 Click Massing & Site tab ► Conceptual Mass panel ► Model by Face drop-down ► Floor.
- 3 In the Type Selector, select a floor type.
- 4 If desired, specify an offset for the floor.
If you enter an offset value, the floor is offset that amount from the edges of the mass floor. A positive value makes a smaller floor; a negative value makes a larger floor.
- 5 To select more than one face, click Select Multiple. Otherwise, clear this option.
- 6 Place the cursor on a mass floor.

Cursor highlighting mass floor



- 7 Click to select the mass floor.
If you cleared the Select Multiple option, a floor is placed on the face immediately.
 - 8 If Select Multiple is checked, do the following:
 - Continue selecting mass floors.
You can add or remove mass floors from the selection by clicking them. The cursor indicates whether you are adding (+) or removing (–) a face. To clear the selection of all faces and start selecting again, click Place Floor by Face tab ► Multiple Selection panel ► Clear Selection.
-
- TIP** You may want to select mass floors using a selection box, particularly if the mass contains many mass floors. See [Selecting Multiple Elements](#) on page 340.
-
- On the Multiple Selection panel, click Create Floor to create a floor on all selected faces.

Created floors



9 To exit Place Floor by Face, click Select panel ► Modify.

Floors created from floor faces do not automatically update if you change the mass face. To update the floor, use the Update to Face tool. See [Updating Face-Based Host Shapes](#) on page 625.

If you edit the sketch of a floor created from a floor face, and then update the floor, you lose all edits to the floor sketch.

Related topic

■ [Floors](#) on page 709

Creating Curtain Systems from Mass Instances

You can create curtain systems on any mass faces or generic model faces using the Curtain System by Face tool. Curtain systems do not have editable sketches. Use curtain walls if you require an editable sketch on a vertical mass face. See [Curtain Walls, Curtain Grids, and Mullions](#) on page 766.

Creating Curtain Systems by Face

NOTE You cannot edit the profile of a curtain system. If you want to edit the profile, place a curtain wall.

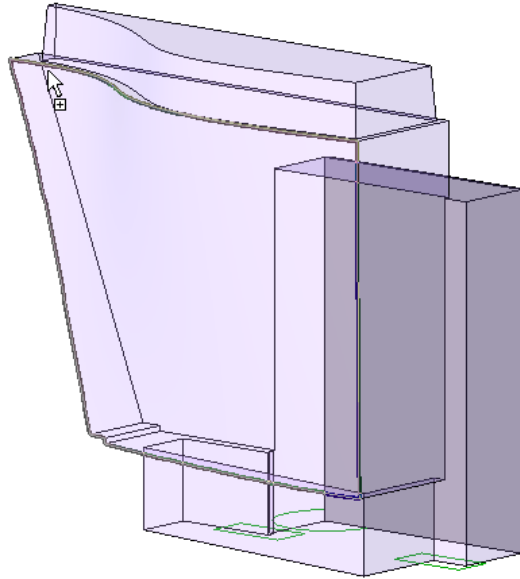
- 1 Click Massing & Site tab ► Conceptual Mass panel ► Model by Face drop-down ► Curtain System.
- 2 In the Type Selector, select a curtain system type.

Use a curtain system type with a curtain grid layout. For more information on specifying a curtain grid layout by type, see [Type-Driven Curtain Element Layout](#) on page 772.

3 To select more than one face, click Select Multiple. Otherwise, clear this option.

4 Place the cursor on a mass face.

Cursor highlighting mass face



TIP Drag a pick box over the entire shape to make a curtain system on the entire form.

5 Click to select the face.

A curtain system is placed on the face immediately if the Select Multiple option is cleared.

6 If Select Multiple is active, do the following:

- Continue selecting faces.

You can add or remove faces from the selection by clicking them. The cursor indicates whether you are adding (+) or removing (–) a face. To clear the selection of all faces and start selecting again, click Place Curtain System by Face tab ► Multiple Selection panel ► Clear Selection.

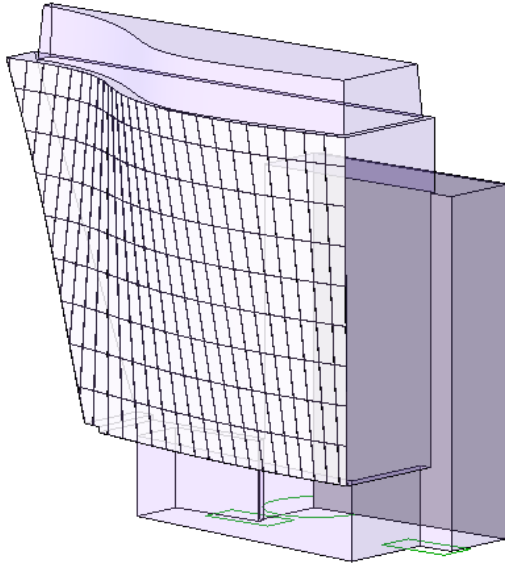
- When finished selecting faces, click Multiple Selection panel ► Create System.

Revit Architecture creates a curtain system on each of the selected faces.

7 On the Selection panel, click Modify.

Curtain systems created with the Curtain System by Face tool do not automatically update if you change the mass face. To update the curtain system, use the Update to Face tool. See [Updating Face-Based Host Shapes](#) on page 625.

Created curtain system



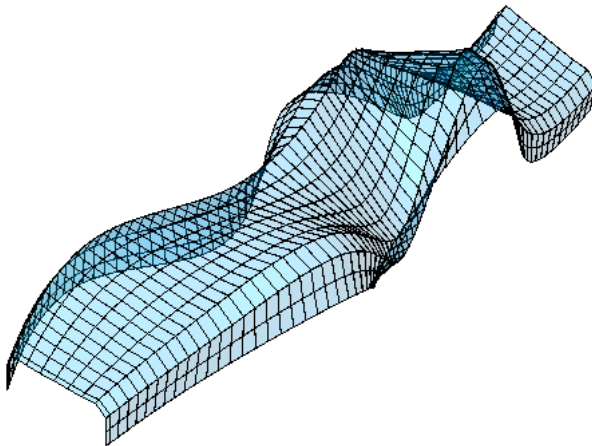
Related topics

- [Curtain Systems](#) on page 785
- [Curtain Systems on NURB Surfaces](#) on page 621

Curtain Systems on NURB Surfaces

You can create curtain systems on NURB (Non-Uniform Rational B-spline) surfaces in generic model families or mass families. When creating a generic model or mass family, you can import a DWG or SAT file containing NURB surfaces. (See [Importing Massing Studies from Other Applications](#) on page 626.) After saving the family, use the Curtain System by Face tool to place a curtain system on the NURB surfaces. See [Creating Curtain Systems by Face](#) on page 619.

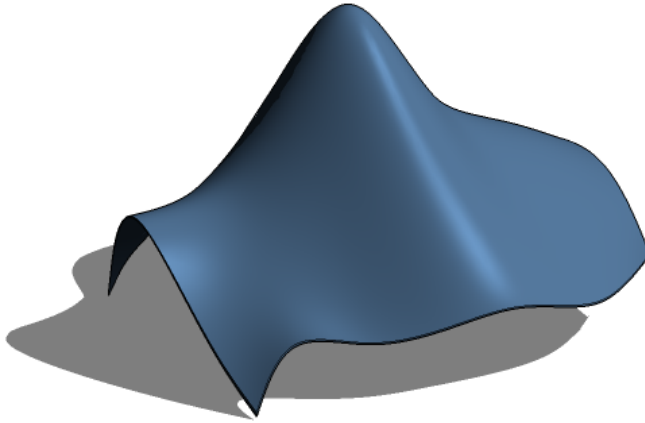
Curtain system created on NURB surface



NOTE Use open geometry in generic model families rather than mass families. This applies to isolated NURB surfaces, as shown above, as well as other open geometry. For optimal performance in a mass instance, use only geometry that can be recognized by Revit Architecture as oriented 3D geometry. Open geometry in a mass instance can slow processing and generate warnings, but it will provide no additional capabilities beyond those available in the generic model family.

Creating Roofs from Mass Instances

Using the Roof by Face tool, you can create roofs on any non-vertical faces of a mass. You cannot select faces from different masses for the same roof.

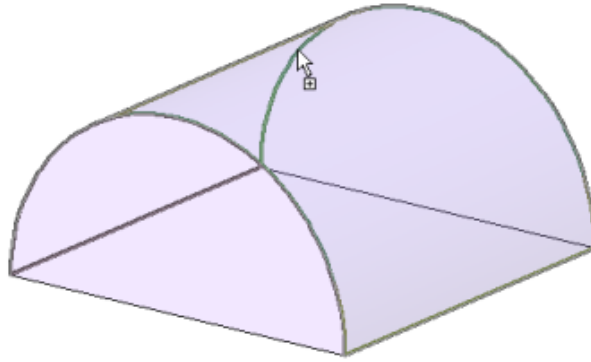


You can also create roofs or edit the roof sketch using the Roof by Footprint or Roof by Extrusion tools. For more information about Roof by Footprint and Roof by Extrusion, see [Roofs](#) on page 675.

Creating Roofs Using the Roof by Face Tool

- 1 Click Massing & Site tab ► Conceptual Mass panel ► Model by Face drop-down ► Roof.
- 2 In the Type Selector, select a roof type.
- 3 If desired, on the Options Bar, specify the level of the roof.
For more information on roofs, see [Roofs](#) on page 675.
- 4 To select more than one face, on the Options Bar, click Select Multiple. Otherwise, clear this option.
- 5 Move the cursor to highlight a face that you want to turn into a roof.

Cursor highlighting cylindrical face



6 Click to select the face.

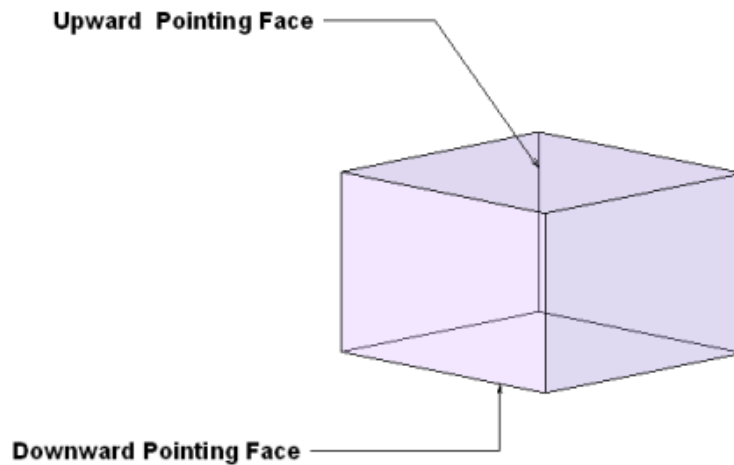
A roof is placed on the face immediately if the Select Multiple option is cleared.

7 If you clicked Select Multiple, do the following:

- Continue selecting faces.

You can add or remove faces from the selection by clicking them. The cursor indicates whether you are adding (+) or removing (-) a face. To clear the selection of all faces and start selecting again, click Place Roof by Face tab ► Multiple Selection panel ► Clear Selection.

NOTE Do not select upward-pointing and downward-pointing faces for the same roof. If you do, Revit Architecture warns you that it is placing a roof on the upward pointing faces only. If you want to make roof panels that cover both upward and downward faces, split the mass into 2 faces, so that each face is either completely upward or downward. Then create one or more roofs from the downward faces and one or more from the upward faces.

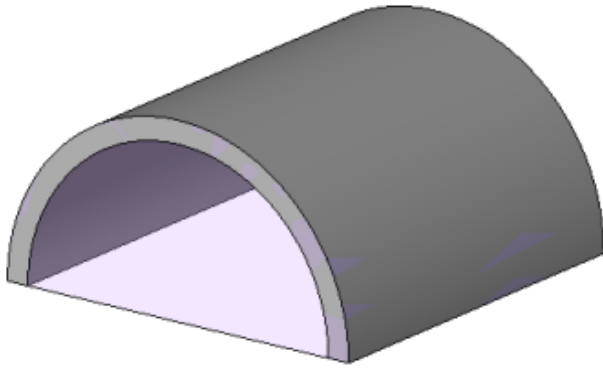


-
- When you are finished selecting faces, click Create Roof.

TIP You can change the pick face location of the roof (either top or bottom) by modifying the roof's Picked Faces Location property in the Instance Properties dialog.

Roofs created using the Roof by Face tool do not automatically update if you change the mass face. To update the roof, use the Update to Face tool. See [Updating Face-Based Host Shapes](#) on page 625.

Placed roof



Related topics

- [Roofs](#) on page 675
- [Extending the Roof Face](#) on page 624
- [Roofs on NURB Surfaces](#) on page 624

Extending the Roof Face

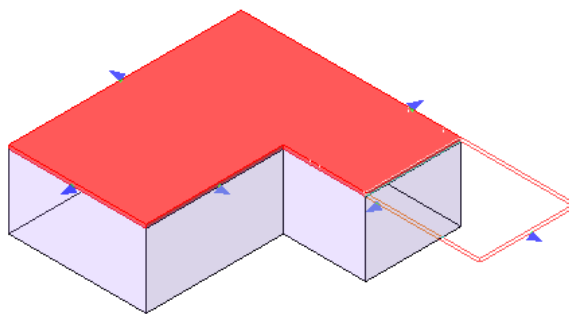
1 In the drawing area, select the roof face.

When you select the roof face, roof shape handles display. Use these handles to drag the side surfaces. Shape handles are available for all non-horizontal side surfaces. Shape handles are not available for surfaces created by openings placed in roof faces.

2 Drag the shape handles to extend the roof face.

These extensions remain in effect after an update.

Extending roof face using shape handles

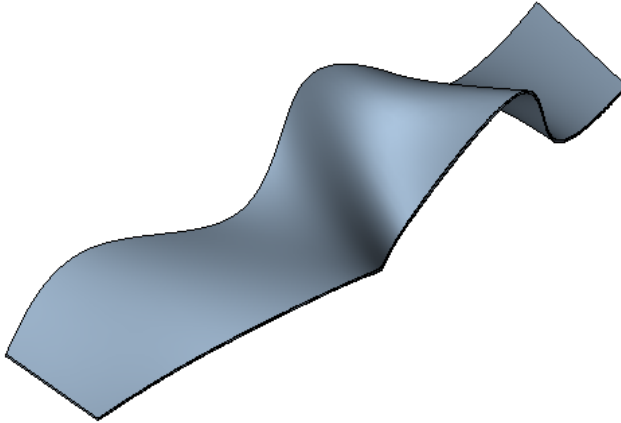


Roofs on NURB Surfaces

You can create roofs on NURB (Non-Uniform Rational B-spline) surfaces in generic model or mass families. When you are creating a generic model or mass family, you can import a DWG or SAT file containing NURB surfaces. (See [Importing Massing Studies from Other Applications](#) on page 626.) After saving the family, use

the Roof by Face tool to place a roof on the NURB surfaces. See [Creating Roofs Using the Roof by Face Tool](#) on page 622.

Roof created on NURB surface



NOTE Use open geometry in generic model families rather than mass families. This applies to isolated NURB surfaces, as shown above, as well as other open geometry. For optimal performance in a mass instance, use only geometry that can be recognized by Revit Architecture as oriented 3D geometry. Open geometry in a mass instance can slow processing and generate warnings, but it will provide no additional capabilities beyond those available in the generic model family.

Updating Face Selections for Roofs and Curtain Systems

If you have created a roof or curtain system on a mass or generic model, you can add faces to or subtract faces from it.

- 1 In the drawing area, select the roof or curtain system.
- 2 Click Modify <Element> tab ► Model by Face panel ► Edit Face Selection.
- 3 Select the faces to add or remove.
- 4 Click Recreate Roof or Recreate System.

Updating Face-Based Host Shapes

Building elements created by face do not update when you change the mass face. To adjust to the current size and shape of the mass face, update the element.

NOTE If the element has explicit constraints on it (for example, walls with a Top Constraint set to Up to Level), then the Update to Face tool has no effect.

To update face-based host shapes

- 1 In the drawing area, select the element.
- 2 Click Modify <Element> tab ► Model by Face panel ► Update to Face.

Walls and floors lose any sketch edits when you use the Update to Face tool.

Selecting Face-Based Hosts from a Mass Instance

When updating face-based hosts (such as walls, floors, and roofs), you may find it easier to select the mass instance or generic model with which the elements are associated first, and then select the face-based hosts.

- 1 In the drawing area, select any mass instance or generic model instance that has associated face-based elements.
- 2 Click Modify <Element> tab ► Massing panel ► Related Hosts.

The selection changes from the mass instance or generic model instance to the selection of face-based hosts.

Controlling Visibility of Mass Instances

You can control the visibility of mass instances in the following ways:

- Set view-specific mass category visibility. The view-specific setting determines whether the mass prints, and whether it is visible when Show Mass is not turned on. To display a mass in a view, click View tab ► Graphics panel ► Visibility/Graphics. On the Model Categories tab, select the mass category. If Mass is selected, the subcategories Form and Mass Floor can be controlled independently.

Importing Massing Studies from Other Applications

You can use 3D design software (such as Autodesk 3ds Max®, Google™ SketchUp®, or Form/Z® by AutoDesSys, Inc.) to create large-scale massing studies, and then use Revit Architecture to associate host elements (walls, roofs, and so on) to the mass faces.

In order for Revit Architecture to understand the exported geometry as a mass object, use the design software to create a design, export the design to a supported file format (such as DWG or SAT), and import the file into a mass family in Revit Architecture. Revit Architecture then treats the geometry as a mass, allowing the faces of the mass component to be selected and associated to Revit host elements (such as walls, floors, and roofs).

NOTE Exported objects are faceted, rather than smooth. When exported, curved elements may be triangulated.

Related topics

- [Importing or Linking CAD Formats](#) on page 1387
- [Importing Files from SketchUp](#) on page 1389
- [Referencing Imported Geometry](#) on page 565

Considerations for Imported Geometry in Mass or Generic Model Families

You can import geometry from external CAD formats into a mass instance or mass family in the same way that you import such geometry into other family definitions. However, in some cases, imported geometry is not well suited to mass instances.

When imported geometry is not well suited to mass instances, it may be possible to use the generic model category instead. There is overlap between the mass instance and generic model categories. Walls, roofs, and curtain systems can be made from faces in a generic model family. Floors can be created from sketches that reference the geometry in a generic model or a mass model. Mass models also support level-based mass floors, which in turn support one-click parametric floor creation.

When using imported geometry in mass families and generic model families, consider the following:

- **Avoid complex geometry in mass instances.** Unlike other family categories, mass instances always maintain a separate copy of each internal geometry, plus extra geometry to represent the combined volume of the mass. For complex geometry, the additional data can slow down processing considerably. When a generic model is joined by the Join Geometry tool, the software also creates an extra copy of the geometry, which can slow performance. For complex geometry in a generic model, you may join the geometry inside a family definition to avoid extra copies of the geometry.
- **If the imported geometry in a mass instance (or between generic models) is not well suited to join geometry, then errors, warnings, and unexpected behavior can result.** If geometry is combined within a mass definition, it should be solid geometry with either a strong connection or no connection. Examples of geometric characteristics that are ill-suited to joining include odd tangencies, edge-only overlaps, open meshes, and ambiguous connectivity.
- **Some CAD formats do not have geometry in a form that a mass instance can use to compute volumetric information and mass floors.** When such formats are used, errors and warnings result. For more information about imported CAD formats, see [Import/Link](#) on page 1386 and [Suitability of Imported Geometry](#) on page 1387.
- **Host by Face tools** (available for roofs, floors, walls, and curtain systems) associate a single host element with one face or several faces. For example, detailed geometry (that contains cornices, reveals, windows, casework, tessellated approximations of surfaces, and so on) is likely to have many small faces that will fail to produce meaningful host elements and may produce errors. This is a consideration for both mass families and generic model families.

Best Practices When Importing Masses


- **Complete the design.** Before importing a mass to Revit Architecture, complete as much of the design as required in the design software. If you make changes to the design after importing it to Revit Architecture, you cannot update the Revit family or project with the changes.
- **Level of detail.** Before importing a mass to Revit Architecture, reduce the amount of detail that it contains. For example, cornices, roof eaves, window detail, reveals, windows, casework, tessellated approximations of surfaces, ornaments and articulation on walls, and other such fine work can be imported as separate families. After importing the simplified mass to Revit Architecture, you can then add these details to the walls and roofs created from the mass.
- **Mass floors.** If a mass family imports only non-volumetric geometry, you cannot create mass floors in Revit Architecture. However, if an imported mass family contains both volumetric and non-volumetric geometry, you will be able to create mass floors from the volumetric portions of the geometry. (You will also receive warnings. You can ignore those.)

Importing a Design to a Mass Family Outside a Revit Project

Import a massing study from design software (such as SketchUp) into an external mass family when you plan to use it in multiple projects. (This is the recommended workflow.) Import the design into an in-place mass in a Revit project when you intend to use the design in one project only. (See [Importing a Design as an In-Place Mass](#) on page 629.)

To import a design to a mass family

- 1 Use the design software to create the massing study.
- 2 In Revit Architecture, open the Revit project in which you want to use the massing study, and open a 3D view.

- 3 Click  ► New ► Family.
- 4 In the New dialog, select Mass.rft, and click Open.
- 5 Import the file containing the design, as follows:
- Click Insert tab ► Import panel ► Import CAD.
For more information, see [Importing or Linking CAD Files Using the Import CAD and Link CAD Tools](#) on page 1388.
 - In the Import CAD Formats dialog, navigate to the folder that contains the file to import.
 - For Files of type, select the appropriate file type (such as DWG, SAT, or SKP).
 - Select the file to import.
 - Specify the desired import settings.
The following settings are recommended:
 - Colors: Preserve
 - Import Units: Auto-Detect
 - Positioning: Auto - Origin to Origin
 - Place at: Level 1 or Ref. Level
 - Orient to ViewSee [Import and Link Options for CAD Formats and Revit Models](#) on page 1392.
 - Click Open.

To see the massing study, you may need to do the following:

- Switch to a 3D view.
- Type **ZF** (Zoom to Fit) to adjust the drawing area to show the entire mass.
- Click Massing & Site tab ► Conceptual Mass panel ► Show Mass.
- To improve visibility, on the View Control Bar, for Model Graphics Style, select Shading with Edges.

6 Save the mass family.

7 Load the mass family into the Revit project and place the component, as follows:

- Click Insert tab ► Load from Library panel ► Load Family.
- In the Load Family dialog, navigate to the mass family file and then click Open.
- Click Massing & Site tab ► Conceptual Mass panel ► Place Mass.
- At the Show Mass Mode message, click OK.
- Click in the drawing area to place the mass.

If you cannot see the mass, you may need to do the following:

- Switch to a 3D view.
- Type **ZF** (Zoom to Fit) to adjust the drawing area to show the entire mass.

For more information, see [Placing a Mass Instance from a Mass Family](#) on page 592.

- 8** To convert the faces of the mass component, use the Wall by Face, Floor by Face, Curtain System by Face, and Roof by Face tools.

For more information about these tools, see [Creating Building Elements from Mass Instances](#) on page 615.

Importing a Design as an In-Place Mass

Import a massing study from design software (such as SketchUp) to an in-place mass in a Revit project when you intend to use the design in one project only. Import the design into an external mass family when you plan to use it in multiple projects. (See [Importing a Design to a Mass Family Outside a Revit Project](#) on page 627.)

To import a design to an in-place mass

- 1** Use the design software to create the massing study.
- 2** In Revit Architecture, open the Revit project in which you want to use the massing study, and open a 3D view.
- 3** Click Massing & Site tab ► Conceptual Mass panel ► In-Place Mass.
- 4** At the Show Mass Mode message, click OK.
- 5** In the Name dialog, enter a name for the mass, and click OK.
- 6** Import the file containing the design, as follows:
 - a** Click Insert tab ► Import panel ► Import CAD.
For more information, see [Importing or Linking CAD Files Using the Import CAD and Link CAD Tools](#) on page 1388.
 - b** In the Import CAD Formats dialog, navigate to the folder that contains the file to import.
 - c** For Files of type, select the appropriate file type (such as DWG, SAT, or SKP).
 - d** Select the file to import.
 - e** Specify the desired import settings.
The following settings are recommended:
 - Colors: Preserve
 - Import Units: Auto-Detect
 - Positioning: Auto - Origin to Origin
 - Place at: Level 1 or Ref. Level
 - Orient to ViewSee [Import and Link Options for CAD Formats and Revit Models](#) on page 1392.
 - f** Click Open.

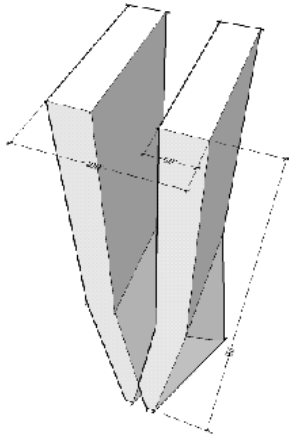
To see the mass, you may need to type **ZF** (Zoom to Fit) to adjust the drawing area to show the entire mass.

- 7** In the Revit project, click Finish Mass.
- 8** To convert the faces of the mass, use the Wall by Face, Floor by Face, Curtain System by Face, and Roof by Face tools.
For more information about these tools, see [Creating Building Elements from Mass Instances](#) on page 615.

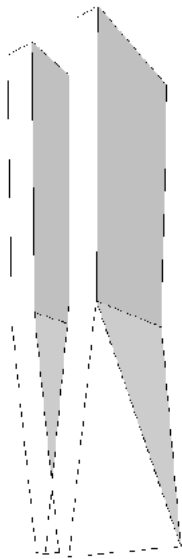
Example of Importing a Massing Study

The following images demonstrate the process of importing a massing study created using design software (SketchUp) into Revit Architecture, and converting mass faces to building elements.

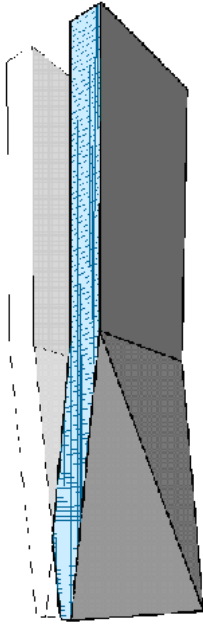
Building mass created in SketchUp



SketchUp file imported into Revit Architecture



Walls being associated to
mass faces in Revit project



Printing Mass Elements

To print mass elements, be sure that mass category visibility is turned on. Mass elements will not print or export if category visibility is turned off, even if Show Mass is turned on. See [Controlling Visibility of Mass Instances](#) on page 626.

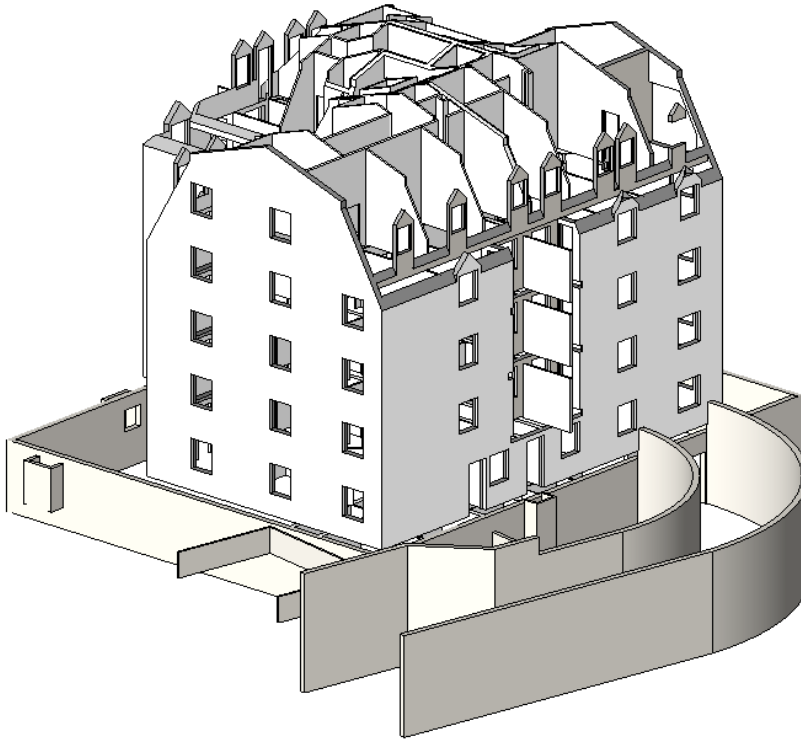
Revit Architecture provides various familiar components for building design. No programming language or coding is required to create these components.



Walls

Walls can function as interior, exterior, foundation, retaining, soffit, or core-shaft. All walls have a structure that can be defined through the type properties of the wall. In addition, various instance and type properties can be specified to define the appearance of the wall.

You create a wall by drawing the location line of the wall in a plan view, ceiling plan view, or 3D view. Revit Architecture applies the thickness, height, and other properties of the wall around the location line of the wall. The location line is a plane in the wall that does not change, even if the wall type changes. For example, if you draw a wall and specify its location line as Core Centerline, the location line remains there, even if you select that wall and change it to another type or change its structure.






Adding Interior and Exterior Walls

- 1 In a floor plan view or 3D view, click Home tab ► Build panel ► Wall.
- 2 Click Place Wall tab ► Element panel, and select the desired wall type from the Type Selector drop-down.
- 3 To change the properties of the wall, click Place Wall tab ► Element panel ► Element Properties drop-down ► Instance Properties or Type Properties.
For descriptions of wall properties and their values, see [Wall Properties](#) on page 672.
- 4 On the Options Bar, specify wall design options:
 - **Level** (3D views only): Choose a level as the base constraint. You can choose a non-story level. See [Levels](#) on page 1101.
 - **Height**: Set the height of a wall to go up to a level. The default value is Unconnected, which allows you to specify a value for Height.

NOTE When you draw a foundation wall type, the option name is displayed as Depth.

- **Location Line**: Specify the location line of the wall as Wall Centerline, Core Centerline, Finish Face: Exterior, Finish Face: Interior, Core Face: Exterior, or Core Face: Interior. The position of the location line can vary, depending on how you draw the wall. For example, if you specify the location line as Finish Face: Interior and draw the wall from left to right, the location line displays on the exterior side of the wall. If you draw from right to left, the location line displays on the interior side of the wall.

5 Create the wall, using one of the following methods:

- **Draw the wall:** By default, Line is active. (If it is not active, click Place Wall tab ► Draw panel ►  (Line), or select another draw tool.) See [Sketching](#) on page 303.
As you draw a wall, you can quickly set its length by entering a value on the keyboard, taking advantage of the listening dimension feature. See [Listening Dimensions](#) on page 283.
If you want to flip the orientation of the wall about its location line, press the *Spacebar* as you draw the wall. This works for all wall drawing tools, such as rectangles, circles, and 3-point arcs.
- **Pick Lines** (): Select existing lines. Lines can be model lines or edges of elements, such as roofs, curtain panels, and other walls.
- **Pick Faces** (): Select either a massing face or a generic model face. The generic model could be created as in-place or family file based. See [Creating Walls from Mass Faces](#) on page 615.

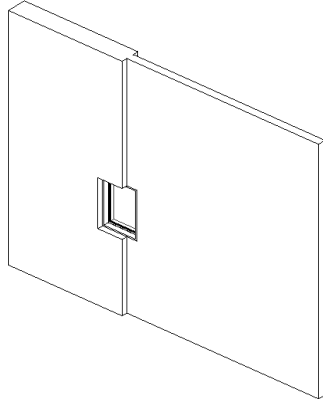
TIP To highlight all vertical faces on the mass or generic model, press *Tab*. Click to place walls simultaneously on each highlighted face.

6 Add dimensions if desired. See [Placing Permanent Dimensions](#) on page 265.

Exterior/Interior Wall Tips

- When creating the exterior walls of a multi-level building to which you want to add windows before adding the roof, specify Unconnected Height as the height of the wall on the next level. This ensures that the wall is high enough to add windows and doors.
- To flip the orientation of the wall between exterior and interior, select the wall and click the blue flip controls that are displayed near it. The flip controls always are displayed on the side that Revit Architecture interprets as the exterior side.
- Walls do not automatically attach to other modelling components, such as roofs and ceilings. You must explicitly attach them using the Attach and Detach tools. See [Attaching Walls to Other Components](#) on page 651 and [Detaching Walls from Other Components](#) on page 651.
- As you draw a wall, you can offset it from the cursor by specifying a value for Offset on the Options Bar. You can specify to which location line the offset is measured.
- You can access wall type properties from the Project Browser. In the Project Browser, expand Families, expand Walls, expand a wall family, and right-click wall type. Click Properties to access the Type Properties dialog, where you can modify wall properties.
- If you rename or create a wall type, indicate the function in the name and specify the Function Type property (interior, exterior, foundation, retaining, soffit, or core-shaft) in the Type Properties dialog.
- The top constraint for interior partition walls is set, by default, to the level above.
- You can drag inserts, such as windows and doors, between 2 walls.

Window placed at a join between 2 walls



- When an insert is placed between hosts of unequal thickness (as shown above), you can resize the thickness of the insert relative to its hosts. Select the insert and click Pick Primary Host. Select the host you want the insert to resize to match. The insert resizes to the selected host's thickness. If you later delete the host, you delete the insert as well.
- If you select Radius on the Options Bar, and then join the end of a straight wall to the end of another straight wall, a fillet is created between the walls at the specified radius.

Adding Retaining Walls

- 1 In a plan view or 3D view, click Home tab ► Build panel ► Wall.
- 2 Click Place Wall tab ► Element panel, and select the desired wall type from the Type Selector drop-down.
- 3 Click Place Wall tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 4 In the Type Properties dialog, select Retaining for the Function parameter.
- 5 Click OK.

NOTE A retaining wall is automatically set to be non-room bounding. See [Rooms](#) on page 977.

- 6 Sketch the retaining wall.
For more information about the sketching tools, see [Sketching](#) on page 303.
- 7 Add dimensions if desired.
See [Placing Permanent Dimensions](#) on page 265.

Arc Walls

When you sketch arc walls, Revit Architecture displays a temporary angular dimension to help you precisely place the wall in the project.

Revit Architecture treats a full-circle wall as 2 arcs joined together. You can cut inserts at this join, but you cannot drag an insert from one part of the wall onto the join.

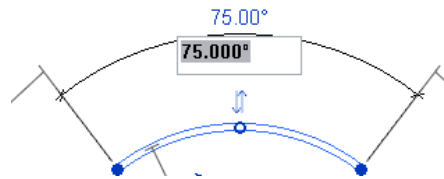
You can place sketched asymmetrical openings on arc walls using in-place families.

Adding Arc Walls

- 1 In a floor plan or 3D view, click Home tab ► Build panel ► Wall.
- 2 Click Place Wall tab ► Draw panel, and select one of the arc tools.
- 3 Sketch the arc wall.

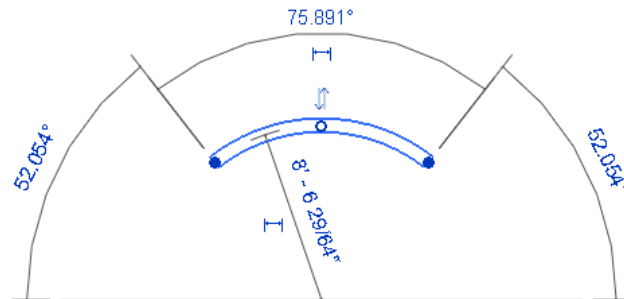
For more information, see [Sketching](#) on page 303.

- 4 If necessary, change the value of the angular dimension to increase or decrease the size of the arc.
 - a Click Place Wall tab ► Select panel ► Modify.
 - b In the drawing area, select the arc wall.
 - c Click the angular dimension value, enter a new value, and press *Enter*.



Resizing Arc Walls

- 1 Select the arc wall.



- 2 Drag the end controls to change the arc length.
- 3 On the Options Bar, select Keep Concentric to change the radius of the arc while keeping the radius concentric, or clear Keep Concentric to retain existing end conditions such as end point location or tangency to a straight wall.
- 4 Drag the middle control.

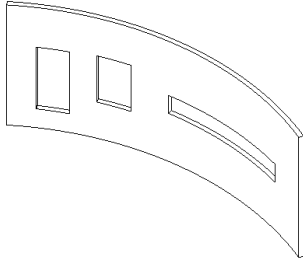
Cutting Openings in Arc Walls

You can cut square or rectangular openings into arc walls. As you sketch openings in an arc wall, permanent dimensions appear. If the wall has a top constraint set to a level, dimensions appear from both the top and base constraints. If the wall has a top constraint that is explicit, dimensions appear from the base constraint only.

To cut openings in arc walls

- 1 In a 3D or elevation view, select an arc wall.
- 2 Click Modify Walls tab ► Modify Wall panel ► Create Opening.
- 3 Sketch square or rectangular openings in the arc wall.
- 4 When you are finished, click any white space in the drawing area, or press *Esc* twice.

The following image shows an arc wall with several openings.



Embedded Walls

Walls can be embedded into a host wall, so that the embedded wall is associated with the host wall. The behavior of an embedded wall is similar to that of a window; the embedded wall does not resize if you resize the host wall. If you rotate the host wall, the embedded wall moves with it. To embed walls, you do not have to edit the profile of the host wall, cut a hole in it, and then insert a wall into that hole; you can use the Cut Geometry tool.

Embedded walls are useful when, for example, you need to create storefronts on the exterior walls of the building. When embedding walls, consider the following:

- A curtain wall can be embedded into another wall, provided that it is parallel to the host wall and the walls are within 6 inches of each other.
- Walls can be embedded into other walls using the Cut Geometry tool. Some curtain wall types automatically embed into a wall. To determine whether the curtain wall type automatically embeds into another wall, check the type properties of the wall. Select the Automatically Embed parameter if it is not already selected.
- You can embed a wall into a curtain panel and then embed a curtain wall into that embedded wall. You can repeat this process as many times as desired.
- If you edit the elevation profile of the embedded wall, the opening in the host wall is adjusted automatically, and the host wall's material fills in the adjusted opening. You do not have to edit the elevation profile of the host wall to follow the opening of the embedded wall.

Embedding a Wall into Another Wall

- 1 Sketch a host wall of any type in the drawing area. The host wall can be a straight wall or an arc wall.
- 2 Draw a wall that is within the boundary of the host wall or that is parallel to and within 6 inches of it.

Keep in mind the following when you are sketching the wall:

- If the host wall is an arc wall, the embedded wall must be a concentric arc.
- Be sure the embedded wall is shorter in length than the host wall.

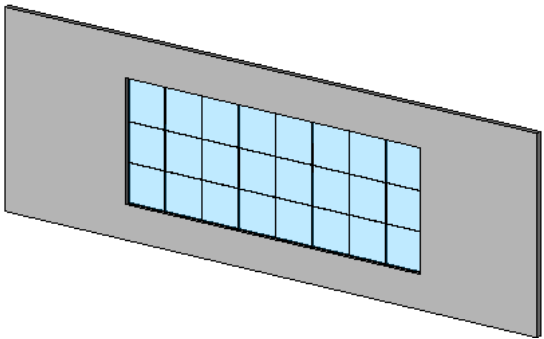
- If the embedded wall is within the boundary of the host wall, Revit Architecture issues a warning and advises you to use the Cut Geometry tool.

3 Click Modify tab ► Edit Geometry panel ► Cut.

IMPORTANT When using the Cut Geometry tool, do not select the shorter wall first and then the larger host.

- 4 Select the host wall.
- 5 Select the wall to embed into the host wall.
The wall is now embedded.
- 6 If necessary, resize the embedded wall by selecting it and using the drag controls.

Curtain wall embedded in host wall



Separating Embedded Walls

- 1 Click Modify tab ► Edit Geometry panel ► Cut drop-down ► Uncut Geometry.
- 2 Highlight the host wall, and click to select it.
- 3 Highlight the embedded wall, and click to select it.

Vertically Compound Walls

The structure of vertically compound walls is defined using either layers or regions. The following image shows the Edit Assembly dialog.

NOTE To access the Edit Assembly dialog, select a wall and click Modify Walls tab ► Element panel ► Element Properties drop-down ► Type Properties. In the Type Properties dialog, click Edit for the Structure parameter.

Layer rows: correspond to wall layers or regions

Layers				
EXTERIOR SIDE				
	Function	Material	Thickness	Wraps
1	Finish 1 [4]	Masonry - Brick	0' 3 5/8"	<input checked="" type="checkbox"/>
2	Finish 2 [5]	Masonry - Concrete	0' 3 5/8"	<input checked="" type="checkbox"/>
3	Thermal/Air Layer	Misc. Air Layers - Ai	0' 3"	<input checked="" type="checkbox"/>
4	Membrane Layer	Air Barrier - Air Infil	0' 0"	<input checked="" type="checkbox"/>
5	Substrate [2]	Wood - Sheathing	0' 0 3/4"	<input checked="" type="checkbox"/>
6	Core Boundary	Layers Above Wra	0' 0"	
7	Structure [1]	Metal - Stud Layer	0' 6"	<input type="checkbox"/>
8	Core Boundary	Layers Below Wrap	0' 0"	
9	Membrane Layer	Vapor / Moisture Ba	0' 0"	<input checked="" type="checkbox"/>
10	Finish 2 [5]	Fabric	0' 0 1/2"	<input checked="" type="checkbox"/>

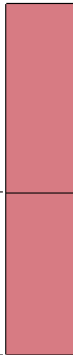
A layer is assigned to one row. It has a constant thickness and extends the height of the wall. You can change its thickness in the row assigned to it.

Wall layer: constant thickness and extends the height of the wall



A region is any shape in the wall that does not meet the criteria of a layer. Regions can have either constant or variable thickness. In a row assigned to a region, if region has a constant thickness, a numeric value appears for it. If the region has a variable thickness, the value is variable. You cannot change a region's thickness in the row that is assigned to it. Note that the thickness value appears shaded, indicating that it is unavailable for modification. You can only change its thickness and height graphically in the preview pane.

Regions: neither region extends the full height of the wall



Because core thickness can vary in vertically compound walls, the core centerline and core face location lines are determined by the core thickness at the bottom of the wall. For example, if the wall core is thicker at the top than at the bottom, and you specify the location line as Core Centerline, the centerline of the core is measured between the core boundaries at the bottom.

You can add wall sweeps or reveals to vertically compound walls. See [Wall Sweeps](#) on page 664 and [Wall Reveals](#) on page 669.

You can use various tools to modify the structure of vertically compound walls.

Accessing Vertically Compound Wall Tools

- 1 In the drawing area, select the wall and click Modify Walls tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 2 In the Type Properties dialog, click Preview to open the preview pane.
All changes you make to the wall occur in the preview pane.
- 3 Below the preview pane, for View, select Section: Modify type attributes.
- 4 Click Edit for the Structure parameter.
Notice the tools that display at the bottom right of the dialog under Modify Vertical Structure.

NOTE The vertically compound wall tools are available in the section preview only. Use them to modify the wall type only, not an actual wall instance.

Sample Height

The sample height is the height of the wall in the preview pane only. You can specify any value for the sample height, but it should be high enough to allow you to create the desired wall structure. The sample height does NOT affect the height of any walls of that type in the project.

Modify Tool

To change a vertically compound wall, in the Edit Assembly dialog, click Modify. (See [Accessing Vertically Compound Wall Tools](#) on page 640.) Then highlight and select either outer boundaries of the sample wall or borders between regions in the preview pane. Watch for tool tips and status bar messages that indicate what you are highlighting.

After you select a boundary, you can change thickness, set layer extension, or constrain a region's distance from the top or bottom of the wall.

Changing Thickness

If you select an outer vertical boundary of the sample wall, a temporary dimension displays. If you change the value of the temporary dimension, the thickness of the layer or region immediately adjacent to the boundary changes.

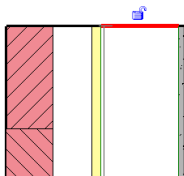
If you select a vertical border between regions, 2 temporary dimensions appear which control the thickness of the regions to the left and right of the border.

Allowing Layer Extension

If you select the horizontal outer boundary at the top or bottom of a layer, you can specify whether that layer can be extended.

Select a horizontal boundary at the top of the wall, and a padlock displays. A locked padlock indicates that the selected layer cannot be extended. Click the padlock to unlock it, and the layer can be extended.

Unlocked layer indicating extendability



When you unlock layers for extension, 2 instance properties of the wall become enabled: Top Extension Distance (for layers at the top of the wall) or Base Extension Distance (for layers at the bottom of the wall). You can enter values for these properties in the selected wall's Element Properties, or you can drag the unlocked wall layers in a view.

NOTE Unlocked layers must be adjacent. For example, you cannot have one layer locked and its adjacent layers unlocked.

To drag wall layers, modify them in section, 3D, and elevation views.

To drag wall layers

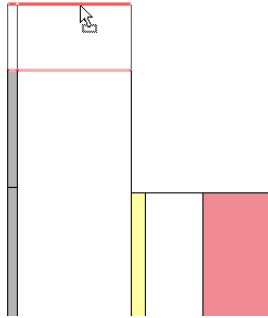
1 Place the cursor at the top or bottom of the wall and press *Tab* until you highlight the shape handle for the extendable layers.

Watch the status bar to be sure you are highlighting the shape handle.

2 Click to select the shape handle.

3 Drag the shape handle up or down.

Dragging layers with the shape handle



TIP If you join 2 walls and they both have a vertical extension, the extended portions will be horizontally joined. The extension joins must be the same, top-to-top or bottom-to-bottom.

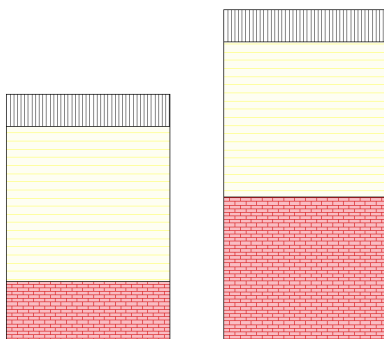
Constraining a Region

To constrain a region a certain distance from the top or bottom of a wall, click the horizontal border between 2 regions. A blue control arrow displays. Clicking the arrow alternates the constraint from the top to the bottom and displays a temporary dimension that you can edit.

When a region is constrained to the bottom of a wall, the region is always the same distance from the bottom regardless of how high the wall becomes. Likewise, when a region is constrained from the top, the region is always the same distance from the top.

Use constraints to keep a trim border or a brick soldier course at a specific height at the top of a building or a CMU a specific distance from the base of the building. See [Split Region Tool](#) on page 643.

Soldier Course Constrained to Top of Wall

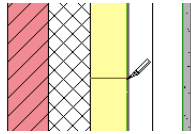


Split Region Tool

When editing [vertically compound walls](#), the Split Region tool divides a wall layer (or regions) horizontally or vertically into new regions. When you split a region, the new regions assume the same material as the original.

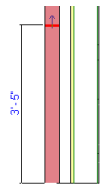
- To split a layer or region horizontally, highlight one of the borders. A preview split line displays when you highlight a border.

Horizontal split preview



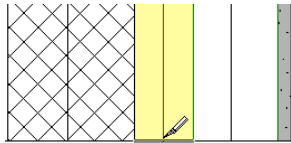
After you split a region or layer horizontally, click the border between the regions. A blue control arrow displays with a temporary dimension. If you click the arrow, it switches the constraint and its temporary dimension between the top and bottom of the wall. See [Modify Tool](#) on page 641.

Blue control arrow displayed when border is selected



- To split a layer or region vertically, highlight and select a horizontal boundary. That boundary can be the outside boundary, or an inside boundary created if you previously split horizontally.

Vertical split preview



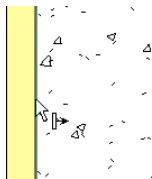
TIP It is helpful to zoom in on the outer horizontal boundary to split it vertically.

Merge Regions Tool

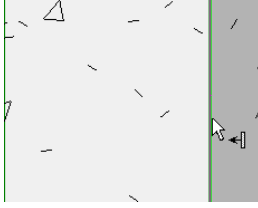
When editing [vertically compound walls](#), the Merge Regions tool merges wall regions together horizontally or vertically into new regions. Highlight a border between regions and click to merge them.

When you merge regions, the position of the cursor when you highlight a border determines which material prevails after the merge.

The material from the right region prevails when you merge



The material from the left region prevails when you merge



Assign Layers Tool

When editing [vertically compound walls](#), the Assign Layers tool assigns a row to a layer or region. (It assigns the number, material, and function of that row.)

It is more useful to assign layers to regions vertically, rather than horizontally. For example, you might split finish layer 1 into several regions. Then you could assign another finish row to some of those regions and create an alternating pattern, such as brick over concrete.

You should familiarize yourself with the layer functions of compound walls. See [Applying a Function to a Layer of a Compound Structure](#) on page 813. Also see [Layer Assignment Rules](#) on page 644.

To assign wall layers:

- 1 Click a row number to select it.

All regions currently assigned to that row appear selected in the preview pane.

NOTE If the row does not have any regions assigned to it, it appears as a line in the preview pane, and its thickness is 0.

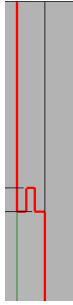
- 2 Click Assign Layers.
- 3 Highlight a region boundary.
- 4 Click the boundary to assign the row to that region.
- 5 Continue clicking other regions to continue assigning, or click Assign Layers to exit.

Layer Assignment Rules

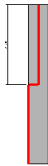
When assigning layers in walls, consider the following guidelines:

- Rows of the sample wall in the preview pane must remain in a sequential order from left to right. To test the sample wall, select row numbers sequentially and observe the selection in the preview pane. If the layers do not highlight in an order from left to right, Revit Architecture cannot produce this wall.
- A row cannot be assigned more than one layer.
- You cannot have the same row assigned to regions on both sides of the core.
- You cannot apply a thickness to a membrane layer.
- Non-membrane layers cannot have a thickness smaller than 1/8" or 4 mm.
- A layer in the core must have a thickness greater than 0. You cannot specify a layer in the core as a membrane layer.
- The exterior and interior core boundaries and the membrane layer cannot rise up and down.

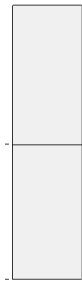
Invalid boundary for core boundaries or membrane layers



- You can add thickness only to a layer that is straight from the top of the wall to the bottom. You cannot add thickness to a complex layer, such as the one shown in the following image.



- You cannot split a wall horizontally and then move the outside boundary of one of the regions independently of the other. For example, if you select the left outer boundary of the lower region, the left outer boundary of the upper region is also selected.



- Layer function priorities cannot ascend from the core boundary to the finish face. For example, you cannot have a finish layer in the core boundary and then a structure layer at the exterior side.

Sweeps and Reveals Tools

When editing [vertically compound walls](#), the Sweeps and Reveals tools control placement and display of sweeps or reveals on the wall.

To add a sweep to the wall structure:

- 1 In the Edit Assembly dialog, click Sweeps.
- 2 In the Wall Sweeps dialog, click Add.
- 3 Select a profile from the list.
For example, select Parapet Cap-Precast.
- 4 Specify a material for the sweep.
- 5 For Distance, specify the distance from either the top or base of the wall (select top or base in the From column).

6 For Side, specify the interior or exterior of the wall.

7 Specify a value, if necessary, for Offset.

A negative value moves the sweep toward the wall core.

8 Select Flip to measure the distance from the top of the sweep profile rather than the bottom.

9 For Setback, specify the sweep setback distance from inserts, such as windows and doors.

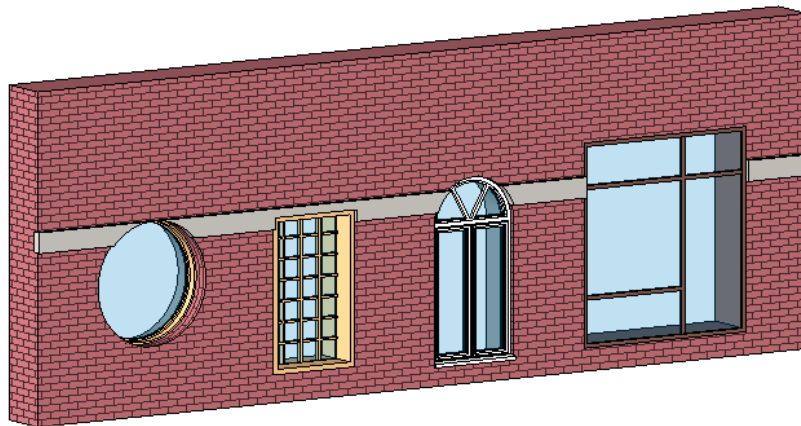
10 Select Cuts Wall if you want the sweep to cut geometry out of the host wall.

When a sweep is offset and embedded in the wall, it cuts the geometry from the wall. In complex models with many sweeps, you can increase performance by clearing this option.

11 Select Cuttable if the sweep should be cut by wall inserts.

In the image below, see how the sweep is cut by the windows.

Wall sweep with Cuttable option selected



12 Click OK.

To add a reveal to the wall structure:

1 In the Edit Assembly dialog, click Reveals.

2 In the Reveals dialog, click Add.

3 Select a profile from the list.

NOTE There is no material choice for reveals. The material for the reveal is the same as the material it is cutting.

4 For Distance, specify the distance from either the top or base of the wall (select top or base in the From column).

5 For Side, specify the interior or exterior of the wall.

6 Specify a value, if necessary, for Offset.

A negative value moves the reveal toward the wall core.

7 Select Flip to measure the distance from the top of the reveal profile rather than the bottom.

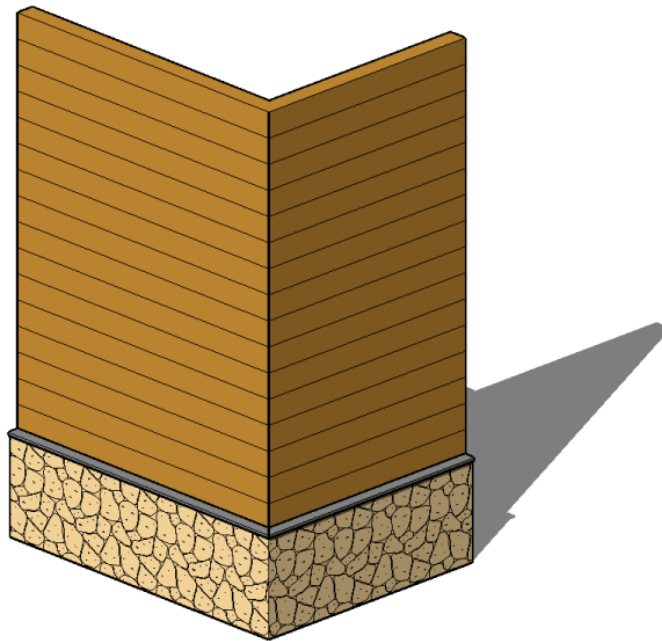
8 For Setback, specify the reveal setback distance from inserts, such as windows and doors.

9 Click OK.

Vertically Stacked Walls

Revit Architecture features a stacked wall type which is one wall that includes several different subwalls stacked on top of each other. All subwalls in a stacked wall are attached and have joined geometry to each other; the subwalls can only be types in the Basic Wall system family. For example, you can have a stacked wall comprising an Exterior Brick on Metal Stud and an Exterior CMU on Metal Stud that are attached and joined.

Using stacked wall types, you can define different wall thicknesses at different heights. You define its structure using Type Properties.



Specifying Instance Parameters of Subwalls

When you define the structure of the stacked wall type, you indirectly change instance parameters of the individual subwalls that compose the stacked wall. That is, when you specify the height, offset, top, and base of the stacked wall, you are also specifying Unconnected Height, Location Line Offset, Top Extension Distance, and Base Extension Distance, respectively, of the subwalls. The only instance parameters you can directly specify for subwalls are Room Bounding and Structural Usage; values for the remainder are inherited from the stacked wall type and are read-only.

Defining the Stacked Wall Structure

You can make various changes to a stacked wall to change its structure:

- You can add or delete walls.
- You can move subwalls up or down the height of the stacked wall.
- You can define a reference line for the entire stacked wall, and then offset each subwall from that reference line.

IMPORTANT Define the structure of vertically stacked walls before placing any instances in the project. Height conflicts may occur when previously placed instances are lower than the defined height of the type.

To define the structure of a stacked wall:

- 1 Access the properties of a vertically stacked wall.

For example, in the Project Browser, under Families ► Walls ► Stacked Wall, right-click a stacked wall type, and click Properties. Alternatively, if you have placed a stacked wall in the project, select it in the drawing area and click Modify Walls tab ► Element panel ► Element Properties drop-down ► Type Properties.

- 2 In the Type Properties dialog, click Preview to open the preview pane. All changes you make to the wall display in the preview pane.

The preview pane displays the wall in section view.

- 3 Click Edit for the Structure parameter.

A table shows the different wall types that compose the stacked wall. Every stacked wall has at least one subwall in it.

- 4 In the Edit Assembly dialog, specify an offset reference.

This establishes an imaginary reference line to align all the subwalls of the stacked wall. For example, if you select Finish Face Exterior, each subwall piece aligns to its finish face. This value becomes the Location Line value of each subwall.

- 5 Enter a value for Sample Height.

This is the height of the wall in the preview pane. This value changes when you insert subwalls whose unconnected height is greater than the sample height.

- 6 Under Types, click a row in the Type table to select a subwall, or click Insert to add a new subwall to the main wall.

- 7 For Name, select the desired subwall type.

- 8 For Height, specify an unconnected height for the subwall.

NOTE One subwall is required to have a variable height. Its height changes relative to the heights of the other subwalls. You cannot edit the Height field when the subwall is variable. To change the height of the variable subwall, change another subwall to variable by selecting its row and clicking Variable.

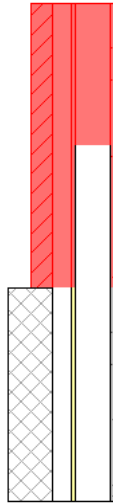
- 9 For Offset (for the selected subwall), specify the distance to offset the horizontal location line of the subwall from the reference line (Offset) of the main wall.

A positive value moves the subwall toward the exterior side (left side in the preview pane) of the main wall. For example, if the reference line of the main wall is set to Wall Centerline, and you specify 1" for all subwall offsets, each subwall is aligned 1" to the left of the centerline of the main wall.

- 10 If enabled, enter a value for the Top or Base Extension Distance.

This value raises or lowers a wall layer that is unlocked at the top or bottom. A positive value moves the layer up; a negative value moves it down. This value corresponds to the value for the Top or Base Extension Distance instance parameters for the subwalls. For more information on unlocking layers, see [Vertically Compound Walls](#) on page 639.

If you specify an extension distance for a subwall, the subwall below it attaches to it. For example, suppose you specify a Base Extension Distance of 2 feet for the top subwall. The top of the next subwall down moves up to attach to the modified wall above it. The value for Top Extension Distance of the lower subwall is Attach. For example, in the following image, the top wall is highlighted in red. It has a positive base extension distance. The lower subwall attaches to it.



11 To flip the subwall about the reference line (Offset) of the main stacked wall, select Flip.

12 To rearrange rows, select a row and click Up or Down.

13 To delete a subwall type, select its row and click Delete.

If you delete a subwall with an explicit height, the variable subwall extends to the height of the other subwalls. If you delete a variable subwall, the subwall above it becomes variable. If there is only one subwall, you cannot delete it.

14 Click OK.

Breaking Up a Vertically Stacked Wall

The subwalls of a stacked wall are closely tied together. However, you may want to control them independently. Use the Break Up tool to accomplish this.

To access the Break Up tool, right-click a stacked wall instance, and click Break Up.

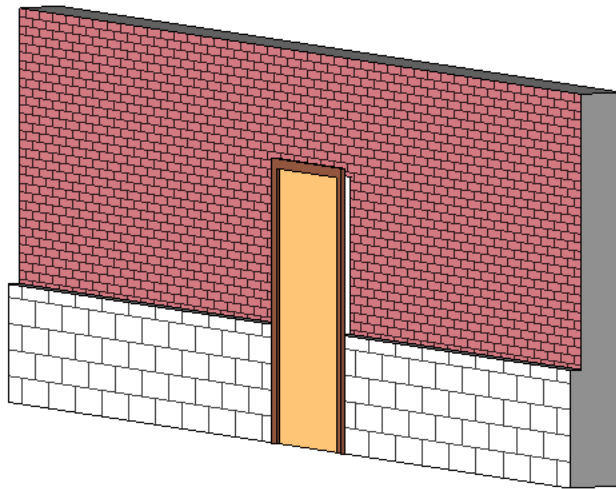
Once a stacked wall is broken up, the subwalls become walls on their own. There is no reassemble tool to restack such a wall. When you break up a stacked wall, the base constraint and base offset of each subwall is the same as that of the stacked wall. You can then edit instance properties for any of the walls.

Vertically Stacked Wall Notes

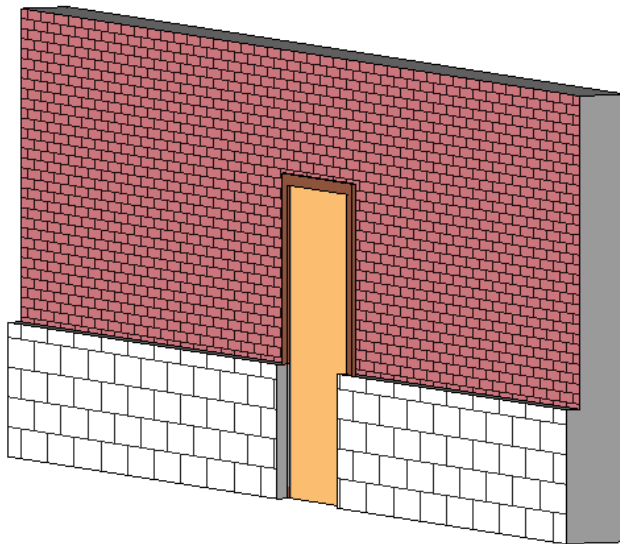
When using vertically stacked walls, consider the following guidelines:

- All subwalls use the same base constraint and base offset as the stacked wall. This means that a subwall can be on a certain level, but is actually based on the same level as its associated stacked wall. For example, if a stacked wall is based on Level 1 but one of its subwalls is on Level 7, the Base Level of that subwall is Level 1.
- You can edit the Type Properties of a basic wall that is also a subwall. To access the type properties of the basic wall, in the Type Selector, select the basic wall type, and click Element Properties drop-down ► Type Properties.
- When you create a wall schedule, the vertically stacked wall does not schedule, but its subwalls do.

- When you edit the elevation profile of a stacked wall, you edit one main profile. If you break up the stacked wall, each subwall retains its edited profile.
- When you highlight a vertically stacked wall in the drawing area, the entire wall highlights first. Press *Tab* to highlight the component subwalls. Using a pick box selects only the stacked wall.
- You can embed a vertically stacked wall.
- Subwalls can host wall sweeps; stacked walls cannot.
- Subwalls cannot be in different phases, worksets, or design options from that of the stacked wall.
- To place inserts in a vertically stacked wall, you may need to use the Pick Primary Host tool to switch between the vertically stacked wall and one of the walls that compose it. For example, the door panel in the following illustration is outside the upper wall because the main host of the door is the bottom subwall.



To place the door properly, select the door and click **Modify Doors** tab ► **Host panel** ► **Pick Primary Host**. Place the cursor on the wall, and select one of the component walls. You may need to press *Tab* to select the desired wall.



Attaching Walls to Other Components

Walls do not directly attach to roofs, ceilings, and other modelling components through their properties. Use the Attach option of the Top/Base tool to explicitly join walls to other modelling components.

When attaching walls, consider the following guidelines:

- You can attach wall tops to non-vertical reference planes.
- You can attach walls to in-place roofs or floors.
- If a wall's top is currently attached to a reference plane, attaching the top to a second reference plane detaches it from the first.
- You can attach walls that are parallel and directly above or below one another.

To attach walls to other components

- 1 In the drawing area, select the walls to which you want to attach another modelling component.
- 2 Click Modify Walls tab ► Modify Wall panel ► Attach.
- 3 Select a roof, floor, or ceiling to attach.

The selected walls attach to the selected modelling component, and Revit Architecture returns to Modify mode. Repeat this procedure as many times as needed to attach the walls.

Detaching Walls from Other Components

The Detach Top/Base tool detaches walls from other modelling components or reference planes. This tool is most effective if you are in a view where you can select walls and the components to which they are attached.

Detaching Walls

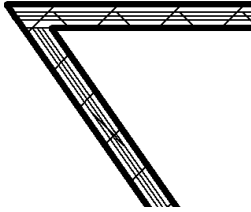
- 1 In the drawing area, select the walls to detach.
- 2 Click Modify Walls tab ► Modify Wall panel ► Detach.
- 3 Select the model components to detach from the walls.
- 4 If you want to detach the selected walls from all components at once, or if you are not sure which components are attached to the walls, on the Options Bar, click Detach All.
The walls detach from any component to which they were previously attached.

Wall Joins

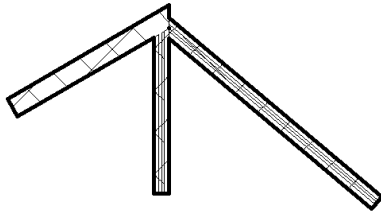
When you create walls, Revit Architecture automatically joins them at their intersections. You can edit wall joins when necessary. For best results, edit wall joins in a plan view.

The following are examples of valid wall joins that you can edit:

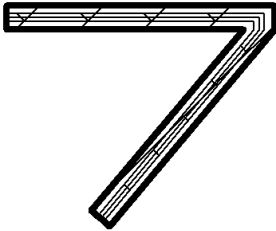
Walls at acute angles



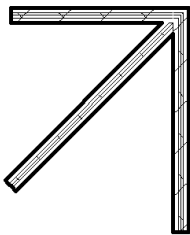
Several walls joined together



Walls squared off at angle

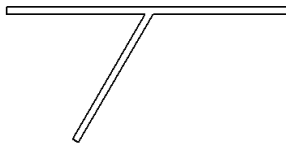


Walls squared off at 90 degrees



You cannot square off the join of one wall that is joined with the interior of another wall, because there is only one configuration for the join. You can change the visibility of the line separating the 2 walls by cleaning the wall join.

Interior wall join



Related topics

- [Design Options and Wall Joins](#) on page 1325

Editing Wall Joins

NOTE The Wall Joins tool is not recommended for complex wall joins (for example, a wall join with more than 4 walls, a wall join on many floors, or a wall join that is in more than one workset). For more information, see [Editing Complex Wall Joins](#) on page 654.

1 Click Modify tab ► Edit Geometry panel ► Wall Joins.

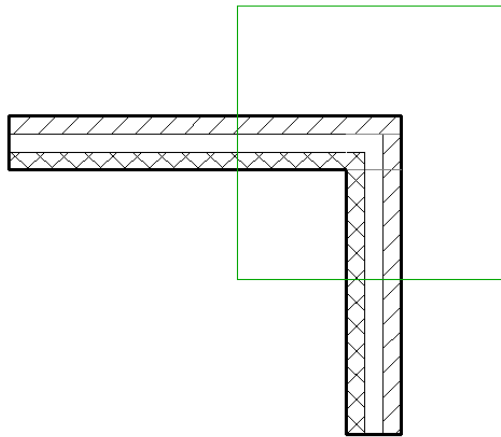
2 Move the cursor over the wall join and click.

A square encloses the wall join.

3 On the Options Bar, select a join type:

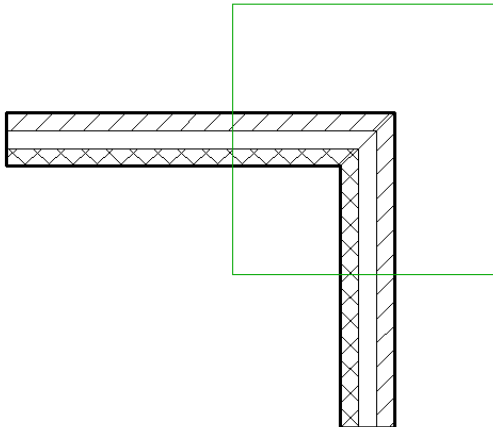
- **Butt:** Creates a butt join between the walls. This is the default join type.

Butt join



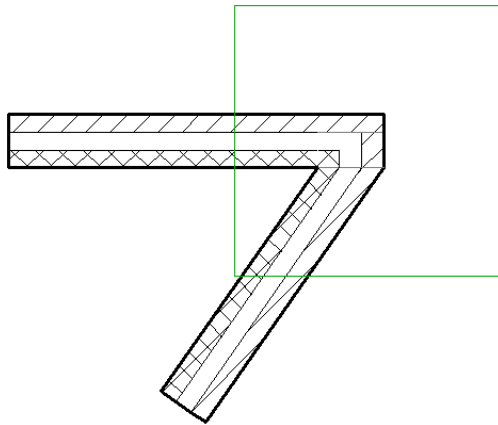
- **Miter:** Creates a miter join between the walls. All wall joins less than 20 are mitered.

Miter join



- **Square off:** Squares a wall end to 90. This option is not available for walls already joined at 90.

Squared off join



Editing Complex Wall Joins

Revit Architecture does not recommend using the Wall Joins tool to edit a complex wall join. Complex wall joins are those that, for example, have more than 4 walls, are on many floors, or exist in more than 1 workset. Complex wall joins can produce a large number of configurations, and you may have to step through hundreds of configurations to find the desired one.

To edit a complex wall join

- 1 If applicable, set all involved worksets to editable. See [Making Worksets Editable](#) on page 1263.
- 2 Use the drag controls on the wall ends to move the walls out of the join.
- 3 Drag the wall ends back into the join using the snapping feedback to create the desired configuration.
- 4 Prevent walls from joining.

For more information, see [Preventing Wall Ends from Joining](#) on page 659.

Changing the Order of a Wall Join

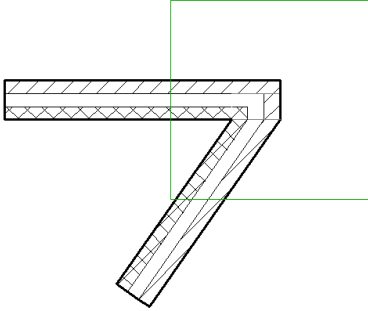
Changing wall order affects the display of a wall join by changing which wall butts up against another.

To change wall join order

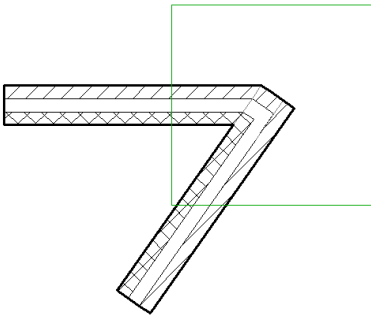
- 1 In a plan view, click Modify tab ► Edit Geometry panel ► Wall Joins.
- 2 Move the cursor over the wall join and click.
A square encloses the wall join.
- 3 On the Options Bar, click Previous or Next to cycle through the wall join order options.
- 4 When the drawing area displays the desired wall join configuration, click Modify tab ► Selection panel ► Modify.

The following images show wall joins and the available wall join order options.

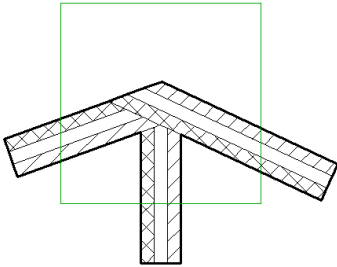
Current wall join



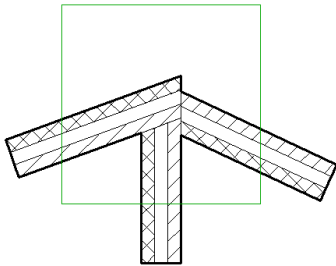
Display after changing order



Current wall join



Display after changing order (note difference in the imaginary lines depicting the wall) ends.



Cleaning Wall Joins

Cleaning up wall joins affects display in a plan view only. If multiple plan views of the same join are open, the tool only affects the plan view in which you issued the clean up.

To clean wall joins

1 In a plan view, click Modify tab ► Edit Geometry panel ► Wall Joins.

2 Move the cursor over the wall join and click.

A square encloses the wall join.

3 On the Options Bar, for Display, select one of the following options:

- **Clean Join** displays a smooth join. Imaginary solid lines appear to indicate where the walls actually end. The lines only appear while editing the wall join; they do not print and go away when you finish cleaning the join.

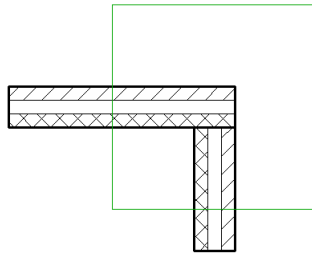
NOTE The wall join looks significantly different in 3D view if the walls are at a different height.

Clean join



- **Don't Clean Join** displays the wall ends butting up against one another.

Don't Clean Join



- **Use View Setting** cleans wall joins depending on how the property Wall Join Display is set. See [View Properties](#) on page 259.

4 When you finish making wall join edits, click Modify or press *Esc* to exit the tool.

Joining Parallel Walls that Contain Inserts

If you join 2 parallel walls and one of them has an insert (such as a window), the insert cuts through the joined wall.

If 2 walls are joined at an obtuse angle, you can place 2 inserts near the join if the join is mitered. If the join is squared off, Revit Architecture notifies you that it cannot place both inserts.

To join parallel walls with inserts

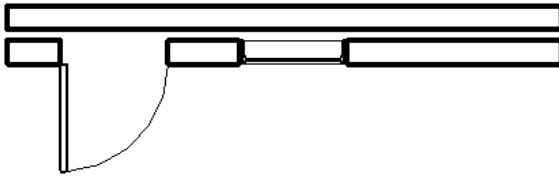
1 In a plan view, place the walls less than 6 inches apart.

2 Click Modify tab ► Edit Geometry panel ► Join.

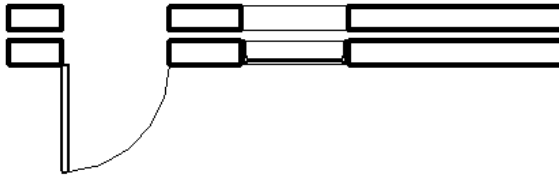
3 Select the walls to join.

The inserts cut openings in the joined walls. Any geometry around the insert, such as a frame, does not appear on the joined wall.

The following image shows 2 parallel walls in plan view, one with inserts (a door and a window), before the walls are joined.



The following image shows the walls after they are joined using the Join Geometry tool.



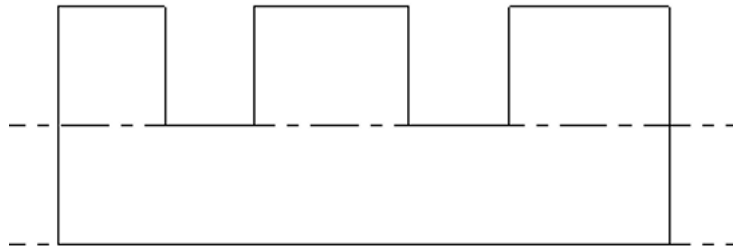
Creating Walls with Mid-End Faces

You can join walls to mid-end faces. To create mid-end faces, you edit the wall's elevation profile.

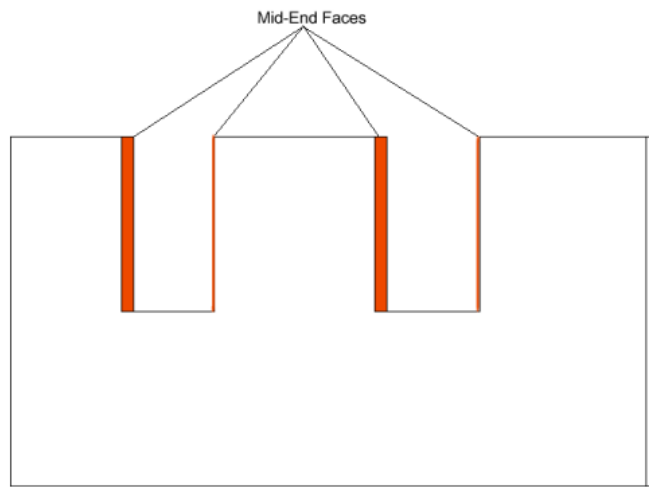
To create mid-end faces

- 1 Draw a wall with several levels.
- 2 Select the wall and click Modify Walls tab ► Modify Wall panel ► Edit Profile.
- 3 Add vertical lines in between the wall ends.

Sample wall elevation profile



- 4 Open a 3D view.

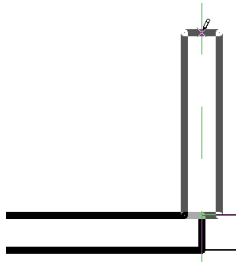


Notice the mid-end face is created at a vertical segment of the elevation profile to allow other walls to form a corner join.

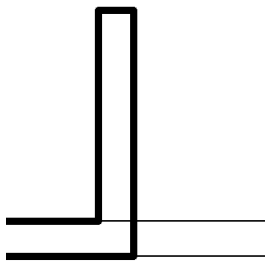
Joining Walls to Mid-End Faces

You can join a wall to a mid-end face. As you drag one of the attached walls, the sketch updates and maintains the join.

Adding wall to mid-end face

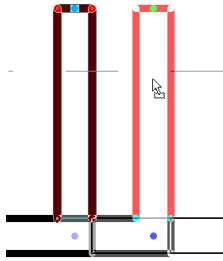


2 walls join with cleaned join



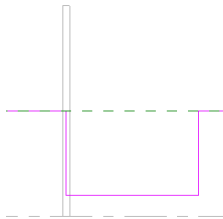
Drag one of the joined walls and the wall join moves with it.

Wall join updates (note the join moves with the preview wall)



NOTE Join a wall to another wall with mid-end faces and start to edit the elevation profile of the wall with mid-end faces. The vertical line in the wall's sketch is aligned to the center line of the joined wall, not the actual face of the wall. This is only temporary while you are editing the sketch. When you leave sketch mode, the join cleans up by going to one of the end faces.

Sample elevation profile of mid-end face (note the sketch line in the middle of the joined wall, not at the face)



Joins with Non-Editable Walls

Non-editable walls can be joined and unjoined in the following ways:

- You can join or unjoin an editable wall to the side face of a non-editable wall or to a corner where 2 or more non-editable walls are already joined.
- You can delete an editable wall that is joined to a non-editable wall, except as noted below.
- You cannot join or unjoin an editable wall to a non-editable wall if that would change the shape of the non-editable wall.
- You cannot join an editable wall to the end of a non-editable wall. Revit Architecture keeps the walls close together but does not join them and issues a warning. At a later time, you can join the walls if they are both editable.
- A wall can resize, even if it is not editable. This happens if you move the wall to which it is joined.

For more information on editability status and worksharing, see [Working in a Team](#) on page 1249.

Preventing Wall Ends from Joining

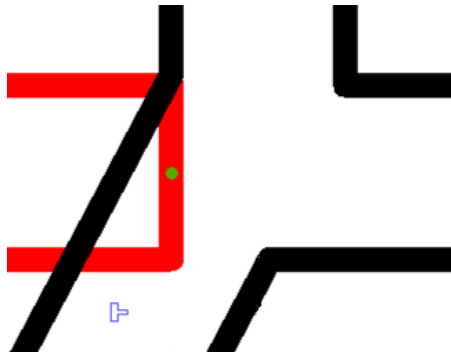
In construction, you might have small expansion spaces that you want to keep between walls. In these cases, you need to prevent wall ends from joining. You can do this by disallowing wall joins.

2 horizontal walls with 3/8-inch expansion space between them

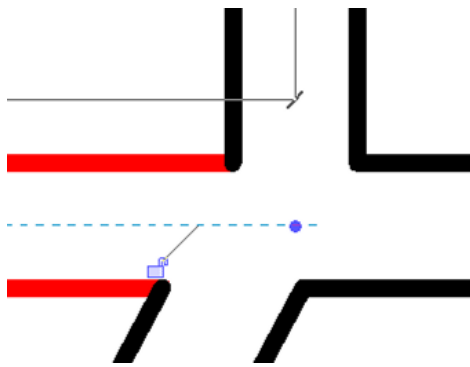


Disallowing joins is also useful for resolving complex joins. For example, if you add a wall to a complex join and it produces undesired results, you can disallow joins on the added wall and then use the Join Geometry tool to clean the join between this wall and other walls.

Selected wall with disallowed join




Wall cleaned up after Join Geometry used



To prevent a join on a wall end

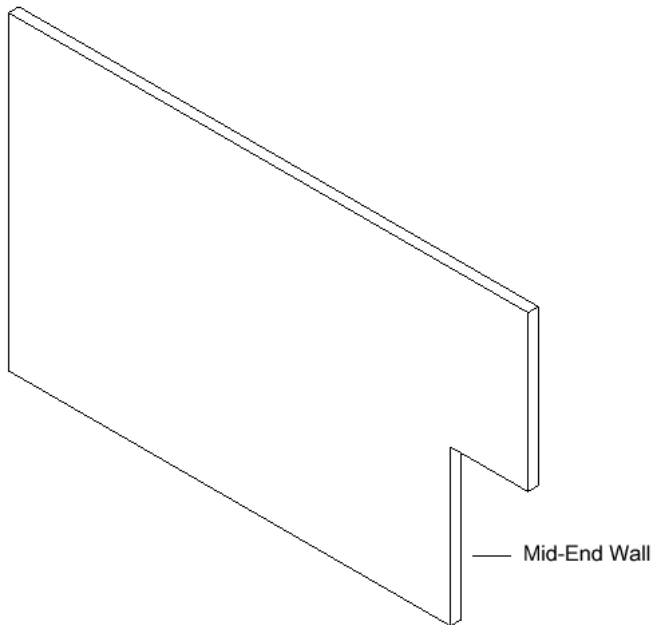
- 1 Select the wall.
- 2 Right-click the wall end control where you want to disallow the join.
- 3 Click Disallow Join from the shortcut menu.

The end of the wall cannot join to the end of another wall. If you want to allow the join, you can select the wall, right-click the wall end control, and click Allow Join from the shortcut menu, or right-click  (Allow Join) above the end of the wall.

Preventing a Join on a Mid-End Wall Face




You can prevent mid-end wall faces from joining to another wall. See [Creating Walls with Mid-End Faces](#) on page 657.

Profile of a Mid-End Wall



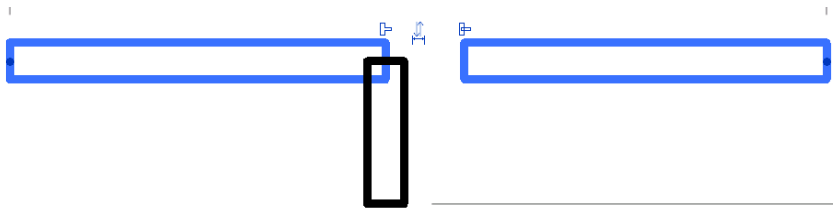
To disallow a join on a mid-end wall face


1 Select the wall.

2 Click  (Disallow Join) above the mid-end wall face, or right click and click Disallow Join from the shortcut menu. Notice  changes to .

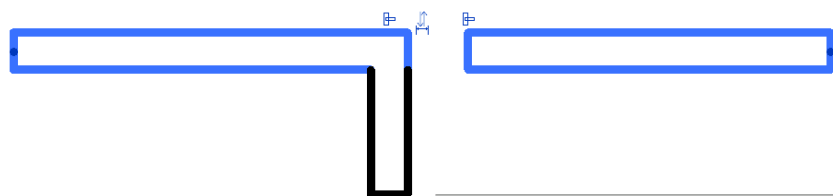
The mid-end wall cannot join to the end of another wall.

Selected mid-end wall with join disallowed



If you want to allow the join, click  above the mid-end wall face or right-click and click Allow Join from the shortcut menu.

Selected mid-end wall with join allowed



You can switch between the allow join or disallow join states by clicking the join icons.

Aligning Walls

When you draw 2 collinear walls of different widths, Revit Architecture aligns their centerlines. If you wish to align the side faces of the walls, use the Align tool. See [Aligning Elements](#) on page 377.

Splitting Walls

You can split walls using the Split tool. See [Splitting Walls and Lines](#) on page 408.

Sketching Wall Shapes

In Revit Architecture, you can sketch straight, curved, or circular walls and you can add openings or cuts to walls. Also, you can specify properties for dimensioning, snapping, and locking walls. For descriptions of the different sketch tools, see [Sketching](#) on page 303.

Defining Wall Shapes or Openings

When you draw a wall by picking 2 points, Revit Architecture draws a rectangular wall. Your design, however, may call for different shapes or even openings in the wall. Revit Architecture allows you to modify the shape of the wall or add openings to it by selecting the wall and editing its elevation profile. To edit a wall's elevation profile, the view must be parallel and can be either a section or elevation view.

Related topics

- [Cutting Rectangular Openings in Walls](#) on page 725

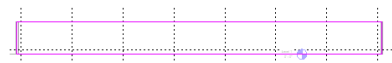
Modifying Wall Elevations

1 After drawing a wall, click Modify. Then click the wall to select it.

2 Click Modify Walls tab ► Modify Wall panel ► Edit Profile.

If necessary, select the elevation view in which you want to see the wall. By default, Revit Architecture allows you to see the center plane in the appropriate elevation. For example, if you select the north wall, Revit Architecture allows you to switch to either the North or South elevation view.

Your screen should appear something like this in sketch mode:



The 4 lines that appear represent the wall in an elevation view.

3 Edit the wall as desired.

For example, you can delete the lines and then sketch a completely different shape. You can split the existing lines and add arcs. Or you can draw openings or holes in the rectangle.

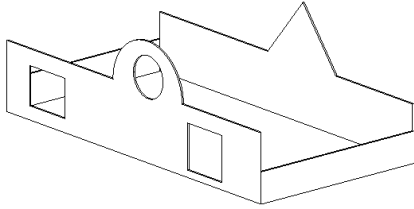
TIP As you move and edit the rectangle, datum planes appear to indicate the original shape and size of the wall when you entered sketch mode. If the sketched lines snap to the datum planes, the endpoints of the lines automatically align to the planes, unless you explicitly unlock them. If you unlock the sketched lines, you can modify them independently of the datum planes. If you exit sketch mode with the sketched lines still aligned, then as you move a datum handle, the sketched lines move with it.

4 When you are finished, click Finish Wall.

Revit Architecture returns you to the last active view.

After modifying walls shapes, your design might look something like this:

Design with non-rectangular walls and cut openings



NOTE If you want to revert an edited wall to its original shape, select the wall in a view and click Modify Walls tab ► Modify Wall panel ► Reset Profile.

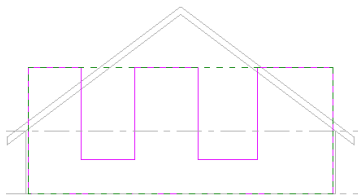
Guidelines for Defining Wall Shapes or Openings

When defining wall shapes and openings, consider the following guidelines:

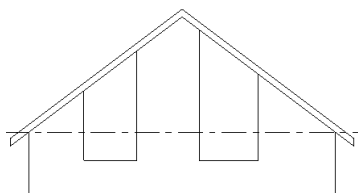
- If you are defining a shape on a wall that is not horizontal or vertical in a plan view, you should draw a section parallel to the wall before going into the elevation sketch mode. When you go into sketch mode, the Go To View dialog appears. Revit Architecture suggests the section view as the optimal view for editing the sketch. Click Open View to open that view.
- You cannot edit the elevation profile of an arc wall.
- While you edit the elevation profile of a wall attached to another element, the wall temporarily reverts to its shape and height prior to attaching it. For example, if you edit the profile of a wall attached to a roof, the wall assumes its unconnected height prior to attaching to the roof. As a result, you may find the wall is not at the right height to complete the elevation profile edits. To change the height, while in sketch mode, click Modify Walls > Edit Profile tab ► Element panel ► Wall Properties. Change the Unconnected Height of the wall.

As you edit the elevation profile, keep in mind that after you finish the sketch, the wall top or bottom attaches only where horizontal lines are coincident with the reference planes in the sketch.

Sample edited profile in sketch mode (note top sketch lines that are coincident with reference planes)

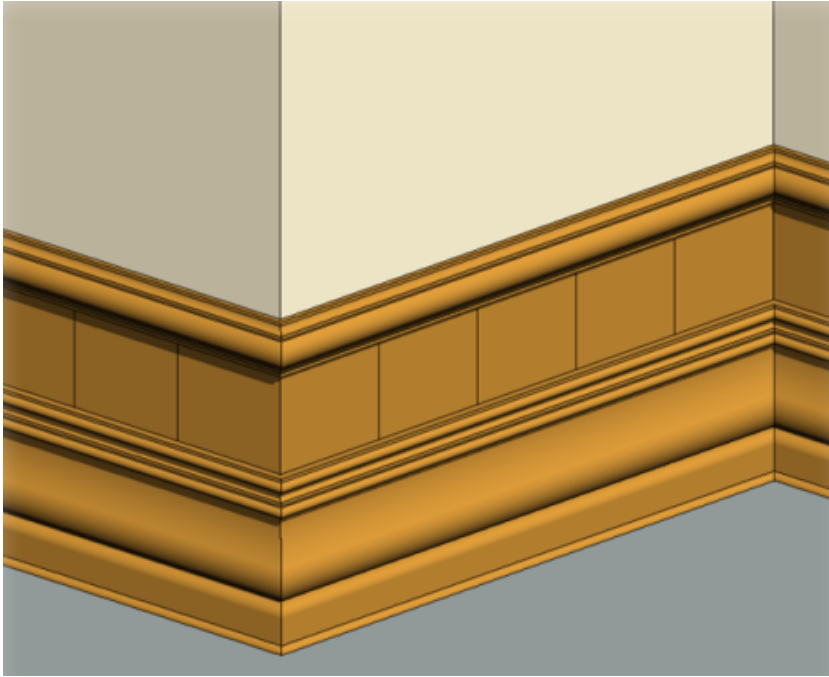


Finished wall attached to roof (non-coincident horizontal lines from sketch did not attach)



Wall Sweeps

A wall sweep is a horizontal or vertical projection from a wall, often decorative in nature. Examples of wall sweeps include baseboards along the bottom of a wall or crown molding along the top of a wall. You can add a wall sweep to a wall from a 3D or elevation view.

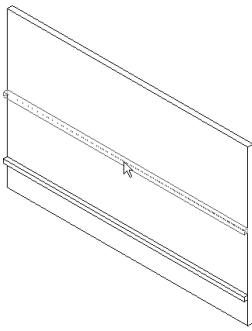


You can schedule wall sweeps. Integral wall sweeps, which are part of the wall type definition, can not be scheduled independently. For more information on creating schedules, see [Schedule Views](#) on page 172.

NOTE If you create wall sweeps at different heights and then later set them to the same height, the sweeps miter at the joins.

Adding Wall Sweeps

- 1 Go to a 3D or elevation view.
- 2 Click Home tab ► Build panel ► Wall drop-down ► Wall Sweep.
- 3 Click Place Wall Sweep tab ► Element panel, and select the desired type of wall sweep from the Type Selector drop-down.
- 4 Select the orientation of the wall sweep: Horizontal or Vertical.
- 5 Place the cursor over the wall to highlight the wall sweep location. Click to place the wall sweep.
- 6 Add the wall sweep to adjacent walls, if needed.
Revit Architecture preselects the wall sweep location on each adjacent wall.
If you are in a 3D view, you can add a wall sweep to all exterior walls by using the ViewCube to rotate the view. For more information, see [ViewCube](#) on page 217.
- 7 To start a wall sweep in a different location, click Place Wall Sweep tab ► Profile panel ► Finish Current. Move the cursor to the desired location on the wall, and click to place the wall sweep.
- 8 To finish placing wall sweeps, click Modify.



Related topics

- [Changing the Wall Sweep Profile](#) on page 665
- [Returning Wall Sweeps Back to the Wall](#) on page 665
- [Adding or Removing Segments from a Wall Sweep](#) on page 666
- [Adding a Wall Reveal](#) on page 670

Changing the Wall Sweep Profile

- 1 Select a wall sweep in a 3D or elevation view, or click Home tab ► Build panel ► Wall drop-down ► Wall Sweep.
- 2 Click Modify Wall Sweeps tab (or Place Wall Sweep tab) ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 For Profile, select the desired profile type.
- 4 Click OK.

Returning Wall Sweeps Back to the Wall

After placing a wall sweep, you can return its ends back toward the wall.

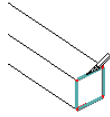
NOTE This procedure is also available for wall reveals.

- 1 In a 3D or elevation view, select the wall sweep segment. Be sure it is not already joined to another segment.
- 2 Click Modify Wall Sweeps tab ► Wall Sweep panel ► Modify Returns.
The Straight Cut and Return options appear on the Options Bar. The Straight Cut is a perfectly squared off edge. This option is not available if the sweep end is already in this state.
- 3 Select Return and type an angle value in the text box next to it (for example 45).

NOTE A positive return angle moves the sweep end toward the wall. A negative value moves the sweep end away from the wall. For reveals, a positive return value moves the reveal end away from the wall, and a negative value moves the end toward the wall.

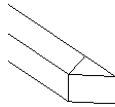
- 4 Highlight the wall sweep end.

Highlighted wall sweep end



5 Click to apply the new return value.

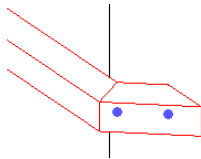
Applied return value



In this example, the option Straight Cut becomes available. Select that option, and click the sweep end to apply a straight cut to the sweep.

After you change the return, you can drag the end of the sweep or reveal to extend the return. Select the wall sweep, and use the blue dot drag control.

Drag the right blue control



Changing the Wall Sweep Type

- 1 In the drawing area, select a wall sweep.
- 2 Click Modify Wall Sweeps tab ► Element panel, and select the desired wall sweep from the Type Selector drop-down.

If the desired wall sweep type is not listed in the Type Selector, you can load additional profile families. Click Insert tab ► Load from Library panel ► Load Family.

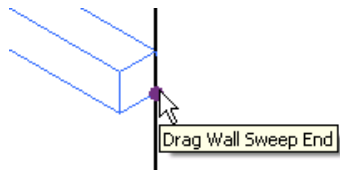
Adding or Removing Segments from a Wall Sweep

You can continue an existing sweep onto new walls, or remove segments from existing wall sweeps.

- 1 Open a 3D view and select the desired wall sweep.
- 2 Click Modify Wall Sweeps tab ► Wall Sweep panel ► Add/Remove Walls.
- 3 Select the walls to continue adding to or removing from the wall sweep.

Resizing Unconnected Wall Sweeps

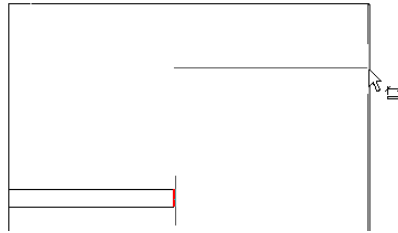
- 1 In a 3D or elevation view, select the wall sweep.
- 2 Drag the wall sweep end to resize it.



Dimensioning to a Wall Sweep

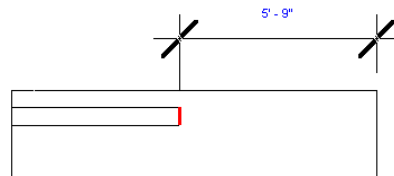
- 1 Place a dimension between the wall sweep end face reference and another reference.

Dimension references between wall sweep end face and wall



- 2 To change the dimension value, drag the wall sweep's shape handle. The dimension value adjusts accordingly.

Selected shape handle on sweep



Changing a Wall Sweep's Horizontal or Vertical Offset

To move a single wall sweep segment

- 1 Select the segment.
- 2 Move it up or down (horizontal wall sweeps) or side to side (vertical wall sweeps).

To move a multi-segmented wall sweep

- 1 Place the cursor over the wall sweep and press *TAB* to select the shape handle of the wall sweep. Watch the status bar to know when you are highlighting the shape handle.
- 2 Click to select the shape handle.
- 3 Move the wall sweep up or down (horizontal wall sweeps) or side to side (vertical wall sweeps). This affects the offset of all segments of the wall sweep, so the segments are symmetrical.

Wall Sweep Properties

You can modify several properties for wall sweeps, including profiles and offsets.

Modifying Wall Sweep Properties

- 1 In a 3D or elevation view, select a wall sweep and click Modify Wall Sweeps tab ► Element panel ► Element Properties.
- 2 In the Instance Properties dialog, edit wall sweep instance parameters.
- 3 Click Edit Type to edit wall sweep type parameters.
Changes made to type properties affect all wall sweeps of this type in the project. You can click Duplicate to create a new wall sweep type.
- 4 When you are finished, click OK.

Wall Sweep Type Properties

Name	Description
Constraints	
Cuts Wall	When selected, the sweep will cut geometry out of the host wall if there is an overlap. Setting this value to No can increase performance on large building models with many sweeps.
Cut by Inserts	When selected, inserts such as doors and windows cut geometry out of the sweep. See Sweeps and Reveals Tools on page 645.
Default Setback	This value specifies the distance the sweep is set back from each intersecting wall insert.
Construction	
Profile	Specifies the profile family used to create the wall sweep.
Materials and Finishes	
Material	Sets the material of the wall sweep.
Identity Data	
Subcategory of Walls	By default, wall sweeps are set to the Wall Sweep subcategory of walls. In the Object Styles dialog, you can create new Wall subcategories and subsequently select one here. This allows you to modify wall sweep style at a project level using the Object Styles dialog.
Keynote	Add or edit the wall sweep keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The model type of the wall sweep.
Manufacturer	The manufacturer for the wall sweep's materials
Type Comments	Specific building or design comments.
URL	Link to a web page (such as a manufacturer's web page).
Description	Description of the wall sweep.

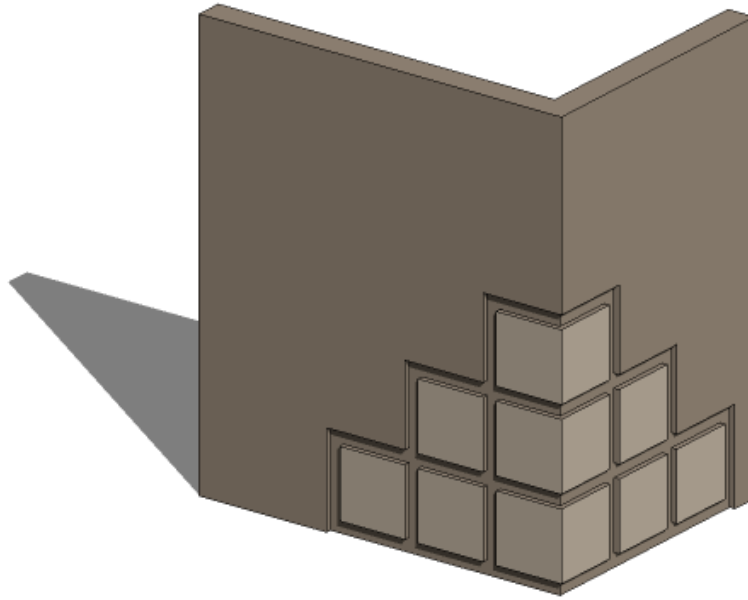
Name	Description
Assembly Description	Description of the assembly based on the assembly code selection.
Assembly Code	Unifomat assembly code selected from a hierarchical list.
Type Mark	A value to designate the particular wall sweep. This value must be unique for each wall sweep in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Cost	Cost of the materials for constructing the wall sweep. This information can be included in a schedule.

Wall Sweep Instance Properties

Name	Description
Constraints	
Offset From Wall	The distance from the wall face.
Level	The level of the wall sweep. This property only appears for horizontal wall sweeps.
Offset From Level	The wall sweep's offset from the level. This property only appears for horizontal wall sweeps.
Dimensions	
Length	The length of the wall sweep. This is a read-only parameter.
Identity Data	
Comments	Enter comments for the wall sweep.
Mark	A value to designate the particular wall sweep. This value must be unique for each wall sweep in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Phasing	
Phase Created	The phase when the wall sweep was created.
Phase Demolished	The phase when the wall sweep was demolished.

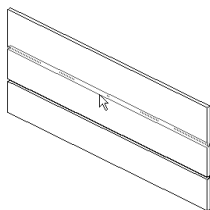
Wall Reveals

A wall reveal is a decorative cutout in a wall. You can add a reveal to a wall from a 3D or elevation view. Reveals can be horizontal or vertical.



Adding a Wall Reveal

- 1 Go to a 3D or non-parallel elevation view.
- 2 Click Home tab ► Build panel ► Wall drop-down ► Reveal.
- 3 Click Place Reveal tab ► Element panel, and select the desired wall reveal from the Type Selector drop-down.
- 4 Select the orientation of the wall reveal: Horizontal or Vertical.
- 5 Place the cursor over the wall to highlight the wall reveal location. Click to place the reveal.
- 6 Add the reveal to adjacent walls if needed.
Revit Architecture preselects the reveal location on each adjacent wall.
- 7 To finish placing wall reveals, click in the view away from the wall.



Related topics

- [Changing the Wall Reveal Profile](#) on page 671
- [Moving Wall Reveals Away from or Towards the Wall](#) on page 671
- [Changing the Wall Reveal Type](#) on page 671
- [Wall Reveal Properties](#) on page 671

Adding or Removing Segments from a Wall Reveal

You can continue an existing reveal onto new walls, or remove segments from a reveal.

- 1 Open a view that displays the reveal, and select the reveal.
- 2 Click Modify Reveals tab ► Reveal panel ► Add/Remove Walls.
- 3 Select the walls to continue adding to or removing from the reveal.
- 4 To exit the Add/Remove Walls tool, press *Esc* twice.

Changing the Wall Reveal Profile

- 1 Select a wall reveal in a 3D or elevation view, or click Home tab ► Build panel ► Wall drop-down ► Reveal.
- 2 Click Modify Reveals tab (or Place Reveal tab) ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 For Profile, select the desired profile type.
- 4 Click OK twice.

Moving Wall Reveals Away from or Towards the Wall

After placing a wall reveal, you can move its ends away from or toward the wall. The procedure is the same as moving wall sweeps back to the wall. See [Returning Wall Sweeps Back to the Wall](#) on page 665.

Changing the Wall Reveal Type

- 1 In the drawing area, select a wall reveal.
- 2 Click Modify Reveals tab ► Element panel, and select the desired wall reveal from the Type Selector drop-down.

If the desired wall reveal type is not listed in the Type Selector, you can load additional profile families. Click Insert tab ► Load from Library panel ► Load Family.

Wall Reveal Properties

You can modify several properties for wall reveals, including profiles and offsets.

Modifying Wall Reveal Properties

- 1 In a 3D or elevation view, select a wall reveal and click Modify Reveals tab ► Element panel ► Element Properties.
- 2 In the Instance Properties dialog, edit wall reveal instance parameters.
- 3 Click Edit Type to edit wall reveal type parameters.
Changes made to type properties affect all wall reveals of this type in the project. You can click Duplicate to create a new wall reveal type.
- 4 When you are finished, click OK.

Wall Reveal Type Properties

Name	Description
Constraints	
Default Setback	A length value whose default is 0.0. When set to positive or negative values, the ends of the wall reveal curve pull back or push forward by the designated amount when they are interrupted at an insert. This allows you to quickly set wall reveals properly near window or door trims. This value is overwritten when you pull the ends manually.
Construction	
Profile	The profile family used to create the reveal.

Wall Reveal Instance Properties

Name	Description
Constraints	
Offset from wall	The distance from the wall face. This setting changes the depth of the reveal.
Level	The reveal's level. This property only appears with horizontal reveals.
Offset from level	The reveal's offset from the level. This property only appears with horizontal reveals.
Dimensions	
Length	The length of the reveal.

Modifying Walls

After creating a wall, you can modify it by changing the wall type or resizing the wall.

Changing Wall Types

When you activate the Wall tool to place walls, you can use the Type Selector drop-down to select different types of walls.

Wall Properties

Walls have properties based on whether they are interior or exterior walls. You can modify the properties of one wall type and set them for all walls of that type. For example, if you set properties for a basic interior wall type, then all interior walls assume those property values. You can also select an instance of a wall and change its parameters only.

NOTE Be aware that the type names do not update upon changing parameters. For example, you could set the width of a 200 mm exterior wall to 250 mm and its name will not change.

Wall Type Properties

Name	Description
Construction	
Structure	Click Edit to create compound walls. See Compound Structure on page 813.
Wrapping at Inserts	Sets the layer wrapping of walls at inserts. See Layer Wrapping on page 815.
Wrapping at Ends	Sets the layer wrapping of wall end caps. See Setting Layer Wrapping on page 816.
Width	Sets the width of the wall.
Function	The purpose of a wall: exterior, interior, retaining, foundation, soffit, or core-shaft. Before creating a wall, you can click Element Properties to see the default instance values for function. See Adding Interior and Exterior Walls on page 634 and Adding Retaining Walls on page 636. The value should be set to Soffit when the wall is attached to a ceiling. In this case, the attachment is made to the surface of the ceiling, regardless of the shape of the ceiling. Function can also be used in scheduling and to create filters that simplify a model when exporting.
Graphics	
Coarse Scale Fill Pattern	Sets a fill pattern for a wall in a coarse-scale view. See View Properties on page 259.
Coarse Scale Fill Color	Applies a color to the fill pattern for a wall in a coarse-scale view.
Identity Data	
Model	Generally, this is not an applicable property for walls.
Manufacturer	Generally, this is not an applicable property for walls.
Type Comments	A field for placing general comments about the wall type.
URL	Link to a web page.
Description	Description of the wall.
Assembly Description	Description of the assembly based on the assembly code selection.
Assembly Code	Unifomat assembly code selected from hierarchical list.
Type Mark	A value to designate the particular wall. Generally, this is not an applicable property for walls. This value must be unique for each wall in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Fire Rating	Fire rating of the wall.
Cost	Cost of the materials for constructing the wall.

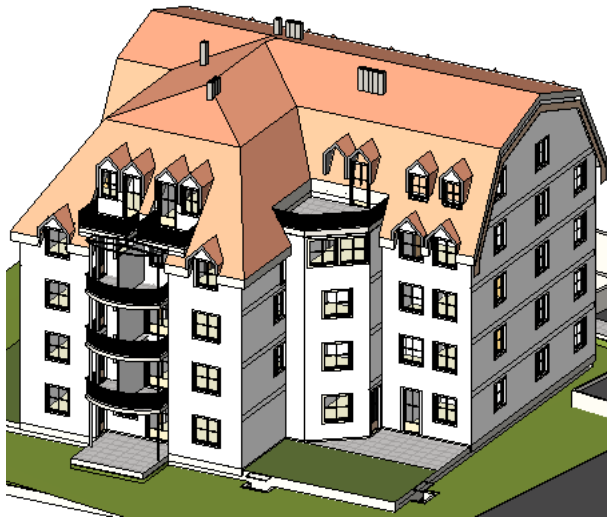
Wall Instance Properties

Name	Description
Constraints	
Location Line	A location line for the wall at the specified plane. The wall location line remains the same for that wall, even if the type changes.
Location Line Offset (for walls used as panels only)	Offsets the wall panel the specified distance and in a direction perpendicular to the face of the curtain wall.
Base Constraint	The base level of the wall. For example, Level 1.
Base Offset	The wall's height from its base constraint. This property is available only when the Base Constraint is set to a level.
Base Is Attached	Indicates whether the base of the wall is attached to another model component, such as a floor. This is a read-only value.
Base Extension Distance	The distance you have moved the base of the layers in a wall. See Compound Structure on page 813. This parameter is enabled when layers of a wall are extendable.
Top Constraint	Wall height extends to value specified in Unconnected Height.
Unconnected Height	The height of the wall when it is sketched.
Top Offset	The offset of the wall from the top level. This parameter is enabled only when the Top Constraint is set to a level.
Top is Attached	Indicates whether the wall top is attached to another model component, such as a roof or ceiling. This is a read-only value.
Top Extension Distance	The distance you have moved the top of the layers in a wall. See Compound Structure on page 813. This parameter is enabled when layers of a wall are extendable.
Room Bounding	If selected, the wall is part of a room boundary. If cleared, the wall is not part of a room boundary. This property is read-only before creating a wall. After you draw the wall, you can select it and then modify this property.
Related to Mass	Indicates that the element was created from a mass element. This is a read-only value.
Structural	
Structural Usage	The structural usage of the wall. This property is read-only before creating a wall. After you draw the wall, you can select it and then modify this property.
Dimensions	
Length	The length of the wall. This is a read-only value.
Area	The area of the wall. This is a read-only value.
Volume	The volume of the wall. This is a read-only value.

Name	Description
Identity Data	
Comments	Specific comments added to describe the wall.
Mark	A label applied to a wall. Usually a numeric value. This value must be unique for each wall in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Categorize as	Indicates whether the wall panel should schedule as a curtain panel or a wall.
Phasing	
Phase Created	The phase when the wall was created.
Phase Demolished	The phase when the wall was demolished.

Roofs

Roofs are components that define different types of roofs for the building design. Various types of roofs can be made in Revit Architecture.

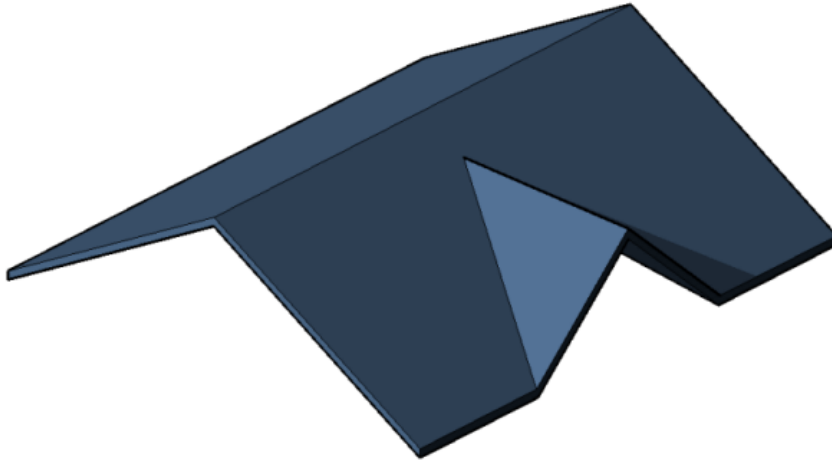


Adding a Roof

Roofs can be made from the building footprint, as extrusions, or from mass instances. For information on adding a roof from a mass instance, see [Creating Roofs from Mass Instances](#) on page 622. A roof cannot cut through windows or doors.

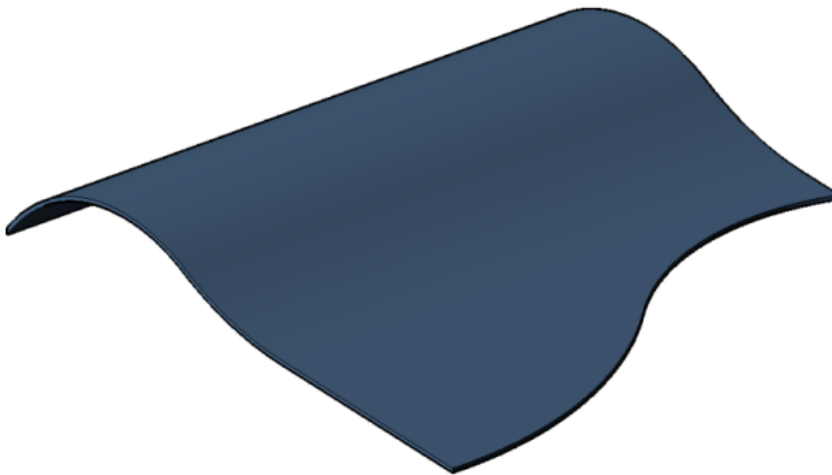
With the Roof by Footprint tool, you specify the footprint or outline of the roof in a plan view. You then define the slopes of the roof by identifying lines in the footprint that are edges of sloping roof planes.

Roof by footprint



With the Roof by Extrusion tool, you sketch the profile of the roof from an elevation view and then extrude it. You can specify the depth of the extrusion by setting start and end points, or let Revit Architecture calculate the depth based on the size and shape of the sketch.

Roof by extrusion



Adding a Roof by Footprint

The roof footprint is a 2D sketch of the perimeter of the roof, which you create by drawing lines or by selecting walls to define the roof profile. The footprint sketch is created at the level of the plan view where it is sketched. You can control the height of the start of the sloping roof plane using the Base Height Offset property for the roof. The sketch must contain a closed loop representing the outside or perimeter of the roof. The roof sketch may also contain other closed loops, which define openings in the roof.

Sketching a Roof by Footprint

- 1 Display a floor plan view or a reflected ceiling plan view.
- 2 Click Home tab ► Build panel ► Roof drop-down ► Roof By Footprint.

NOTE If you try to add a roof on the lowest level, a dialog prompts you to move it to a higher level. If you choose not to move the roof to a different level, Revit Architecture notifies you later if the roof is too low.

- 3 Click Create Roof Footprint tab ► Draw panel, and select a sketch or pick tool.

Sketch tools allow you to create the roof by clicking and moving the cursor; pick tools allow you to select existing lines or walls.


To edit roof properties before sketching, click Properties.

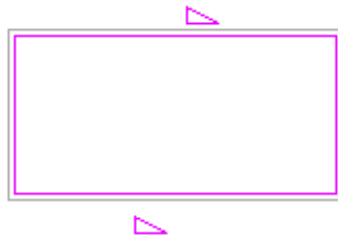
TIP When using Pick Walls, you can specify the overhang before you sketch the roof. On the Options Bar, select Extend to wall core if you want the overhang to be measured from the core of the wall, and then specify a value for Overhang.

- 4 Sketch, or pick, a closed loop for the roof.

- 5 Set slope defining lines.

To change the slope definition of a line, select the line and, on the Options Bar, click the Defines slope check box. For lines that are slope defining, you can change the slope value by clicking the line and editing the value.

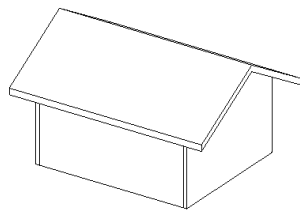
When a roof line is set to slope defining, this symbol appears adjacent to it . In the following image, the top horizontal line and the bottom horizontal line are slope defining.



- 6 Click Finish Roof.

To see the roof, open a 3D view.

Completed gable roof with overhang



Related topics

- [Footprint Roof Tips](#) on page 678
- [Adding a Roof by Extrusion](#) on page 678
- [Adding Sloped Glazing](#) on page 680
- [Roofs](#) on page 675

Footprint Roof Tips

- To cut off a roof in order to sketch another roof on top of it, use the Cutoff Level constraint in the Instance Properties, and then specify a height for the Cutoff Offset. This property specifies the distance above or below the level at which the roof is cut off.
- If a roof includes a slope-defining arc line, you can specify the number of segments for the line. Access the Instance Properties for the arc line and specify a value for Number of Full Segments. By default, 4 segments are created. If you specify zero segments, a conical roof is created.

Adding a Roof by Extrusion

You create extruded roofs in relation to a level in a project. You can use a combination of straight lines and arcs to create the profile of the roof. The height of the roof depends on the location where you sketch the profile in the elevation view.

When you sketch a roof by extrusion, if you did not specify start and end points, Revit Architecture calculates a depth for you based on the size of the shape you sketched. For more information about start and end points for extrusions, see [Start and End Points for Extruded Roofs](#) on page 680.

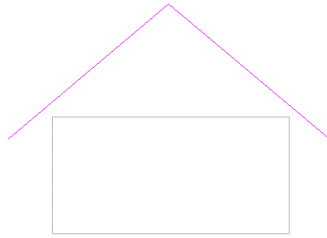
It is helpful to use reference planes when sketching the profile of an extruded roof. For example, sketch 3 vertical reference planes parallel to one another, and then sketch a horizontal reference plane that intersects all 3 vertical planes.

The Roof by Extrusion tool lets you create a roof with simple slopes. To create a roof with complex slopes, you can use massing. See [Creating Roofs from Mass Instances](#) on page 622.

After you create a roof by extrusion, you can rehost the roof or edit the work plane of the roof. For more information, see [Rehosting Work Plane-based and Face-based Elements and Components](#) on page 812 and [Changing the Work Plane of an Element](#) on page 318.

Sketching a Roof by Extrusion

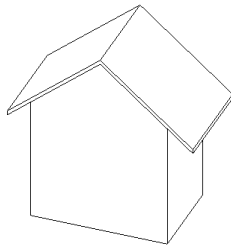
- 1 Display an elevation, 3D, or section view.
- 2 Click Home tab ► Build panel ► Roof drop-down ► Roof By Extrusion.
- 3 In the Work Plane dialog, select an option for specifying the work plane. For more information on work planes, see [Sketching and Work Planes](#) on page 317.
- 4 To specify the reference level and offset for the roof, click Create Extrusion Roof Profile tab ► Element panel ► Roof Properties.
 - a In the Instance Properties dialog, select a value for Reference Level. The highest level in the project is selected by default.
 - b Specify a value for Offset to raise or lower the roof from the reference level.
Revit Architecture places a reference plane at the specified offset. Using the reference plane, you can control the position of the extruded roof in relation to a level.
 - c Click OK.
- 5 Sketch the profile of the roof. The profile must be an open loop, as shown in the following image.



6 Click Finish Roof.

To see the roof, open a 3D view.

Completed extruded roof



If you need to attach walls to the roof, select the walls and click Modify Walls tab ► Modify Wall panel ► Attach. Then, select the roof. See [Attaching Walls to Other Components](#) on page 651 for more information.

After you create a roof by extrusion, you can rehost the roof or edit the work plane of the roof. For more information, see [Rehosting Work Plane-based and Face-based Elements and Components](#) on page 812 and [Changing the Work Plane of an Element](#) on page 318.

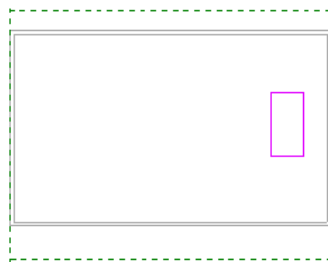
Cutting Openings in an Extruded Roof

- 1 Select the extruded roof, and click Modify Roofs tab ► Modify Roof panel ► Vertical Opening.
- 2 If the Go to View dialog is displayed, choose the appropriate plan view in which to edit the profile.

A plan view representation of the roof is displayed. Reference planes define the boundary of the roof.

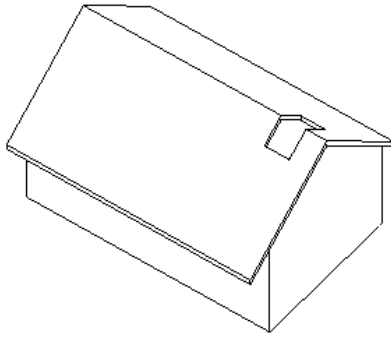
- 3 Sketch closed-loop openings in the roof using the sketch tools.

Closed-loop sketches in sketch mode



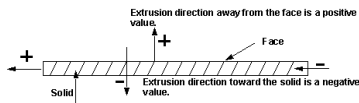
- 4 Click Finish Roof.

Closed-loop sketches become vertical cuts in the roof



Start and End Points for Extruded Roofs

The extrusion of a roof can extend in either direction along the plane perpendicular to the face of a solid component (such as a wall). If the extrusion extends away from the solid, the start and end points are positive values. If the extrusion extends toward a solid component, the start and end points are negative.



You can edit the start and end points through the roof properties. See [Roof Properties](#) on page 703 for more information.

Adding Sloped Glazing

You can create sloped glazing using the footprint or extrusion method. Sloped glazing has one or more slope-defining lines and can join to curtain walls and basic wall types.

Sketching Sloped Glazing

1 Click Home tab ► Build panel ► Roof drop-down ► Roof By Footprint or Roof By Extrusion.

NOTE If you try to create a roof on the lowest level, a dialog prompts you to move it to a different level, ensuring that the roof is higher than any walls joining to it. If you choose not to move the roof to a different level, Revit Architecture notifies you later if the roof is too low.

2 Sketch the roof.

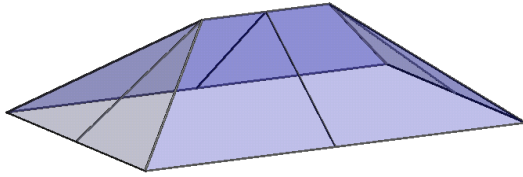
3 If the roof is based on a footprint, specify roof boundary lines as slope-defining, or use the roof slope arrow to define the slope. See [Slope Arrow](#) on page 685.

4 Click Finish Roof.

5 Select the roof, and in the Type Selector drop-down, select Sloped Glazing.

You can place curtain grids on the curtain panels of the sloped glazing. Press *Tab* to switch between horizontal and vertical grids.

Sloped glazing with mullions and grid lines



Joining and Unjoining Roofs

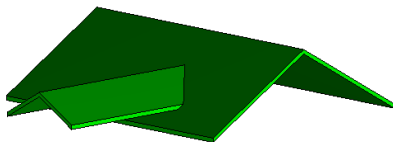
Use the Join/Unjoin Roof tool to join roofs to other roofs or walls, or to unjoin them if they were previously joined. This tool is especially useful if you have already sketched roofs and walls and then want to change your design by adding smaller roofs to create dormers or awnings.

Joining Roofs

NOTE This is a general procedure for joining roofs. You may have variations based on design intent.

- 1 Sketch walls and roofs for your design.
See [Adding Interior and Exterior Walls](#) on page 634 and [Adding a Roof](#) on page 675.
- 2 Sketch a minor roof near your building design, and then use the Roof tool to create the roof.
Note that you cannot add a minor roof by editing the sketch of the major roof.
- 3 If desired, set the lines of the minor roof to be slope defining, except the roof line that will be coincident with the major roof or the wall. See [Roof Slope](#) on page 685.
- 4 If a 3D view of your sketch has not been created already, click View tab ► Create panel ► 3D View.
- 5 On the View Control Bar, select Shading for Model Graphics Style.
- 6 If necessary, spin the design to facilitate selecting the edges of the wall or the major roof and the minor roof.
- 7 Click Modify tab ► Edit Geometry panel ► Join/Unjoin Roof.
- 8 Select one edge on the end of the minor roof that you want to join.
- 9 Select a face on the wall or major roof to which you want to join the minor roof.
Revit Architecture joins the roof.

Joined roofs



Unjoining Roofs

When applied to joined roofs, the Join/Unjoin Roof tool works just like Undo. However, the tool allows you to unjoin the roof, regardless of how many operations you may have performed since using the tool to join the roofs.

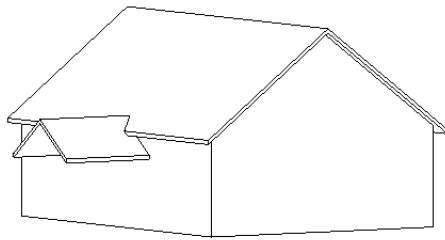
- 1 Click Modify tab ► Edit Geometry panel ► Join/Unjoin Roof.

- 2 Select an edge of the minor roof that is joined to the wall or major roof.
Revit Architecture unjoins the roof.

Tips for Joining Roofs

- The Join/Unjoin Roof tool does not join or unjoin a wall to a roof. To join a wall to a roof, select the wall and click Modify Walls tab ► Modify Wall panel ► Attach. See [Attaching Walls to Other Components](#) on page 651.
- You cannot join a roof to more than one top face of another roof.
- You can join a roof to the top face of another roof and the wall below that roof if you select the wall as the target. The wall must be attached to the target roof and the target roof must be a footprint roof.

Roof joined to other roof and wall



Modifying a Roof

You can modify the appearance of roofs in several ways.

If you edit the roof sketch, you can: change the shape of the sketch, change the slope of the roof, add cutouts or holes to a roof, or change the height of the roof. You can also make some modifications to roofs from a project view, such as resizing the roof or roof ridges.

After completing the roof, you can change its position by moving its base level, either graphically or by editing properties. If you are in sketch mode and click Properties, you can edit the Base Level and Offset properties to change the position of the reference plane. When you return to a project view, the roof has moved according to the changes to the reference level.

In a project view, you might be warned that the roof geometry cannot move when you attempt to change the base level or offset. Edit the roof sketch, and check for constraints on the sketch, such as between a level line and a sketch line of the roof.

Changing the Roof Type

To change the roof type in sketch mode

- 1 Click Create Roof tab ► Draw panel ► Properties.
- 2 In the Instance Properties dialog, select a roof type from the Type list.
- 3 Click OK.

To change the roof type in a project view

- 1 Select the roof in the project view.
- 2 Click Modify Roofs tab ► Element panel ► Element Properties.
- 3 In the Instance Properties dialog, select a different roof type.

Editing a Roof Sketch

- 1 In the drawing area, select the roof.
- 2 If you created the roof by footprint, click Modify Roofs tab ► Edit panel ► Edit Footprint.
If you created the roof by extrusion, click Modify Roofs tab ► Modify Roof panel ► Edit Profile.
- 3 Make necessary changes.
- 4 Click Finish Roof.

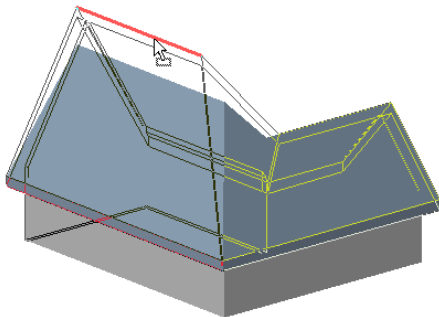
Resizing a Roof

You can resize roofs that were created by footprint or by face using shape handles in elevation or 3D views.

To resize a footprint roof using shape handles

- 1 In an elevation or 3D view, move your cursor over the roof and press *Tab* to highlight the shape handle.
Watch the status bar, which will indicate when you have the shape handle highlighted.
- 2 Click to select the shape handle, then drag it as desired.

Resizing a roof with shape handle



Roof Ridges

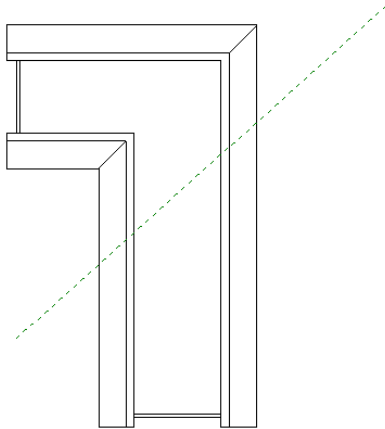
You can align roof ridges in 3D and elevation views. To align roof ridges in an elevation view, use the Align tool. See [Aligning Elements](#) on page 377.

To align in a 3D view, you first must set a work plane in the view that is not perpendicular to the ridges of the roof.

To align roof ridges in an elevation view

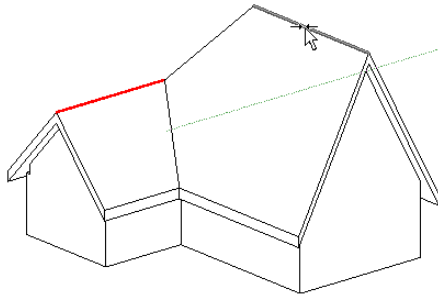
- 1 In a plan view, sketch a reference plane that is not perpendicular to the roof ridges. See [Reference Planes](#) on page 1106.

Reference plane in plan view

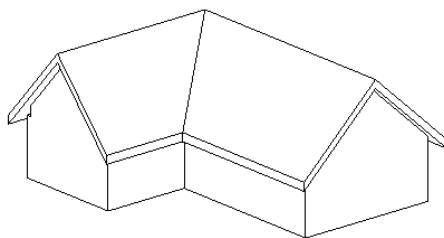


- 2 Select the reference plane, and click Modify Reference Planes tab ► Element panel ► Element Properties.
- 3 In the Instance Properties dialog, enter a name for the reference plane and click OK.
- 4 Open the 3D view, and click Home tab ► Work Plane panel ► Set.
- 5 In the Work Plane dialog, select the work plane name you just created in Step 2, and click OK.
- 6 Use the Align tool to align roof ridges. See [Aligning Elements](#) on page 377.

Unaligned roof ridges



Result of aligned roof ridges



Roof Slope

You can change the slope of any slope-defining lines in a roof without editing the roof. Select the roof and access its properties to view the Slope parameter.

Roof Slope

You can define different slopes and overhangs for the roof; Revit Architecture warns you if it cannot create the roof geometry based on the specified values for slope and overhang.

You can specify a selected footprint line to be slope-defining. When sketching the roof do one of the following:

- Select the footprint line and click Create Roof Footprint tab ► Draw panel ► Properties. In the Instance Properties dialog, select the check box for Defines Roof Slope.
- Select the footprint line, and on the Options Bar, select Defines Slope.

To specify the slope of a slope-defining line, select the line. A numeric control displays with the line. This is the slope value. Enter a value for the slope.

You can then change the height and the angle of the roof. If you do not define any of the lines as slope-defining, the roof is flat. If you define one side of the roof as sloping, the result is a shed roof. If you define 2 lines on opposite sides, the result is a gable roof. If you define slope lines on 4 sides, the result is a hip roof.

Lines that are not specified as slope-defining are considered trimming lines. By extruding these lines vertically, you can trim the surface of the roof.

Slope Arrow

Use the Slope Arrow tool to create elements that include slopes. You can use the Slope Arrow tool for floors, ceilings, soffits, and roofs. For example, to create a flat sloping roof when no footprint boundary lines are specified as slope-defining lines, sketch a slope arrow from the corners of the roof sketch.

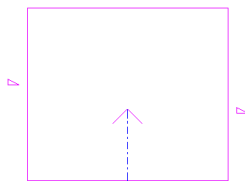
What is the Slope Arrow?

A slope arrow is an alternative way to define the slope of a roof, floor, ceiling, or soffit, using a line in the direction of the slope. You can specify the height at the head of the slope arrow and either the height at the tail or a slope value (rise over run) using the properties of the slope arrow. The tail of the slope arrow must be on one of the sketched lines that defines the boundary. The sketched line containing the tail cannot be slope-defining, unless the slope arrow is at a vertex, because that would specify conflicting slopes for the same segment.

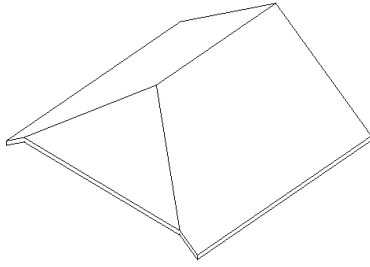
Use the slope arrow when you know the height at the top and bottom of the element plane, rather than the slope. For example, slope arrows can be used to adjust a flat roof to satisfy a particular height at a drainage point. Another good example is creating a hip on gable roof.

NOTE The slope arrow tail cannot start from a slope-defining boundary line.

Proper sketch for creating hip on gable roof with slope arrow



Resulting hip on gable roof created from slope arrows



In this example, Height Offset at Tail is 4 feet, Slope is selected for Specify, and 12 is specified for Slope.

NOTE You could obtain the same result by specifying the bottom sketch line as slope-defining, and specifying an appropriate value for Offset From Roof Base.

Accessing the Slope Arrow Tool for Roofs

1 Click Home tab ► Build panel ► Roof.

If you have already created your roof, select the roof in the drawing area and click Modify Roofs tab ► Edit panel ► Edit Footprint.

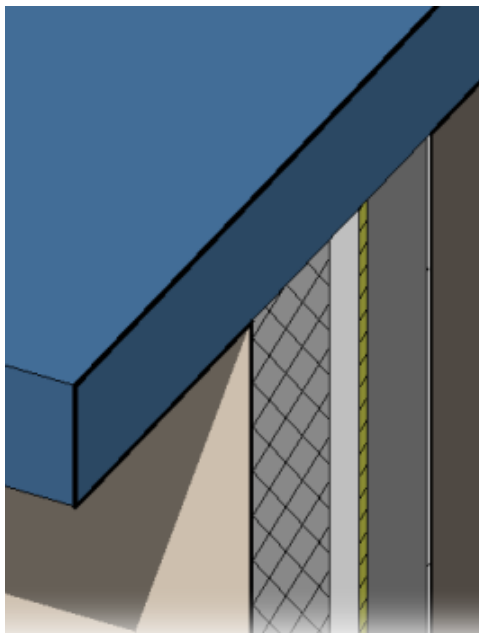
2 Click Create Roof Footprint tab or Modify Roofs > Edit Footprint tab ► Draw panel ► Slope Arrow.

Eaves

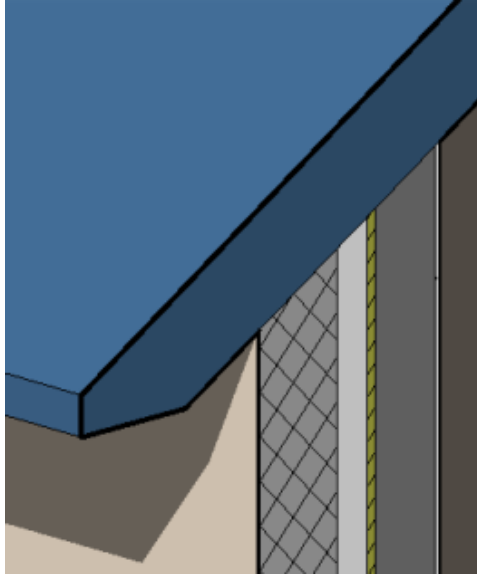
When you sketch a roof, you create eaves by setting an overhang value. Once you complete the sketch of the roof, you can align eaves and change the eave cut. For more information on sketching a roof, see [Adding a Roof](#) on page 675.

Eaves can be cut as

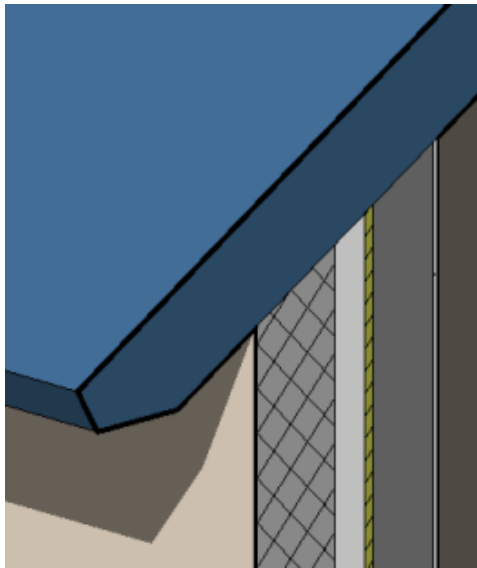
- Plumb cut eave



■ 2-cut plumb eave



■ 2-cut square eave



Creating a Plumb Cut, Two-Cut Plumb, or Two-Cut Square Eave

- 1 Select the roof in a project view.
- 2 Click Modify Roofs tab ► Element panel ► Element Properties.
- 3 In the Instance Properties dialog, for Rafter Cut, select Plumb Cut, Two Cut - Plumb, or Two Cut - Square.
- 4 For Two Cut - Plumb and Two Cut Square, specify a value for Fascia Depth between zero and the thickness of the roof.
- 5 Click OK.

Eaves


Use the Align Eaves tool to realign eave heights of different boundary lines of a roof.

- 1 If you are not already in sketch mode, select the roof and click Modify Roofs tab ► Edit panel ► Edit Footprint.
- 2 Click Modify Roofs > Edit Footprint tab ► Tools panel ► Align Eaves.
- 3 Click a roof eave to align the others to. Note that dimensions are displayed near the eaves to indicate their height.
- 4 On the Options Bar, click Adjust Height or Adjust Overhang, and then click on an eave. As you select the remaining eaves, you can choose between adjusting the height or the overhang if you created the lines using Pick Walls. If you used the drew the lines, only Adjust Height is available. These functions allow you to adjust the eave height or eave overhang. The Adjust Height option changes the Plate height from roof base or Offset from roof base value. The Adjust Overhang option changes the eave height by adjusting the Overhang value. See [Roof Properties](#) on page 703.
- 5 Click Finish Roof.

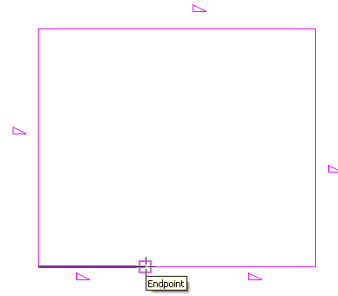
The results of adjusting the overhang are visible after you finish the roof.

Dormers

Creating a Dormer Using Slope Arrows

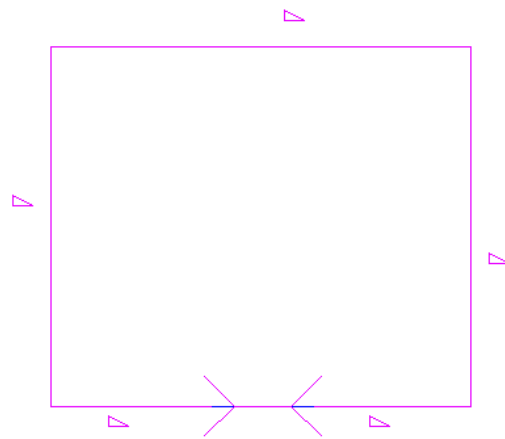
- 1 Sketch a roof footprint, including slope-defining lines. See [Adding a Roof by Footprint](#) on page 676.
- 2 While in sketch mode, click Create Roof Footprint tab ► Edit panel ► Split.
- 3 Split one of the lines in the footprint at 2 points, creating a middle line segment (the dormer segment).
This line segment defines the width at the bottom of the dormer. See [Splitting Walls and Lines](#) on page 408.
- 4 If a slope symbol  displays next to the dormer segment, change its properties so it does not define slope:
 - a While still in sketch mode, click Modify.
 - b Select the segment.
 - c On the Options Bar, clear Defines slope.
- 5 Click Slope Arrow, and sketch a slope arrow from one end of the dormer segment to its midpoint.

Correct placement of cursor for slope arrow



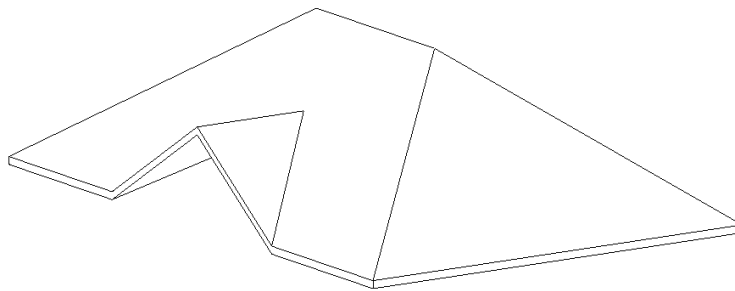
6 Click Slope Arrow again, and sketch a second slope arrow from the other end of the dormer segment to its midpoint.

Properly sketched slope arrows



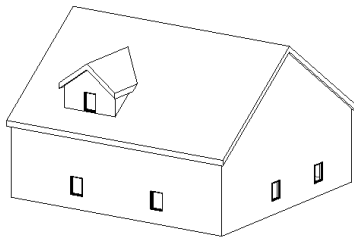
7 Click Finish Roof, and open a 3D view to see the results.

Hip roof with dormer

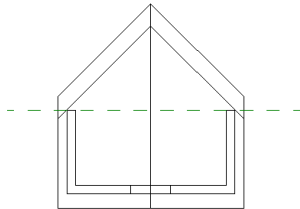


Creating a Dormer Opening in a Roof

1 Start with a building model in which a dormer has been created.



- 2** Open a plan view or an elevation view in which you can see the dormer roof and the attached walls. If the roof is extruded, open an elevation view.



- 3** Click **Modify** tab ► **Edit Geometry** panel ► **Openings** drop-down ► **Dormer Opening**.

- 4** Highlight the main roof on the building model, and click to select it.

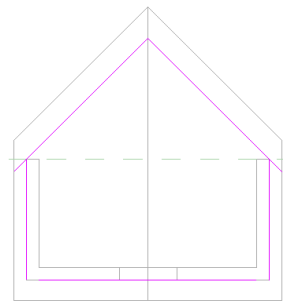
Watch the status bar to be sure that you are highlighting the main roof.

The **Pick Roof/Wall Edges** tool is active so that you can pick the boundaries that compose the dormer opening.

- 5** Place the cursor in the drawing area.

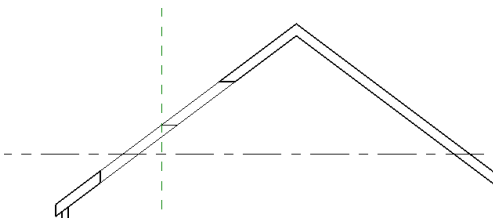
Valid boundaries are highlighted. Valid boundaries are a joined roof or its bottom face, a side face of a wall, a bottom face of a floor, an edge of the roof to be cut, or a model line on the face of the roof to be cut.

In this example, side faces of walls and joined faces of the roof were selected. Note that you do not need to trim the sketch lines to have a valid boundary.



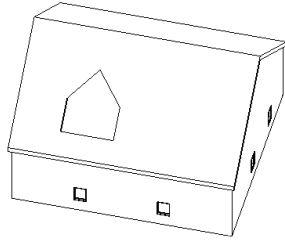
- 6** Click **Finish Opening**.

- 7** Create a section view through the dormer to see how it cuts the main roof.



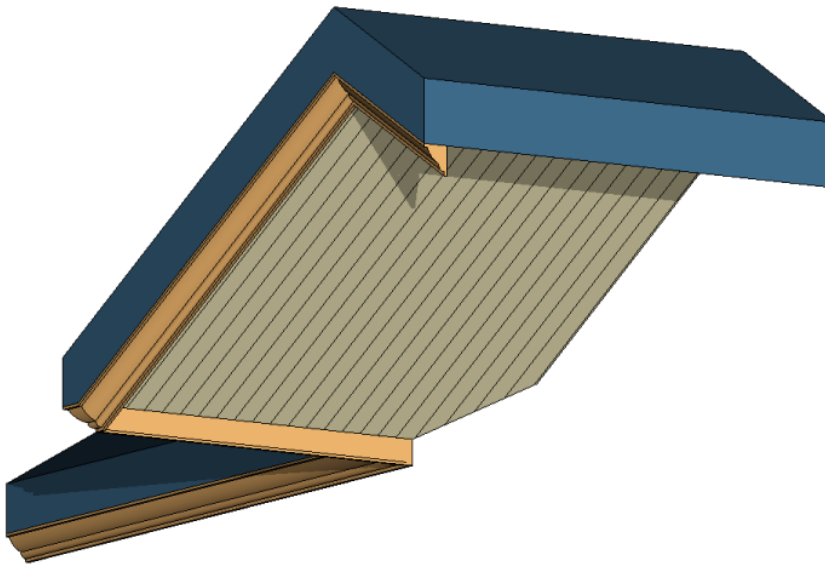
Revit Architecture makes both vertical and horizontal cuts in the roof.

Dormer opening in a 3D view



Fascia

You can add fascia to edges of roofs, soffits, and other fascias. You can also add fascia to model lines.



You can place fascia in 2D views, such as plan or section views, or 3D views.

Adding Roof Fascia

1 Click Home tab ► Build panel ► Roof drop-down ► Fascia.

2 Highlight edges of roofs, soffits, other fascia, or model lines, and click to place the fascia.

As you click edges, Revit Architecture treats this as one continuous fascia. If the fascia segments meet at corners, they miter.

NOTE Watch the status bar. It will indicate valid references or points where you can place fascia. For example, if you are placing fascia on a roof, a valid reference might be: Roofs : Basic Roof : Reference. When you place fascia in a section view, place the cursor near the corners of the element to highlight the reference or press *Tab*.

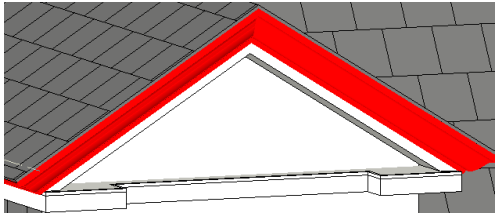
3 Click Place Fascia tab ► Profile panel ► Finish Current to finish the current fascia and start a different fascia.

4 Move the cursor to a new edge and click to place.

This different fascia does not miter with other existing fascias, even if they meet at the corners.

5 Click onto white space in the view to finish placing roof fascias.

Crown molding fascia



NOTE Fascia profiles miter correctly only around a square cut roof. The roof in this image was created by running a fascia along the edge of a roof with a Two-Cut Square rafter cut. For information on setting this property, see [Creating a Plumb Cut, Two-Cut Plumb, or Two-Cut Square Eave](#) on page 687.

Resizing or Flipping Roof Fascias

To resize roof fascia

1 In the drawing area, select the fascia.

If there are many elements near the fascia that make selection difficult, you can use the filter selection tool to select the fascia. Highlight the area where the fascia is using a pick box, and click Multi-Select tab ► Filter panel ► Filter. Select only Fascias and click OK.

2 Move the drag controls to the desired location.

For more information on using drag controls, see [Controls and Shape Handles](#) on page 349.

To flip roof fascia

1 In the drawing area, select the fascia.

2 If you are in a 3D view, click the flip controls that appear to flip the fascia around the vertical or horizontal axis.

If you are in a 2D view, right-click the fascia and select Flip About Horizontal Axis or Flip About Vertical Axis.

Adding or Removing Segments of the Fascia

1 In the drawing area, select the fascia.

If there are many elements near the fascia that make selection difficult, you can use the filter selection tool to select the fascia. Highlight the area where the fascia is using a pick box, and click Multi-Select tab ► Filter panel ► Filter. Select only Fascias and click OK.

2 Click Modify Fascias tab ► Profile panel ► Add/Remove Segments.

3 Click a reference edge to add a fascia or remove a fascia.

NOTE Watch the status bar. It will indicate valid references, or points where you can add or remove fascia. For example, if you are adding fascia to a roof, a valid reference might be: Roofs : Basic Roof : Reference. When you add or remove segments of fascia in a section view, place the cursor near the corners of the element to highlight the reference or press **TAB**.

Changing Mitering Options for Roof Fascia

1 In the drawing area, select the fascia.

If there are many elements near the fascia that make selection difficult, you can use the filter selection tool to select the fascia. Highlight the area where the fascia is using a pick box, and click Multi-Select tab ► Filter panel ► Filter. Select only Fascias and click OK.

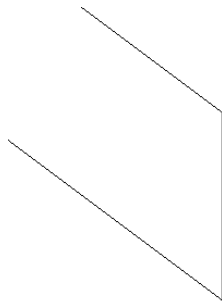
2 Click Modify Fascias tab ► Roof Fascia panel ► Modify Mitering.

3 Select a mitering option:

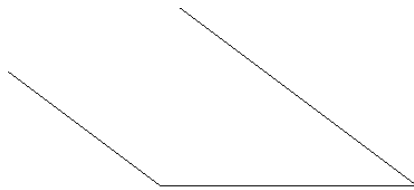
- Vertical
- Horizontal
- Perpendicular

4 Click on the end face of the fascia to change the miter option.

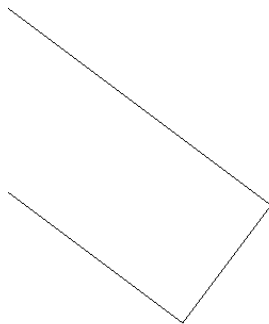
Vertical miter



Horizontal miter

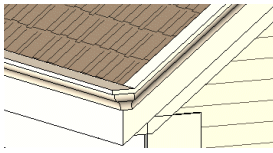


Perpendicular miter



5 Press *Esc* to exit the Modify Mitering tool.

Roof fascias can miter between the eave and rake edges of a plumb-cut gable roof.



Changing Horizontal and Vertical Offset of Roof Fascia

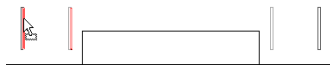
You can change the horizontal or vertical offset of a fascia either through its properties or by graphically moving the fascia. To change the offset through properties, see [Roof Properties](#) on page 703.

Changing Horizontal Offset of Roof Fascia

To move a single fascia

- Select the fascia and drag it horizontally.

Moving fascia on the left also moves fascia on the right



To move multi-segmented fascia

- 1 Place the cursor over the fascia and press *Tab* to highlight the shape handle. The status bar indicates when you are highlighting the shape handle.

- 2 Click to select the shape handle.

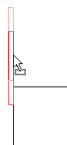
- 3 Move the cursor left or right to change the horizontal offset.

This affects the horizontal offset of all segments of the fascia, so the segments are symmetrical.

Changing Vertical Offset of Roof Fascia

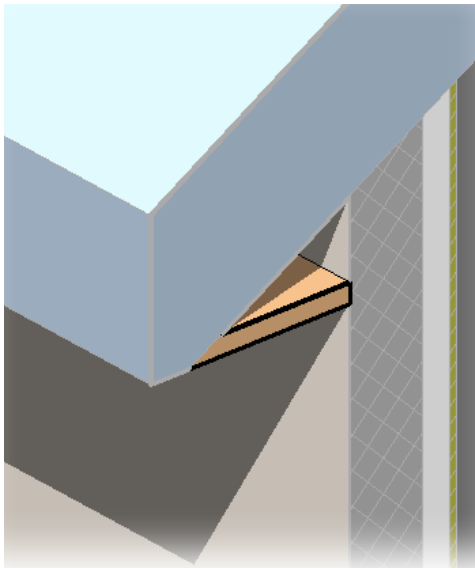
- Select the fascia and drag it up or down. If the fascia is multi-segmented, then all segments move up or down the same distance.

Fascia moving vertically in section



Roof Soffits


Use the Roof Soffit tool to create roof soffits.



Adding Roof Soffits

Design intent for creating roof soffits can vary widely. This procedure creates a soffit from a 2-loop sketch between a wall and a roof. The soffit is associated with the walls and the roof. To create non-associative soffits, use the Lines tool while in sketch mode.

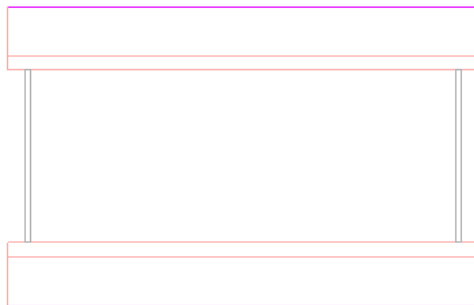
1 Click Home tab ► Build panel ► Roof drop-down ► Roof Soffit.


2 Click Create Roof Soffit Boundary tab ► Draw panel ►  (Pick Roof Edges).

This tool creates a locked sketch line.

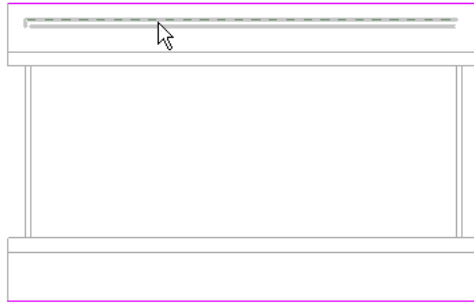
3 Highlight the roof, and click.

Roof selected with Pick Roof Edges tool

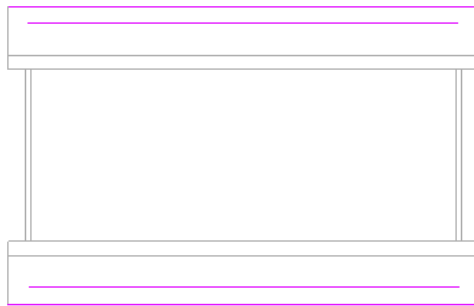


4 Click Create Roof Soffit Boundary tab ► Draw panel ►  (Pick Walls), highlight the outside faces of the wall beneath the roof, and click to select.

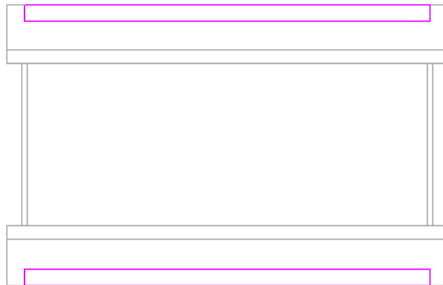
Wall highlighted for soffit line



Sketch lines for soffit after picking walls



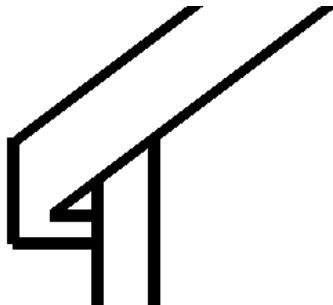
5 Use the Trim tool to trim the excess sketch lines and close the sketch loop. See [Trimming and Extending Elements](#) on page 390.



6 Click Finish Soffit.

To see the soffit better, create a section view through the plan view that shows the wall meeting the roof. See [Creating a Section View](#) on page 138.

Roof, soffit, and wall in section view



NOTE The Join Geometry tool was used to join the soffit and the roof in the previous illustration. To complete the image, use the Join Geometry tool to join the soffit to the wall, and the wall to the roof. See [Joining Geometry](#) on page 406.

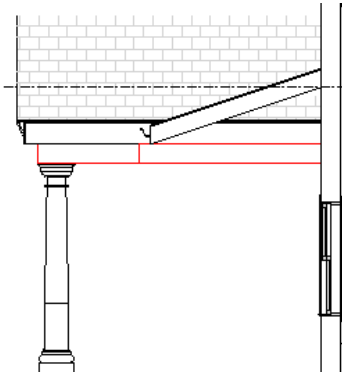
You can use the Slope Arrow tool to create a sloping soffit. See [Slope Arrow](#) on page 685.

Related topic

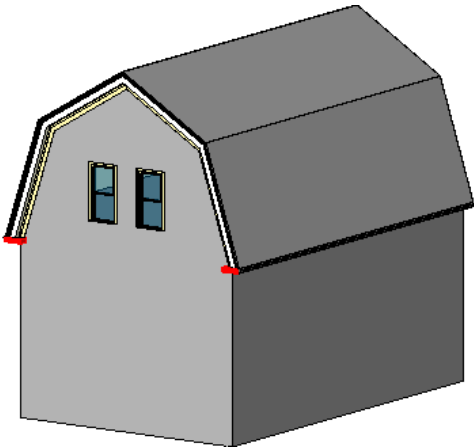
- [Roof Soffit Examples](#) on page 697

Roof Soffit Examples

Soffit selected in elevation view

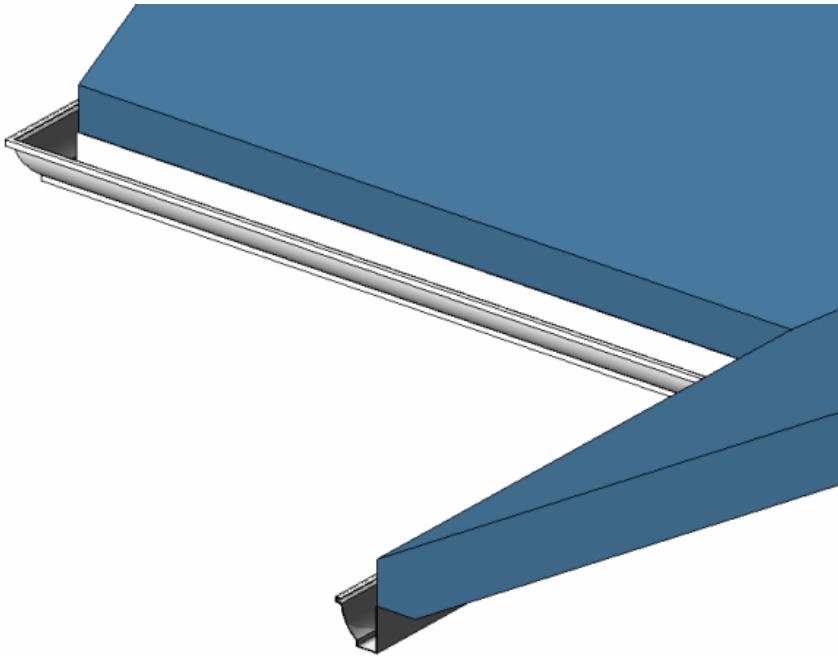


Soffits selected on model with gambrel roof



Roof Gutters

You can add gutters to edges of roofs, soffits, and fascia. You can also add gutters to model lines.



You can place gutters in 2D views, such as plan or section views, or 3D views.

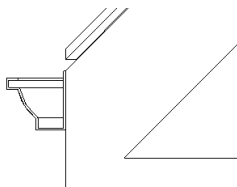
Adding Roof Gutters

- 1 Click Home tab ► Build panel ► Roof drop-down ► Gutter.
- 2 Highlight horizontal edges of roofs, soffits, fascias, or model lines, and click to place the gutter.
As you click edges, Revit Architecture treats this as one continuous gutter.

NOTE Watch the status bar. It will indicate valid references, or points where you can place roof gutters. For example, if you are placing a gutter on a roof, a valid reference might be: Roofs : Basic Roof : Reference. When you place gutters in a section view, place the cursor near the corners of the element to highlight the reference or press *TAB*.

- 3 Click Place Gutter tab ► Profile panel ► Finish Current to finish the current gutter and start a different gutter.
- 4 Move the cursor to a new edge, and click to place.
- 5 To finish placing gutters, click on white space in the view.

Gutter in section



Related topics

- [Resizing or Flipping Roof Gutters](#) on page 699
- [Adding or Removing Segments of the Gutter](#) on page 699

- [Changing Horizontal and Vertical Offset](#) on page 699
- [Roof Gutters](#) on page 697

Resizing or Flipping Roof Gutters

To resize roof gutters

- 1 In the drawing area, select the gutter.
If there are many elements near the gutter that make selection difficult, you can use the filter selection tool to select the gutter. Highlight the area where the gutter is using a pick box, and click Multi-Select tab ► Filter panel ► Filter. Select only Gutters and click OK.
- 2 Move the drag controls to the desired location.
For more information on using drag controls, see [Controls and Shape Handles](#) on page 349.

To flip roof gutters

- 1 In the drawing area, select the gutter.
- 2 If you are in a 3D view, click the flip controls to flip the gutter around the vertical or horizontal axis.
If you are in a 2D view, right-click the gutter and select Flip About Horizontal Axis or Flip About Vertical Axis.

Adding or Removing Segments of the Gutter

- 1 In the drawing area, select the gutter.
If there are many elements near the gutter that make selection difficult, you can use the filter selection tool to select the gutter. Highlight the area where the gutter is using a pick box, and click Multi-Select tab ► Filter panel ► Filter. Select only Gutters and click OK.
- 2 Click Modify Gutters tab ► Profile panel ► Add/Remove Segments.
- 3 Click a reference edge to add a gutter or remove a gutter.

NOTE Watch the status bar. It will indicate valid references, or points where you can add or remove gutters. For example, if you are adding gutters to a roof, a valid reference might be: Roofs : Basic Roof : Reference. When you add or remove segments of a gutter in a section view, place the cursor near the corners of the element to highlight the reference, or press **TAB**.

Changing Horizontal and Vertical Offset

You can change the horizontal or vertical offset of a gutter through its properties or by graphically moving the gutter. See [Roof Fascia and Gutter Instance Properties](#) on page 707.

Horizontal Move

To move a single gutter segment, select the gutter and drag it horizontally.

To move a multi-segmented gutter, you need to select the shape handle of the gutter. Place the cursor over the gutter and press **Tab** to highlight the shape handle. Watch the status bar to be sure you are highlighting the shape handle. Click to select the shape handle. Move the cursor left or right to change the horizontal offset. This affects the horizontal offset of all segments of the gutter, so that the segments are symmetrical.

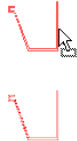
Moving gutter on the left also moves gutter on the right



Vertical Move

Select the gutter and drag it up or down. Note that if the gutter is multi-segmented, then all segments move up or down the same distance.

Gutter moving vertically in section



Roof Examples

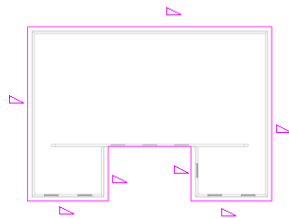
This topic contains several roof examples.

Roof with Intersecting Slope Lines at Different Heights

The following procedure shows you how to create a roof with slope-defined lines at different elevations by joining 2 separate roofs.

TIP This procedure works best with a multi-level building.

- 1 Create a footprint roof sketch, similar to the following:

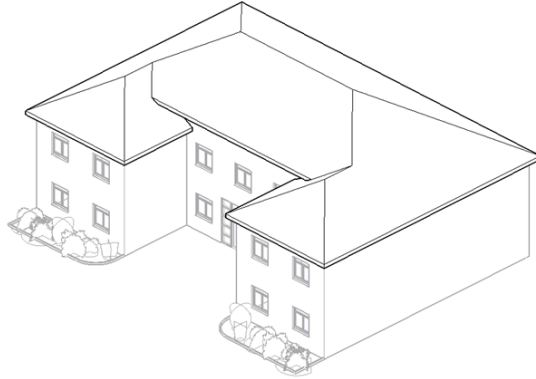


- 2 Click Create Roof Footprint tab ► Element panel ► Roof Properties.
- 3 In the Instance Properties dialog, specify a cutoff level for the roof. For example, if you are sketching the roof on level 2, you might specify level 4 as the cutoff level.
- 4 Click Finish Roof.
- 5 Create another footprint roof sketch at a higher level, similar to the following:

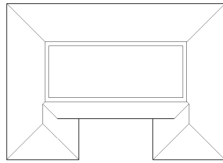


- 6 Click Finish Roof.

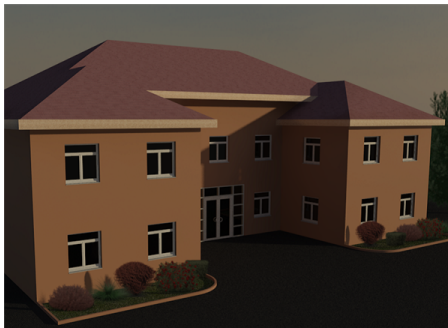
7 In a 3D view, select both roofs, and click Modify tab ► Edit Geometry panel ► Join.



8 View the 2 roofs in a plan view:



You now have a single roof with different eave heights.
Here is the finished house with that roof style.



Four-Sided Gable Roof

A common building scenario is a 4-sided gable roof. The following is a quick procedure to create this look.

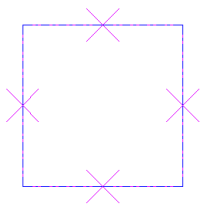


NOTE The results of this procedure will differ from the finished pictures.

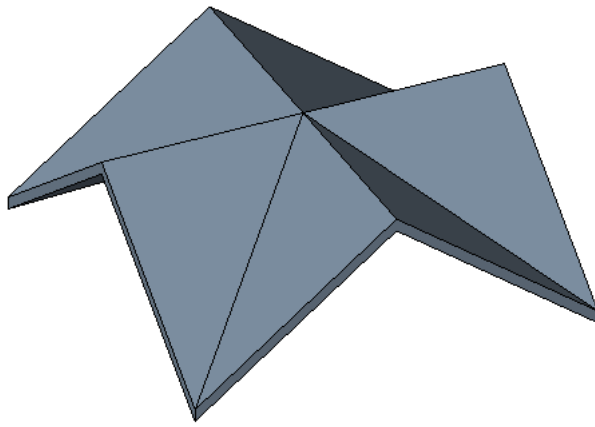
- 1 Create a square footprint sketch and toggle all sketch lines to be non-slope-defining:



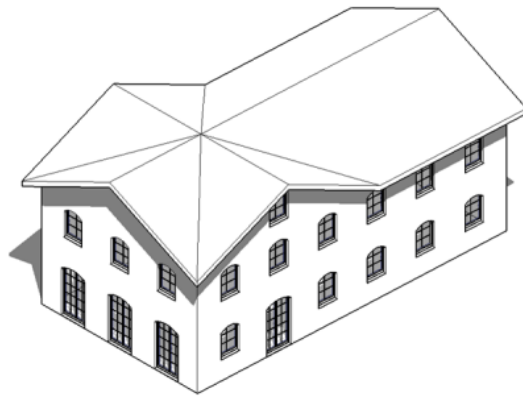
- 2 Click Create Roof Footprint tab ► Draw panel ► Slope Arrow.
- 3 Click Properties.
- 4 For the Specify parameter, select Slope.
- 5 For the Slope parameter, enter 9", or the metric equivalent.
- 6 Sketch slope arrows as shown.



- 7 Click Finish Roof.
- 8 Open the roof in 3D.



Following is a completed roof on a model.



Roof Properties

You can modify several properties for roofs, including slope and structure. You can also modify parameters for roof boundary lines, roof fascia, and roof gutters.

Modifying Roof Properties

- 1 If you are in sketch mode, click Create Roof Footprint tab or Create Extrusion Roof Profile tab ► Element panel ► Roof Properties.
- 2 In the Instance Properties dialog, edit roof instance parameters as desired.
See [Roof Instance Properties](#) on page 704.
- 3 To edit roof type parameters, click Edit Type. Change the roof type parameters as desired, and click OK.
See [Roof Type Properties](#) on page 704.

NOTE Changes made to type parameters affect all roofs of this type in the project. You can click Duplicate to create a new roof type.

- 4 Click OK twice.

Roof Type Properties

Name	Description
Construction	
Structure	Defines the composition of a compound roof. See Compound Structure on page 813.
Default Thickness	Indicates the thickness of the roof type, which is determined by the cumulative thickness of its layers. This is a read-only property.
Graphics	
Coarse Scale Fill Pattern	The fill pattern for a roof displayed at a coarse detail level.
Coarse Scale Fill Color	Applies a color to the fill pattern for a roof in a coarse-scale view.
Identity Data	
Keynote	Add or edit the roof keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The model type for the roof.
Manufacturer	The manufacturer of the roof.
Type Comments	Comments about the roof.
URL	Link for a manufacturer web page.
Description	Description of the roof.
Assembly description	Description of the assembly, based on the assembly code selection.
Assembly code	Unifomat assembly code selected from hierarchical list.
Type Mark	A value to designate the particular roof. This value must be unique for each roof in a project. Revit Architecture issues a warning if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Cost	Cost of the roofing material. The cost can be included in a schedule.

Roof Instance Properties

Name	Description
Constraints	
Base Level	Sets the level for the footprint or extruded roof.
Room Bounding	If selected, it means the roof is part of a room boundary. If not selected, it means the roof is not part of a room boundary. This property is read-only before creating a roof. After you draw the roof, you can select it and then modify this property.

Name	Description
Related to Mass	Indicates the element was created from a mass element. This is a read-only value.
Base Offset From Level	Sets the height of the roof above or below the level where it is being sketched. This property is enabled only when creating a roof by footprint.
Cutoff Level	Specifies a level above which all footprint roof geometry will be not shown. Roofs cut in this manner can be combined with another roof to form Dutch Hip, Mansard, or other roof styles.
Cutoff Offset	Height of the cutoff above or below the level specified in Up to Level.
Extrusion start	Sets the start point of the extrusion. For example, if you pick the outer edge of the wall during creation of the extrusion, the start point starts the extrusion to some point traveling out from the outer edge of the wall. This parameter is only enabled for extruded roofs.
Extrusion end	Sets the end point of the extrusion. For example, if you pick the outer edge of the wall during creation of the extrusion, the end point ends the extrusion at some point out from the outer edge of the wall. This parameter is only enabled for extruded roofs.
Reference Level	The reference level for the roof. The default is the highest level in the project. This parameter is only enabled for extruded roofs.
Level Offset	Raises or lowers the roof from the reference level. This parameter is only enabled for extruded roofs.
Construction	
Fascia Depth	The length of the lines defining the fascia.
Rafter Cut	Defines the rafter cut on an eave. See Creating a Plumb Cut, Two-Cut Plumb, or Two-Cut Square Eave on page 687.
Rafter or Truss	This property is a switch for the Plate Offset from Base property. If you choose Rafter, the Plate Offset from Base is measured from the inside of the wall. If you choose Truss, the Plate Offset from Base is measured from the outside of the wall. To see the effects of this property more clearly, set a value for Plate Offset from Base other than 0. (See Roof Boundary Line Properties on page 706.) This property only affects roofs created by picking walls.
Maximum ridge height	The maximum height of the top of the roof above the base level of the building. You can set a maximum allowable ridge height using the Max Ridge Height tool. This is a read-only value. This property is enabled only when creating a roof by footprint.
Dimensions	
Slope	Changes the value of the slope-defining line to the specified value, without the need to edit the sketch. The parameter initially displays a value if there is a slope-defining line. If there is no slope-defining line, the parameter is blank and disabled.

Name	Description
Thickness	Indicates the thickness of the roof. This is typically a read-only value, unless a shape edit has been applied and its type contains a variable layer. When the value is writable, it can be used to set a uniform thickness of the roof. The entry can be blank if the thickness varies. See Variable Layer Thickness for Roofs and Structural Floors on page 950.
Area	The area of the roof. This is a read-only value.
Volume	The volume of the roof. This is a read-only value.
Identity Data	
Comments	Comments about a particular roof.
Mark	A label applied to a roof. Usually a numeric value. This value must be unique for each roof in a project. Revit Architecture issues a warning if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Phasing	
Phase Created	The phase when the roof was created.
Phase Demolished	The phase when the roof was demolished.

Roof Boundary Line Properties

Name	Description
Constraints	
Defines roof slope	For footprint roofs, sets a roof line to be a slope-defining line.
Overhang	Adjusts the horizontal offset of the line from its associated wall. Available only when picking walls.
Plate Offset From Base	The height above the base level at which the wall and the roof meet. This height is relative to the base level of the roof. The default value is 0. This parameter is enabled when a roof boundary line is created using Pick Walls. If a sloped footprint roof line has an overhang, the height of the roof at the eave will be different from the height at the wall. With this property, you can specify the height at the wall rather than at the eave.
Offset from Roof Base	Sets the offset of the slope line from the base of the roof. This parameter is enabled when a line is set as slope-defining and it is not associated with a wall.
Extend into wall (to core)	Sets the overhang dimension from the roof edge to the exterior core wall. By default, the overhang dimension is measured from the exterior finish face of the wall.
Dimensions	
Slope	Sets the pitch of the roof. This property sets the slope angle for slope-defining lines.

Name	Description
Length	The actual length of the roof boundary line. This is a read-only value.

Roof Fascia and Gutter Type Properties

Name	Description
Construction	
Profile	The profile shape for the fascia or gutter. Choose from a list of predefined profiles, or create your own profile using the profile-hosted.rft template. For information about creating your own profiles, see The Families Guide on page 418.
Materials and Finishes	
Material	Specifies the look of the fascia or gutter in various views, including a raytraced model. For more information on setting a material, see Materials on page 468.
Identity Data	
Keynote	Add or edit the fascia or gutter keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The model type for the fascia or gutter.
Manufacturer	The manufacturer of the fascia or gutter material.
Type Comments	Comments about the fascia or gutter type.
URL	Link for a manufacturer web page.
Description	Description of the fascia or gutter.
Assembly description	Description of the assembly, based on the assembly code selection.
Assembly code	Unifomat assembly code selected from hierarchical list.
Type Mark	A value to designate the particular fascia or gutter. This value must be unique for each fascia or gutter in a project. Revit Architecture issues a warning if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Cost	Cost of the fascia or gutter. Can be included in a schedule.

Roof Fascia and Gutter Instance Properties

Name	Description
Constraints	

Name	Description
Vertical profile offset	Moves the fascia or gutter above or below the edge on which you created it. For example, if you chose a horizontal roof edge, a fascia moves above or below that edge.
Horizontal profile offset	Moves the fascia or gutter forward or backward from the edge on which you created it.
Angle	Rotates the fascia or gutter to the desired angle.
Dimensions	
Length	The actual length of the fascia or gutter.
Identity Data	
Comments	Comments about the roof fascia or gutter.
Mark	A label applied to roof fascia or gutters. Usually a numeric value. This value must be unique for each roof fascia or gutter in a project. Revit Architecture issues a warning if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.

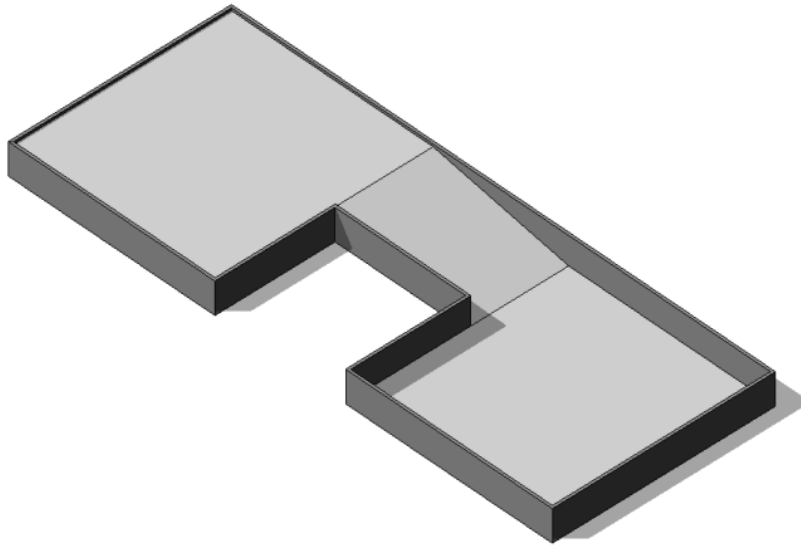
Roof Slope Arrow Properties

Name	Description
Constraints	
Specify	Choose between Slope or Height at Tail. If you select Slope, you can enter a value for Slope. If you select Height at Tail, Level at Head and Height Offset at Head are enabled.
Level at Tail	Specifies the level for the tail relative to the base level of the roof.
Height Offset at Tail	Specifies the start height above the Level at Tail.
Level at Head	Specifies the level for the head relative to the base level of the roof. This property is enabled when Height at Tail is set as the value for Specify.
Height Offset at Head	Specifies the end height above the Level at Head. This property is enabled when Height at Tail is set as the value for Specify.
Dimensions	
Slope	Sets a slope value.
Length	The actual length of the slope arrow. This is a read-only value.

Floors

You create floors by sketching them, either by picking walls or by using the Line tool. Typically, you sketch a floor in a plan view, although you can use a 3D view if the work plane of the 3D view is set to the work plane of a plan view. Floors are offset downward from the level on which they are sketched.


In a conceptual design, you can use floor area faces to analyze masses, and create floors from a mass. For more information, see [Analyzing a Conceptual Design](#) on page 594 and [Creating Floors from Mass Floors](#) on page 617.



Adding Floors

1 Click Home tab ► Build panel ► Floor.

2 Draw the floor boundaries, using one of the following methods:

- **Pick walls:** By default, Pick Walls is active. (If it is not active, click Create Floor Boundary tab ► Draw panel ►  (Pick Walls).) Select walls in the drawing area to use as floor boundaries.
- **Sketch boundaries:** To sketch the profile of the floor, click Create Floor Boundary tab ► Draw panel, and select a sketching tool. See [Sketching](#) on page 303.

The floor boundary must be a closed loop (profile). To create an opening in the floor, you can sketch another closed loop where you want the opening to appear.

3 On the Options Bar, for Offset, specify an offset for the floor edges.

NOTE When you are using Pick Walls, select Extend into wall (to core) to measure the offset from the wall's core.

4 Click Finish Floor.

Changing the Floor Type

To change the floor type in sketch mode

- 1 While sketching a floor, click Create Floor Boundary tab ► Element panel ► Floor Properties.
- 2 In the Instance Properties dialog, for Type, select a floor type.
- 3 Click OK.

To change the floor type in a project view

- 1 Select the floor in the project view.
Watch the tooltip and the status bar to be sure you select the floor, not another element. If desired, you can use a filter to select the floor. See [Selecting Elements Using a Filter](#) on page 341.
- 2 Click Modify Floors tab ► Element panel, and select the desired floor type from the Type Selector drop-down.

Editing a Floor Sketch

- 1 In a plan view, select the floor.
Watch the tooltip and the status bar to be sure you select the floor, not another element. If desired, you can use a filter to select the floor. See [Selecting Elements Using a Filter](#) on page 341.
- 2 Click Modify Floors tab ► Edit panel ► Edit Boundary.
- 3 Make any necessary changes.
See [Sketching](#) on page 303.
- 4 Click Finish Floor.

Sloped Floors

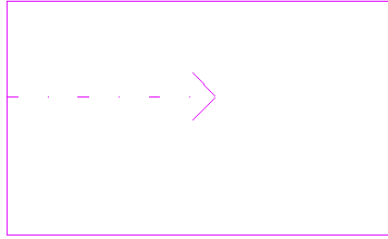
Revit Architecture provides multiple ways to create a sloped floor. You can do any of the following:

- Draw a slope arrow while sketching or editing the sketched floor.
- Specify the Offset from Base parameters for parallel floor sketch lines.
- Specify the Defines Slope and Slope Angle parameters for a single floor sketch line.

Creating a Sloped Floor by Sketching a Slope Arrow

- 1 If you are not already in sketch mode, select the floor in plan view, and click Modify Floors tab ► Edit panel ► Edit Boundary.
- 2 Click Modify Floors > Edit Boundary tab ► Draw panel ► Slope Arrow.
- 3 Sketch the slope arrow on the floor.

Floor sketch with slope arrow



4 Right-click the slope arrow, and click Element Properties.

5 For Specify, select a value: Height at Tail, or Slope.

6 If you selected Height at Tail, do the following:

- a For Level at Tail, specify a level to start the slope arrow at a certain level. For example, the floor sketch is on Level 1. You could choose to start the slope arrow on Level 2.
- b For Height Offset at Tail, specify how high above the level the slope arrow begins.
- c For Height Offset at Head, specify how high above the level the slope arrow ends.
- d For Level at Head, indicate the level at which to end the slope arrow.
For example, the floor sketch is on Level 1. You could choose to end the slope arrow on Level 2.

7 If you selected Slope, do the following:

- a For Level at Tail, specify a level to start the slope arrow at a certain level. For example, the floor sketch is on Level 1. You could choose to start the slope arrow on Level 2.
- b For Height Offset at Tail, specify how high above the level the slope arrow begins.
- c For Slope, set a slope value.

8 Click OK.

Creating a Sloped Floor by Setting Parallel Sketch Line Properties

1 If you are not already in sketch mode, select the floor in plan view, and click Modify Floors tab ► Edit panel ► Edit Boundary.

2 Press *Ctrl* and then click to select parallel floor sketch lines.

3 Right-click the parallel sketch lines, and click Element Properties.

4 In the Instance Properties dialog, select Defines Constant Height.

5 Click OK.

6 Right-click the same sketch lines individually, and click Element Properties.

7 For Offset from Base, specify a value for each line.

8 Click OK.

Creating a Sloped Floor by Setting Single Sketch Line Properties

1 If you are not already in sketch mode, select the floor in plan view, and click Modify Floors tab ► Edit panel ► Edit Boundary.

2 Right-click the sketch line, and click Element Properties.

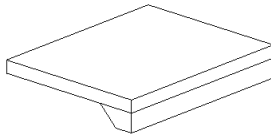
- 3 In the Instance Properties dialog for the sketch line, select Defines Constant Height.
- 4 Select the Defines Slope property, and set a value for Slope.
- 5 Click OK.

Floor Slab Edges

You add slab edges by selecting horizontal edges of floors. You can also select model lines.

- 1 Click Home tab ► Build panel ► Floor drop-down ► Floor Slab Edge.
- 2 Highlight horizontal edges of floors, and click to place a slab edge.
You can also click model lines. As you click edges, Revit Architecture treats this as one continuous slab edge. If the slab edge segments meet at corners, they miter.
- 3 To finish the current slab edge, click Place Slab Edge tab ► Profile panel ► Finish Current.
- 4 To start another slab edge, move the cursor to a new edge and click to place.
This different slab edge does not miter with other existing slab edges, even if they meet at the corners.
- 5 To finish placing slab edges, click Place Slab Edge tab ► Select panel ► Modify.

Slab added to floor



Tips

- You can place slab edges in 2D views (such as plan or section views) or in 3D views. Watch the status bar to look for valid references. For example, if you are placing a slab edge on a floor, the status bar might display: Floors : Basic Floor : Reference.
- When placing a slab edge in section, place the cursor near the corners of the floor to highlight the reference.

After placing slabs, you can modify them in several ways.

Resizing or Flipping Slabs

You can resize slabs. When you select the slab, a drag control appears at either end of it. See [Controls and Shape Handles](#) on page 349.

You can flip slabs by using the Flip controls that appear in 3D, or, if you are in a 2D view (such as section), you can right-click on the slab and select Flip About Horizontal Axis or Flip About Vertical Axis. See [Controls and Shape Handles](#) on page 349.

Adding or Removing Segments of the Slab

- 1 Select an existing slab.
- 2 Click Modify Slab Edges tab ► Profile panel ► Add/Remove Segments.
- 3 Click edges to add or remove segments of the floor slab edge.

NOTE You may need to press *Tab* to highlight a reference edge in section.

Changing Horizontal and Vertical Offset

You can change the horizontal or vertical offset of a slab edge either through its properties or by graphically moving the slab edge. See [Slab Edge Properties](#) on page 713.

Horizontal Move

To move a single slab edge segment, select the slab edge, and drag it horizontally.

To move a multi-segmented slab edge, select the shape handle of the slab edge. Place the cursor over the slab edge, and press *TAB* to highlight the shape handle. Watch the status bar to be sure you are highlighting the shape handle. Click to select the shape handle. Move the cursor left or right to change the horizontal offset. This affects the horizontal offset of all segments of the slab edge, so the segments are symmetrical.

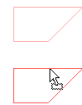
Moving slab edge on left also moves slab edge on the right



Vertical Move

Select the slab edge, and drag it up or down. If the slab edge is multi-segmented, all segments move up or down the same distance.

Slab edge moving vertically in section



Floor Slab Edge Properties

Parameter names, values, and descriptions for floor slab edges. Floor slab edges are classified under host sweeps. Values are modifiable.

Floor Slab Edge Type Properties

Name	Description
Profile	The profile shape for the particular floor slab. Select from a list of predefined profiles, or create your own profile using the profile-hosted.rft template. For information about creating your own profile, see The Families Guide on page 418.
Material	Specifies the appearance of the floor slab in various views, including a rendered image. See Materials on page 468.

Floor Slab Edge Instance Properties

Name	Description
Vertical profile offset	Moves the floor slab above or below the edge on which you created it.
Horizontal profile offset	Moves the floor slab forward or backward from the edge on which you created it.

Name	Description
Length	The actual length of the floor slab.
Volume (floor slab edges only)	The actual volume of the floor slab edge.
Angle	Rotates the floor slab to the desired angle.

Multi-layer Floors

In a multi-layer floor, the graphic display of the lines (or edges) between the floor layers can be controlled through the floor subcategories and by overriding the host layers of the floor.

The Common Edges subcategory specifies the graphic display of the lines between layers in a multi-layer floor. The Interior Edges subcategory is applied to edges between adjacent layers that have the same override style.

You can edit the graphic display of floor subcategories from the Visibility/Graphics dialog. See [Overriding Graphic Display of Element Categories](#) on page 201. To edit host layers, see [Override Cut Line Styles](#) on page 211.

Floor Properties

You can modify several properties for floors, including the slope and the level. You can also modify properties for an individual floor sketch line and the floor slope arrow.

Modifying Floor Properties

- 1 If you are in sketch mode, click Create Floor Boundary tab ► Element panel ► Floor Properties.
If you are in a plan view, select the floor, and click Modify Floors tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 2 In the Instance Properties dialog, edit floor instance parameters.
- 3 Click Edit Type to edit floor type parameters.

NOTE Changes made to type parameters affect all floors of this type in the project. You can click Duplicate to create a new floor type.

- 4 Click OK.

Modifying Floor Sketch Line or Slope Arrow Properties

- 1 If you are not already in sketch mode, select the floor in plan view, and click Modify Floors tab ► Edit panel ► Edit Boundary.
- 2 In sketch mode, select the floor sketch line or slope arrow, and click Create Floor Boundary tab ► Draw panel ► Properties.
- 3 In the Instance Properties dialog, edit the sketch line or slope arrow properties.
- 4 Click OK.

Floor Type Properties

Name	Description
Construction	
Structure	Creates the composition of a compound floor. See Compound Structure on page 813.
Default Thickness	Indicates the thickness of the floor type, which is determined by the cumulative thickness of its layers. This is a read-only property.
Function	Indicates whether a floor is interior (default value) or exterior. Function is used in scheduling and to create filters to simplify a model when exporting.
Graphics	
Coarse Scale Fill Pattern	The fill pattern for a floor displayed at a coarse detail level.
Coarse Scale Fill Color	Applies a color to the fill pattern for a floor in a coarse-scale view.
Identity Data	
Keynote	Add or edit the floor keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The model type for the floor.
Manufacturer	The manufacturer of the flooring material.
Type Comments	Comments about the floor type.
URL	Link for a manufacturer web page.
Description	Provides a description of the floor.
Assembly Description	Description of the assembly based on the assembly code selection.
Assembly Dode	Unifomat assembly code selected from hierarchical list.
Type Mark	A value to designate the particular floor. This value must be unique for each floor in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. (You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.)
Cost	Cost of the flooring. This can be included in a schedule.
Design Option	If design options have been created, this property indicates the design option in which the element exists. For more information on design options, see Design Options on page 1305.

Floor Instance Properties

Name	Description
Constraints	
Level	The level with which the floor is associated.
Height Offset From Level	The height at which the floor is offset from the level.
Room Bounding	Indicates that the floor is a room-bounding element. See Room-Bounding Elements on page 981.
Related to Mass	Indicates that the element was created from a mass element. This is a read-only value.
Structural	
Structural	Indicates that the element has an analytical model. This is a read-only value.
Dimensions	
Slope	Changes the value of slope-defining lines to the specified value, without the need to edit the sketch. The parameter initially displays a value if there is a slope-defining line. If there is no slope-defining line, the parameter is blank and disabled.
Perimeter	The perimeter of the floor. This is a read-only value.
Area	The area of the floor. This is a read-only value.
Volume	The volume of the floor. This is a read-only value.
Thickness	Indicates the thickness of the floor. This is typically a read-only value, unless a shape edit has been applied and its type contains a variable layer. When the value is writable, it can be used to set a uniform thickness of the structural floor. The entry can be blank if the thickness varies. See Variable Layer Thickness for Roofs and Structural Floors on page 950.
Identity Data	
Comments	Specific comments related to the floor that are not already covered in the description or type comments.
Mark	A user-specified label for the floor. This value must be unique for each floor in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. (You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.)
Design Option	If design options have been created, this property indicates the design option in which the element exists. For more information on design options, see Design Options on page 1305.
Phasing	
Phase Created	The phase when the floor was created.

Name	Description
Phase Demolished	The phase when the floor was demolished.
Structural Analysis	
Structural Usage	Sets the structural usage of the floor. This property is read-only before creating a floor. After you draw the floor, you can select it and then modify this property.
Analytical Model	
Vertical Projection	The plane of the floor used for analysis and design.

Floor Sketch Line Properties

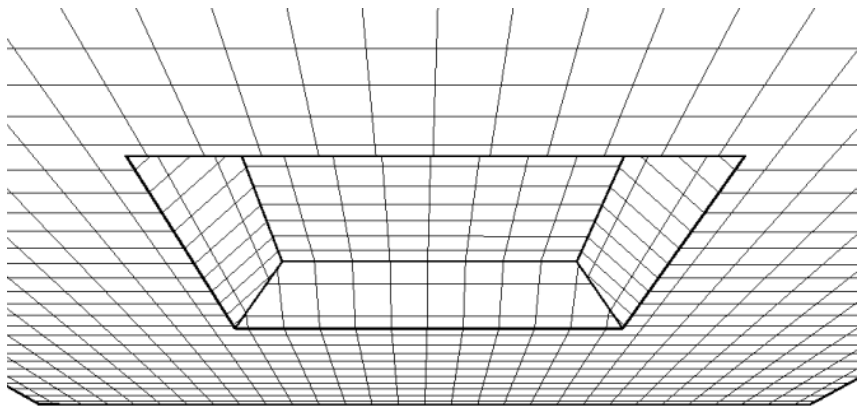
Name	Description
Constraints	
Level	The level with which the floor is associated.
Defines Slope	Sets a floor line to slope-defining. This parameter is enabled when the Defines Constant Height parameter is turned on.
Defines Constant Height	Enables a floor line to have a constant height above the level on which it is sketched. This parameter is for defining slope. For example, to define slope you can set 2 parallel lines to be at a constant height and then set an offset for each line, or you can set a single line to be at a constant height, slope defining, and then set its slope. See Sloped Floors on page 710.
Offset from Base	Sets the height of the floor line above the level on which it is sketched. The default value is 0. This parameter is enabled when the Defines Constant Height parameter is turned on.
Extend into wall (to core)	Determines whether the offset is measured from the wall core.
Graphics	
Center Mark Visible	If the floor sketch line is an arc, specifies whether the center mark for the arc appears. You can dimension to the center mark of an arc.
Dimensions	
Slope	Sets the slope angle for the selected floor line. The default value is 0. This parameter is enabled when Defines Slope parameter is turned on.
Length	The actual length of a sketch line for the floor. This is a read-only parameter.
Identity Data	
Design Option	If design options have been created, this property indicates the design option in which the element exists. For more information on design options, see Design Options on page 1305.
Other	
Wall Offset	Offsets the floor a specified distance from a bounding wall.

Floor Slope Arrow Properties

Name	Description
Constraints	
Specify	Indicates the method for determining slope: Height at Tail, or Slope.
Level at Tail	Starts the slope arrow at the designated level.
Height Offset at Tail	Sets the start height of the slope arrow line. The default value is 0.
Level at Head	Starts the slope arrow at the designated level.
Height Offset at Head	Sets the end height of the slope arrow line. Revit Architecture uses both parameters to calculate the rise of the slope line.
Dimensions	
Slope	The slope angle for the selected floor slope arrow.
Length	The length of the slope arrow. This is a read-only parameter.
Identity Data	
Design Option	If design options have been created, this property indicates the design option in which the element exists. For more information on design options, see Design Options on page 1305.

Ceilings

You can create ceilings automatically in a project view or by sketching. Ceilings should be created in the reflected ceiling plan (RCP) view or in sketch mode.



Ceilings are level-based elements, which means that you sketch them at a specified distance above the level in which they reside. For example, if you sketch a ceiling on Level 1, you might place it 3 meters above Level 1. You can specify this offset in Ceiling Properties. See [Ceiling Properties](#) on page 722.

If the ceiling includes a grid, the grid is centered in the room.

Creating Automatic Ceilings

- 1 Open a Ceiling Plan view.
- 2 Click Home tab ► Build panel ► Ceiling.
- 3 Click Place Ceiling tab ► Element panel, and select the desired ceiling type from the Type Selector drop-down.
- 4 Click inside a room to place the ceiling.
A ceiling is displayed; you can modify it at any time. See [Modifying Ceilings](#) on page 721.


Sketching a Ceiling

- 1 Open a Ceiling Plan view.
- 2 Click Home tab ► Build panel ► Ceiling.
- 3 Click Place Ceiling tab ► Ceiling panel ► Sketch Ceiling.

There are 3 ways to sketch a ceiling:

- pick walls
- draw using sketch tools
- use Auto Ceiling


To sketch a ceiling by picking walls

- 1 Click Create Ceiling Boundary tab ► Draw panel ►  (Pick Walls).
- 2 On the Options Bar, specify an offset.
- 3 Select the walls that will form the boundary of the ceiling.

NOTE To select a chain of walls, highlight a line, press *Tab* until chain of walls displays in the status bar, and click.

- 4 Click Ceiling Properties.
- 5 In the Instance Properties dialog, designate the type of ceiling and its properties, and click OK.
- 6 Click Finish Ceiling.

To sketch a ceiling by drawing

- 1 Click Create Ceiling Boundary tab ► Draw Panel ►  (Line).
- 2 Use the sketching tools to complete the ceiling sketch, which must be a closed loop.
To create an opening in the ceiling, sketch another closed loop within the main loop.
- 3 Click Ceiling Properties.
- 4 In the Instance Properties dialog, designate the type of ceiling and its properties, and click OK.
- 5 Click Finish Ceiling.

To sketch a ceiling using Auto Ceilings

- 1 Click Create Ceiling Boundary tab ► Tools panel ► Auto Ceiling.
- 2 Place the cursor in a room.
The boundary of the room is highlighted.
- 3 Click to insert the ceiling.

- 4 Click Ceiling Properties.
- 5 In the Instance Properties dialog, designate the type of ceiling and its properties.
- 6 Click Finish Ceiling.

NOTE You cannot use the Auto Ceiling tool if you have already sketched lines for the ceiling.

Sloped Ceilings

Revit Architecture provides 3 methods for creating a sloped ceiling while in ceiling sketch mode.

Method 1

While in sketch mode, click Slope Arrow to define the slope of the ceiling. The length of the slope arrow determines the run, and the height of it determines the rise (hence rise/run). Also, the direction of the line determines the orientation of the ceiling.

Ceiling sketch with slope arrow



Slope by Setting Height at Tail

- 1 In ceiling sketch mode, click Create Ceiling Boundary ► Draw panel ► Slope Arrow.
- 2 Sketch a slope arrow on the ceiling.
- 3 Right-click the slope arrow and click Element Properties.
- 4 In the Instance Properties dialog, for Specify, select Height at Tail.
- 5 For Height Offset at Tail, specify how high above the level the slope arrow begins.
- 6 For Level at Tail, specify the level at which to start the slope arrow. For example, the ceiling sketch is on Level 2. You could choose to start the slope arrow on Level 3.
- 7 For Height Offset at Head, specify how high above the level the slope arrow ends.
- 8 For Level at Head, specify the level at which to end the slope arrow. For example, the ceiling sketch is on Level 2. You could choose to end the slope arrow on Level 3.
- 9 Click OK.

Slope by Setting Slope Value

- 1 In ceiling sketch mode, click Create Ceiling Boundary ► Draw panel ► Slope Arrow.
- 2 Sketch a slope arrow on the ceiling.
- 3 Right-click the slope arrow and click Element Properties.
- 4 In the Instance Properties dialog, for Specify, select Slope.
- 5 For Rise/(Run), specify a slope value.
- 6 For Height Offset at Tail, specify how high above the level the slope arrow begins.
- 7 For Level at Tail, specify the level at which to start the slope arrow. For example, the ceiling sketch is on Level 2. You could choose to start the slope arrow on Level 3.
- 8 Click OK.

For more information on the Slope Arrow, including its properties, see [Slope Arrow](#) on page 685.

Method 2

- 1 In the drawing area, select 2 parallel sketch lines of the ceiling and click Modify Ceilings > Edit Boundary tab ► Draw panel ► Properties.
- 2 In the Instance Properties dialog, select Defines Constant Height; this enables Offset From Base.
- 3 Click OK.
- 4 Select the lines individually, access their properties, and specify a value for Offset from Base for each of them.

Method 3

Select a single sketch line, and click Modify Ceilings > Edit Boundary tab ► Draw panel ► Properties. In the Instance Properties dialog, select Defines Constant Height, select Defines Slope, and, under Dimensions, specify a value for the slope angle (rise).

For a complete list of parameters available for specifying slopes, see [Ceiling Properties](#) on page 722.

Modifying Ceilings

Changing Ceiling Types

When you activate the Ceiling tool to place a ceiling, you can select different types of ceilings in the Type Selector.

Creating a New Ceiling Type

- 1 Click Home tab ► Build panel ► Ceiling.
- 2 Click Place Ceiling tab ► Element panel, and select a ceiling type from the Type Selector drop-down.
- 3 Click Element Properties drop-down ► Type Properties.
- 4 In the Type Properties dialog, click Duplicate, and type the ceiling name.
- 5 Click OK.
- 6 Modify the ceiling properties. See [Ceiling Properties](#) on page 722.

Applying a Surface Pattern to a Ceiling

You can apply a surface pattern to a ceiling by setting the ceiling's material type.

- 1 Select the ceiling.
- 2 Click Modify Ceilings tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 Set the Material parameter.

If you are editing a compound ceiling, click Edit for the Structure parameter. In the Edit Assembly dialog, click in the Materials column to open the Materials dialog.

TIP If the desired ceiling material is not available from the list, you can create a new ceiling material. See [Materials](#) on page 468.

Editing a Ceiling Sketch

You can modify ceilings by modifying the sketch. You can move the lines by dragging them or by modifying dimensions. You can also change the ceiling properties to change the height of the ceiling above the level.

For a complete description of the ceiling properties and their values, see [Ceiling Properties](#) on page 722.

Ceiling Properties

You can modify several properties for ceilings, ceiling sketch lines, and ceiling slope arrows.

Modifying Ceiling Properties

- 1 If you are in sketch mode, click Create Ceiling Boundary tab ► Element panel ► Ceiling Properties. If you are in a plan view, select the ceiling, and click Modify Ceilings tab ► Element panel ► Element Properties.
- 2 In the Instance Properties dialog, edit ceiling instance parameters.
- 3 Click Edit Type to edit ceiling type parameters.

NOTE Changes made to type parameters affect all ceilings of this type in the project. You can click Duplicate to create a new ceiling type.

- 4 Click OK.

Ceiling Type Properties

Name	Description
Construction	
Structure	Creates the composition of a compound ceiling. See Compound Structure on page 813.
Thickness	The total thickness of the ceiling.
Graphics	
Coarse Scale Fill Pattern	The fill pattern for a ceiling displayed at a coarse detail level.
Coarse Scale Fill Color	Applies a color to the fill pattern for a ceiling in a coarse-scale view.
Identity Data	
Keynote	Add or edit the ceiling keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	Specify the model for the materials comprising the ceiling.
Manufacturer	The manufacturer for the ceiling materials.
Type Comments	General comments about the ceiling type. This information can be included in a schedule.

Name	Description
URL	Sets a link to a web page.
Description	Provides a description of the ceiling.
Assembly description	Description of the assembly based on the assembly code selection.
Assembly code	Uniformat assembly code selected from hierarchical list.
Type Mark	A value to designate the particular ceiling, such as 1A, 2B, and so on. This value must be unique for each ceiling in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. (You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.)
Cost	Cost of the materials for constructing the wall.
Material	Specifies the appearance of the ceiling in various views, including a raytraced model. For more information on setting a material, see Materials on page 468.

Ceiling Instance Properties

Name	Description
Constraints	
Level	The level at which the ceiling resides.
Height Offset From Level	Sets an offset for the ceiling relative to the specified level.
Dimensions	
Slope	Changes the value of the slope-defining line to the specified value, without the need to edit the sketch. The parameter initially displays a value if there is a slope-defining line. If there is no slope-defining line, the parameter is blank and disabled.
Perimeter	The ceiling's perimeter. This is a read-only parameter.
Area	The ceiling's area. This is a read-only parameter.
Volume	The ceiling's volume. This is a read-only parameter.
Identity Data	
Comments	Specific comments on the ceiling.
Mark	A user-defined label for the ceiling. This value must be unique for each ceiling in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. (You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.)
Phasing	
Phase Created	The phase when the ceiling was created.

Name	Description
Phase Demolished	The phase when the ceiling was demolished.

Ceiling Sketch Line Properties

Name	Description
Constraints	
Level	The level at which the ceiling resides.
Defines Slope	Sets a ceiling line to slope-defining. This property is enabled when Defines Constant Height is turned on.
Defines Constant Height	Enables a ceiling line to have a constant height above the level on which it is sketched. This property is for defining slope. For example, to define slope you can set 2 parallel lines to be at a constant height and then set an offset for each line, or you can set a single line to be at a constant height, slope-defining, and then set its slope. See Sloped Ceilings on page 720.
Offset from Base	Sets the height of the ceiling line above the level on which it is sketched. This property is enabled when Defines Constant Height is turned on.
Dimensions	
Slope	Sets the slope angle for the selected ceiling line. This property is enabled when Defines Slope is turned on.
Length	The length of the sketch-line. This is a read-only parameter.

Ceiling Slope Arrow Properties

Name	Description
Specify	Indicates the method for determining slope.
Level at Tail	Starts the slope arrow at the designated level.
Height Offset at Tail	Sets the start height of the slope arrow line. The default value is 0.
Level at Head	Starts the slope arrow at the designated level.
Height Offset at Head	Sets the end height of the slope arrow line. Revit Architecture uses both parameters to calculate the rise of the slope line.
Slope	Sets the slope angle for the selected ceiling line. The default value is 0. This parameter is enabled when Defines Slope Property is turned on.
Length	The actual length of a sketch line for the ceiling. This is a read-only property.

Openings

Use the Opening tool to cut openings in walls, floors, ceilings, roofs, structural beams, braces, and structural columns.

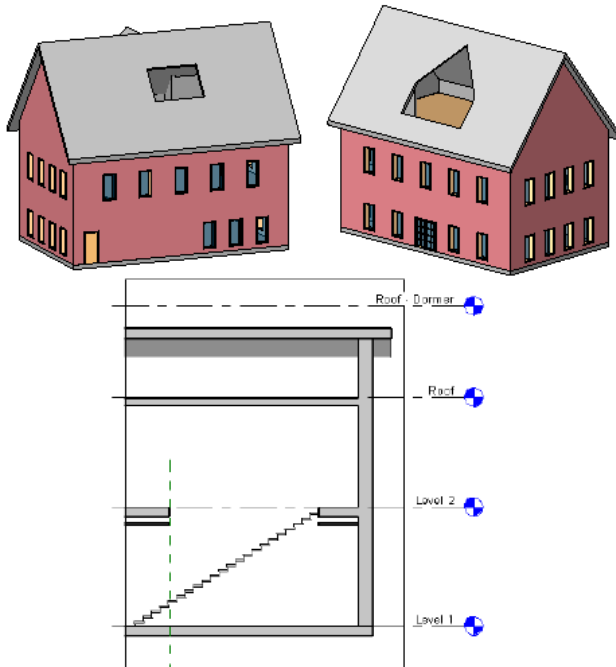
- When you cut a floor, ceiling, or roof, you can choose to cut vertically or perpendicular to the surface. You can also sketch complex shapes using the drawing tools.
- When cutting an opening in a wall, you can sketch a rectangular opening in a straight or arc wall. (For walls, you can create rectangular openings only. You cannot create round or polygon shapes.)

For information on cutting openings in structural beams, braces, and structural columns, see [Openings in a Structural Beam, Brace, or Structural Column](#) on page 904.

You can also cut openings in structural floors and decks. For more information, see [Cutting Openings in Structural Floors](#) on page 934.

When creating a family, you can sketch an opening in family geometry. See [The Families Guide](#) on page 418.

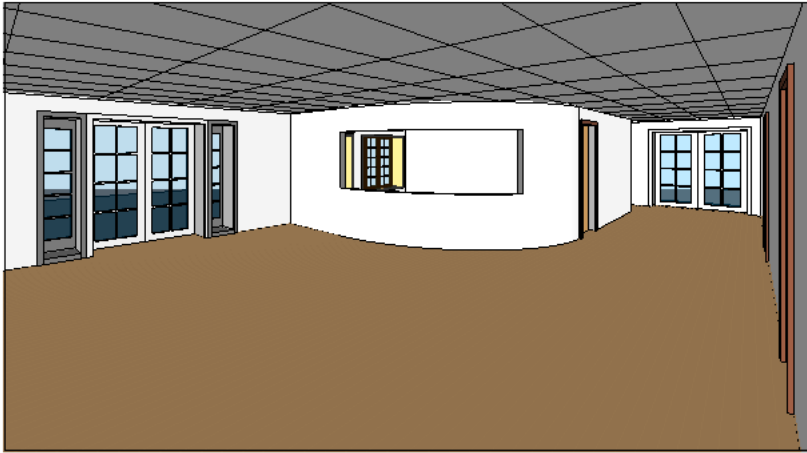
Examples of a roof opening, a dormer cut, and a stairway opening through the floor and ceiling



Cutting Rectangular Openings in Walls

Use the Opening tool to cut rectangular openings in a straight or curved wall. (For walls, you can create rectangular openings only. You cannot create round or polygon shapes.) Before cutting an opening, open a view of the prospective host wall where you can sketch the opening, such as an elevation or section view.

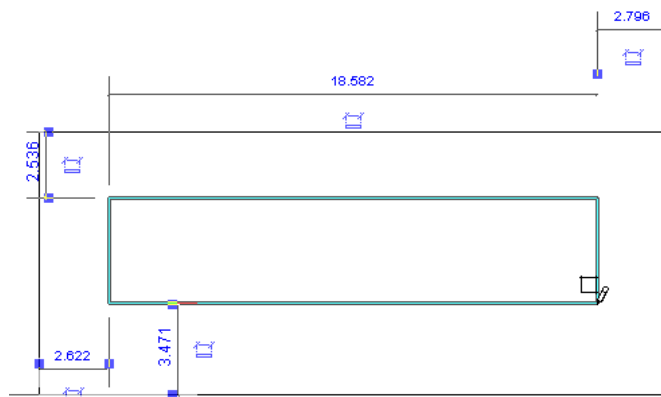
View of an opening in an arc wall



To cut a rectangular opening in a wall

- 1 Open an elevation or section view where you can access the wall that will host the opening.
- 2 Click Modify tab ► Edit Geometry panel ► Openings drop-down ► Wall Opening.
- 3 Select the wall that will host the opening.
- 4 Sketch a rectangular opening.

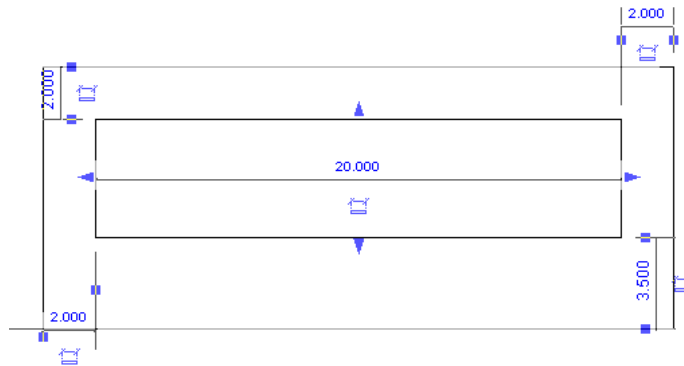
Wall elevation view with opening being sketched



After you specify the final point of the opening, the opening displays.

- 5 To modify an opening, click Modify, and select the opening.

Modifying a selected opening



You can use the drag controls to modify the size and location of the opening. You can also drag it to a new location on the same wall, and add dimension to the opening.

Cutting Openings in Floors, Roofs, and Ceilings

You can cut openings on faces of roofs, floors, or ceilings using the Openings tools in a project view. These tools are useful for creating an opening in a roof to place a chimney.

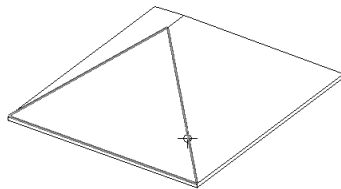
You can either cut an opening in the faces of these elements, or you can select the entire element to make a vertical cut.

- 1 Click **Modify** tab ► **Edit Geometry** panel ► **Openings** drop-down ► **Opening on Face or Vertical Opening**.

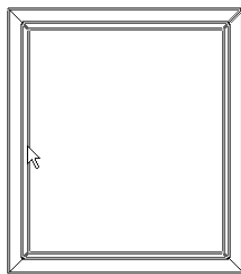
Use **Opening on Face** when you want the opening to be perpendicular to the selected face. Use **Vertical Opening** when you want the opening to be perpendicular to a level.

- 2 If you chose **Opening on Face**, select a face in the floor, ceiling, or roof. If you chose **Vertical Opening**, select the entire element.

Selected face for opening by face



Selected element for vertical cut



Revit Architecture enters sketch mode, where you can create an opening of any shape. For more information about sketching, see [Sketching](#) on page 303.

- 3 Click Finish Opening.

Cutting Shaft Openings

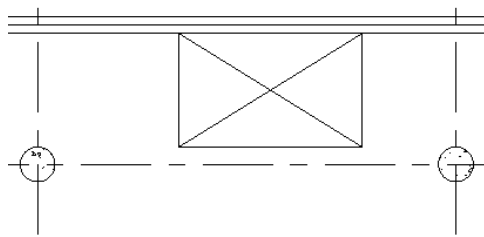
You can cut openings up the entire height of a building (or through selected levels) using the Shaft Opening option of the Openings tool. Using this option, you can cut faces of roofs, floors, or ceilings simultaneously.

- 1 Click Modify tab ► Edit Geometry panel ► Openings drop-down ► Shaft Opening.
- 2 Sketch a shaft opening by drawing lines or by picking walls.

TIP Typically you will want to sketch the shaft on a host element, such as a floor, in a plan view.

- 3 If desired, add symbolic lines to the opening.
- 4 When you are done sketching the shaft, click Finish Opening.

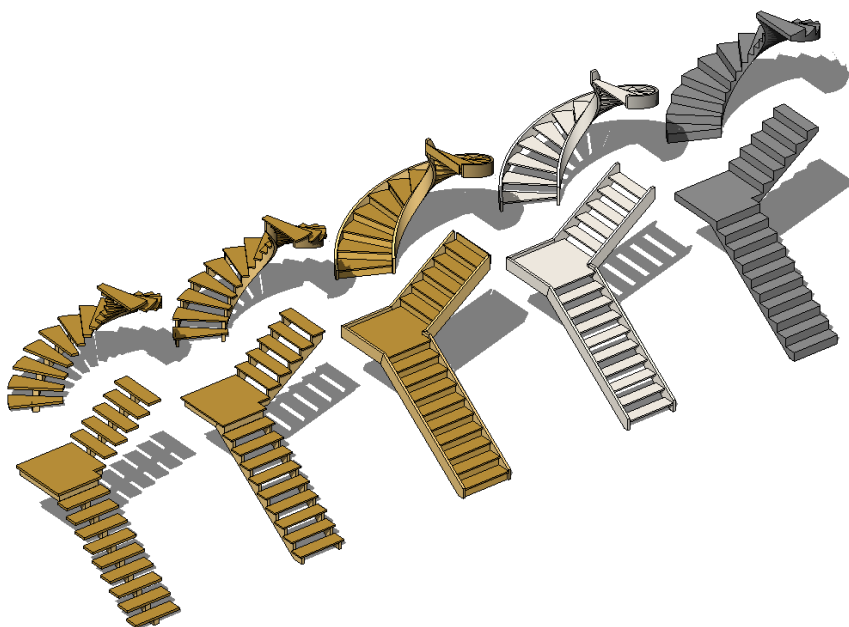
Shaft opening with symbolic lines



- 5 To adjust the levels that the opening cuts, select it, and click Modify Shaft Openings tab ► Element panel ► Element Properties.
- 6 For Base Constraint, specify a level for the start point of the shaft.
- 7 For Top Constraint, specify a level for the end point of the shaft.
The shaft cuts through and is visible on all intermediate levels.
- 8 Click OK to close the Instance Properties dialog.
If you move the shaft on any level, it moves on all levels. The symbolic lines are visible on all levels too.

Stairs

You create stairs in a plan view by defining the run of the stairs or by sketching riser lines and boundary lines. You can define straight runs, L-shaped runs with a platform, U-shaped stairs, and spiral stairs. You can also modify the outside boundary of the stairs by modifying the sketch. The risers and runs update accordingly. Revit Architecture also generates railings automatically for the stairs. In multi-story buildings, you can design one set of stairs and extend identical sets up to the highest level you define in the stair properties.



The number of treads for a stair run is based on the distance between floors and the maximum riser height defined in the stair properties. A rectangle is displayed in the drawing area, representing the footprint of the run of the stairs.

When creating new stairs, you can also specify the railing type to be used. See [Specifying the Railing Type for New Stairs](#) on page 734.

You can schedule stairs with parameters that include Actual Rise (riser), Actual Number of Risers, Run, and Width. See [Creating a Schedule or Quantity](#) on page 173. You can also tag stairs with the stair tag family. The stair tag is available from the Annotations folder of the Revit Architecture family library. For more information, see [Tags](#) on page 1123.

Creating Stairs by Sketching Runs

Click start point on left side



Click endpoint on right end

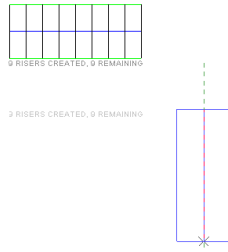


To create [Stairs](#) on page 728 with landings, click inside the rectangle to create a short run; the number of risers created is displayed. You can then click another start point and end point for the remaining stairs.

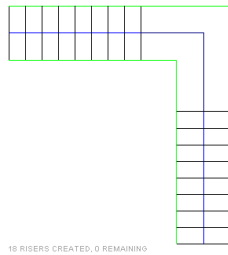
First run of stairs- 9 risers created with 9 remaining



Additional run of stairs perpendicular to the original

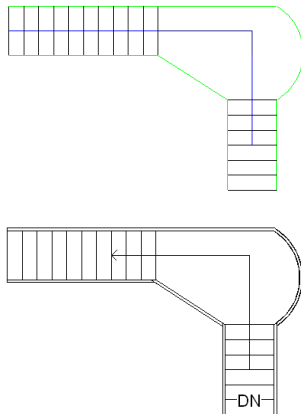


Completed sketch with landing created automatically



You can modify the sketch of the footprint for the stairs. In the next figure the landing of the sketch has been modified.

Run of stairs after modification



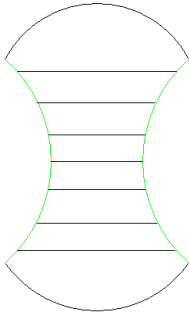
Creating Stairs by Sketching Boundary and Riser Lines

You can define your stairs by sketching boundaries and risers.

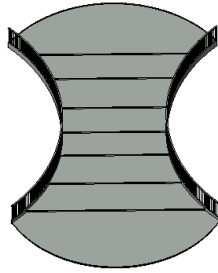
While in stair sketch mode, you can sketch [Stairs](#) on page 728 boundaries and risers instead of having Revit Architecture calculate the stair run automatically.

- 1 Click Home tab ► Circulation panel ► Stairs.
- 2 Click Create Stairs Sketch tab ► Draw panel ► Boundary.
Sketch the boundary.
- 3 Click Riser.
Sketch the risers.

Stairs sketched using Boundary and Riser tools



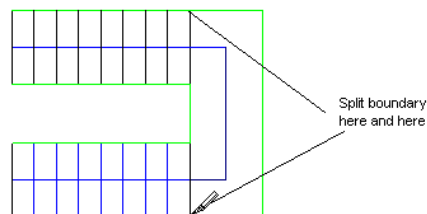
3D view of stairs



Stairs with Landings

When a landing is included in stairs you create by sketching boundary and riser lines, split the boundary lines where they meet the landing in order to achieve the desired results.

- 1 After you have sketched the stairs and are still in sketch mode, click Create Stairs Sketch tab ► Edit panel ► Split.
- 2 Split the boundary lines where they meet the landing.



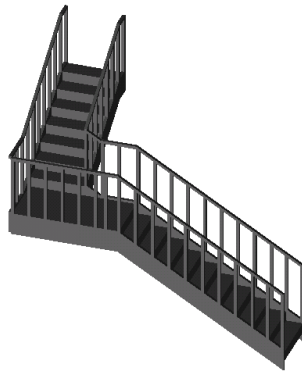
Tips

- Do not connect left and right boundary lines to each other. You can sketch them as single lines or multi-segmented lines (for example, straight lines and arcs connected).
- Connect riser lines between the left and right boundaries.
- See the online tutorials for practical exercises on creating stairs.
- The top riser line on a run of stairs represents the actual riser without a tread.


Creating a Run of Stairs

- 1 Open a plan or 3D view.

- 2 Click Home tab ► Circulation panel ► Stairs.
- 3 Click Home tab ► Work Plane panel ► Set to select a different work plane. See [Sketching and Work Planes](#) on page 317.
- 4 Click Create Stairs Sketch tab ► Draw panel ► Run. Click in the drawing area where you want to start the stairs.
- 5 Move the cursor to set the angle for the stair footprint.
- 6 To create a straight run of stairs, click outside the rectangle on the end away from the start point.
- 7 To create a jogged set of stairs, click for the end of the first run, move the cursor, and click the start and end points for the second run.
Continue this process if there is more than one jog.
- 8 Edit the footprint, if desired.
- 9 To change the properties of the stairs, click Create Stairs Sketch tab ► Element panel ► Stairs Properties. Edit the instance parameters, and click Edit Type to edit type parameters.
For a description of stair properties and their values, see [Stair Properties](#) on page 738.
- 10 Click Finish Stairs.
Revit Architecture generates a staircase with automatic railings.
Completed stairs in 3D with default railings and balusters



Creating Spiral Staircases

- 1 Open a plan or 3D view.
- 2 Click Home tab ► Circulation panel ► Stairs.
- 3 Click Home tab ► Work Plane panel ► Set, to select a different work plane. See [Sketching and Work Planes](#) on page 317.
- 4 Click Create Stairs Sketch tab ► Draw panel ►  + (Center-ends Arc).
- 5 In the drawing area, click to select a center point for the spiral.
- 6 Click a start point.
- 7 Click an end point to complete the spiral.

Completed spiral staircase



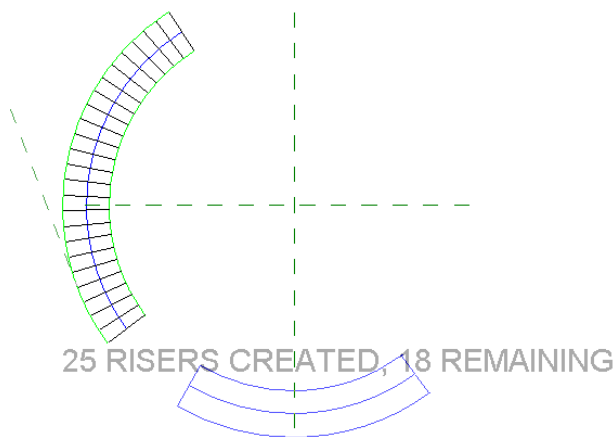
The spiral is limited to fewer than 360 degrees. If you overlap spiral runs, a warning is displayed; stringers and railings are not placed accurately.

TIP To create a spiral staircase to multiple levels, create one helix for the stairs and then copy that helix to the appropriate levels.

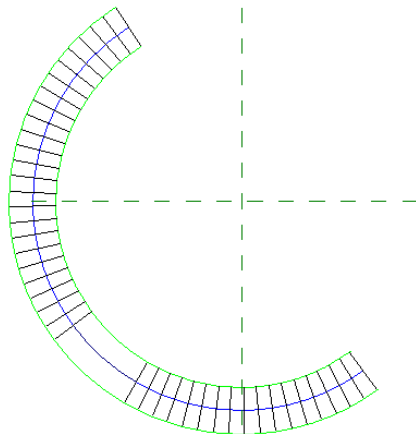
Creating Arced Landings

You can create arced landings if you sketch arced runs that share a center and a radius value.

Spiral arcs with same radius and center



Finished arc landing



43 RISERS CREATED, 0 REMAINING

Specifying the Railing Type for New Stairs

While sketching new stairs, you can specify the railing type to use. Click Create Stairs Sketch tab ► Tools panel ► Railing Type. This tool is only available while sketching new stairs. When you select Railing Type, you are prompted to select the railing type from a list of existing types in the project. You also have the option to select None or Default.

To specify the railing type

- 1 Click Home tab ► Circulation panel ► Stairs.
- 2 Click Create Stairs Sketch tab ► Tools panel ► Railing Type.
- 3 In the Railings Type dialog, select a rail type.

If the desired type does not appear in the list, you can quit the Stairs tool, create the railing type, and then restart the Stairs tool. You can also create the stairs with any railing type, and change the type after you have created the desired railings. For more information, see [Railings](#) on page 746.

- 4 Click OK.

NOTE The default railing type when creating stairs is the railing type specified when you are in Railing sketch mode and click Railing Properties. You can change the default railing by selecting a new railing type in the Instance or Type Properties dialog. For more information, see [Railings](#) on page 746.

Stair Calculator

Use the stair calculator to calculate the tread depth of stairs. The calculator applies a common, rule-of-thumb formula, for example, a formula specified in the Architectural Graphic Standards. Before using the stair calculator, specify values for the minimum tread depth and maximum riser height. See [Stair Properties](#) on page 738.

Using the Stair Calculator

- 1 In drawing area, select the stairs, and click Modify Stairs tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 2 In the Type Properties dialog, under Construction, click Edit for Calculation Rules.
- 3 In the Stair Calculator dialog, select Use Stair Calculator for slope calculation.
- 4 Under Calculation Rule for target slope, enter a value to multiply by Rise.
- 5 Enter a value to multiply by tread Depth.
- 6 Enter a Maximum Result and a Minimum Result for the stair calculator.

NOTE The stair calculator uses the tread depth you specified in the instance properties of the stairs. If the value you specified causes the calculator to produce values that are outside the range of the acceptable results, a warning is displayed.

- 7 Click OK.

The stair calculator computes the tread depth for new stairs only; existing stairs are not affected.

Rule-of-Thumb Formulas

The following is a rule-of-thumb formula for interior stairs, as specified in the Architectural Graphic Standards.

- $\text{Riser} + \text{Tread} = 17.5 \text{ inches}$: 7.5 inches for the riser height; 10 inches for the tread depth.
- $\text{Riser} * \text{Tread} = 75 \text{ inches}$.
- $2(\text{Riser}) + \text{Tread}$ is greater than or equal to 24 inches (minimum threshold) or less than or equal to 25 inches (maximum threshold).

Modifying Stairs

Boundaries and Riser and Run Lines

Stair boundaries, as well as riser and run lines, can be modified to shape the stairs in the desired manner. For example, you can select the run line and drag it to add or remove risers. See the Revit Architecture tutorials for more information.

Modifying Stair Railings

When you add stairs, stair railings are added automatically. You can modify stair railings at any time after their creation.

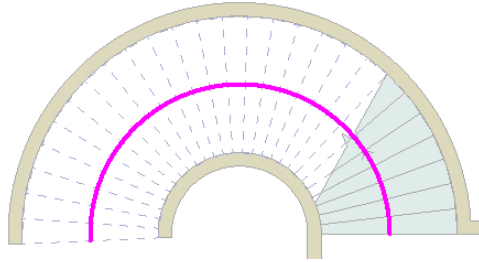
- 1 Select a railing.

If you are working in a plan view, it may be helpful to use the **TAB** key to select the railing.

TIP Modifying railings in a 3D view allows for easier selection and better view of your changes.

- 2 To modify the properties of the railing, click Modify Railings tab ► Element panel ► Element Properties.
- 3 To modify the sketch line of the railing, click Modify Railings tab ► Edit panel ► Edit Path.

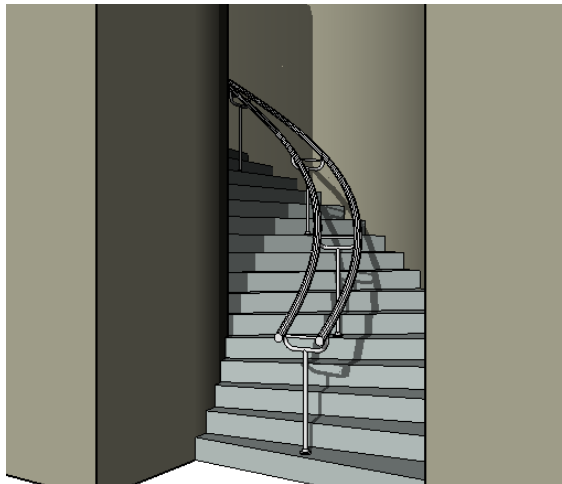
The railing line is selected, as follows.



4 Edit the selected line as desired.

You are in sketch mode, so you can modify the shape of the line to suit your design. The railing line can consist of connected straight and arced segments, but it cannot form a closed loop. You can resize it by dragging the blue controls. See [Controls and Shape Handles](#) on page 349 and [Splitting Walls and Lines](#) on page 408. You can move the railing line to a new location, such as the center of the staircase. You cannot draw multiple railings in the same session.

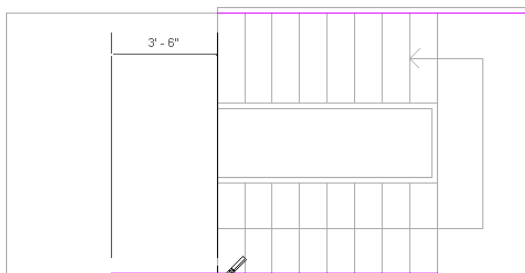
Modified stairs with center railing



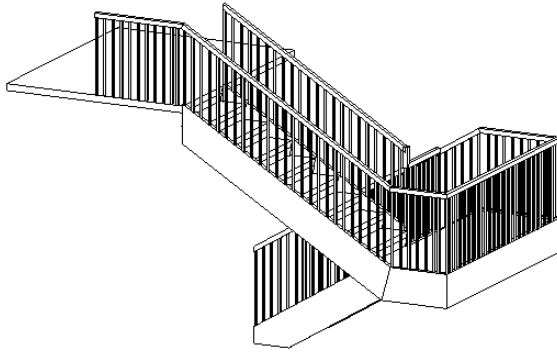
Extending Stair Railings

If you extend stair railings (for example, to extend onto a floor), you need to split the railing line so that the railing changes its slope and meets the floor properly. See [Splitting Walls and Lines](#) on page 408.

Split the rail line as shown in the picture.



Finished result of extending railing



Moving Stair Labels

You can drag the Up or Down label that appears in plan views with a run of stairs.

To move the stair label

1 Place the cursor over the stair text label.

A drag control appears next to the label.

2 Drag the control to move the label.

OR

1 Select the run of stairs.

A blue drag control appears.

2 Drag the control to move the label.

OR

1 Highlight the entire run of stairs, and press *Tab* to select the shape handle.

Watch the status bar as you press *Tab* until it indicates that the shape handle is highlighted.

2 Drag the label to a new position.

Changing the Stair Direction

You can change the direction of stairs after you have completed the stair sketch.

1 Select the stairs in a project view.

2 Click the blue flip control arrows.

Zero Tread Thickness for Monolithic Stairs

You can set the tread thickness of monolithic stairs to 0.

1 In the drawing area, select the stairs and click **Modify Stairs** tab ► **Element panel** ► **Element Properties** drop-down ► **Type Properties**.

2 In the Type Properties dialog, under **Construction**, select **Monolithic Stairs**.

3 Under **Risers**, clear the **End with Riser** parameter.

- 4 For Riser Thickness, enter 0.
- 5 For Tread Thickness, enter 0.

Stair Properties

You can modify several properties for stairs, including the top and base levels, calculation rules, and stair labels.

NOTE If you are upgrading stairs from a previous release of Revit Architecture, and you do not see all of the parameters listed here, duplicate your stair type from the Type Properties dialog, and then you should see all of the parameters.

Modifying Stair Properties

- 1 If you are in sketch mode, click Create Stairs Sketch tab ► Element panel ► Stairs Properties. If you are in a plan view, select the stairs, and click Modify Stairs tab ► Element panel ► Element Properties.
- 2 In the Instance Properties dialog, edit stair instance parameters.
See [Stair Instance Properties](#) on page 741.
- 3 Click Edit Type to edit stair type parameters.
See [Stair Type Properties](#) on page 738.

NOTE Changes made to type parameters affect all stairs of this type in the project. You can click Duplicate to create a new stair type.

- 4 Click OK.

Stair Type Properties

Name	Description
Construction	
Calculation Rules	Click Edit to set the stair calculation rules. See Stair Calculator on page 734.
Extend Below Base	Extends stringers below the base level of the stair. This is useful for cases where the stringer attaches to the face of a floor opening rather than resting on the surface of a floor. To extend the stringer below the floor, enter a negative number.
Monolithic Stairs	Specifies that the stairs are to be made of one material.
Landing Overlap	Enabled when stairs are set to monolithic. When a monolithic stair has a winder, the bottom of the stair can be a smooth shape or stepped. If it is stepped, this parameter controls the distance between the riser face and the vertical face of the corresponding step on the underside.
Underside of Winder	Enabled when stairs are set to monolithic. If a monolithic stair has a winder, the bottom of the stair can be a smooth shape or stepped.

Name	Description
Function	Indicates whether the stairs are interior (default value) or exterior. Function is used in scheduling and to create filters to simplify a model when exporting.
Graphics	
Break Symbol in Plan	Specifies whether the cutline of the stairs in plan view has a break line.
Text Size	Changes the size of the UP-DN symbol in a plan view.
Text Font	Sets the font of the UP-DN symbol.
Materials and Finishes	
Tread Material	Click the button to open the Materials dialog. See Materials on page 468 for more information on creating a material.
Riser Material	See Tread Material description.
Stringer Material	See Tread Material description.
Monolithic Material	See Tread Material description.
Treads	
Minimum Tread Depth	Sets the initial value for the Actual Tread Depth instance parameter. If Actual Tread Depth value exceeds this value, Revit Architecture issues a warning.
Tread Thickness	Sets the thickness of the tread.
Nosing Length	Specifies the amount of the tread depth that overhangs the next tread.
Nosing Profile	The profile for a sweep added to the front of the tread. See The Families Guide on page 418. Also see Creating a Sweep on page 328. Revit Architecture has predefined profiles to use for the sweep.
Apply Nosing Profile	Specifies 1-sided, 2-sided, or 3-sided tread nosing.
Risers	
Maximum Riser Height	Sets the maximum height of each riser on the staircase.
Begin with Riser	If selected, Revit Architecture adds a riser to the beginning of the stairs. If you clear the check box, Revit Architecture removes the beginning riser. Note that you may receive a warning about actual number of risers exceeding the desired number of risers if you clear this check box. To resolve this, either select End with Riser, or change the desired number of risers.
End with Riser	If selected, Revit Architecture adds a riser to the end of the stairs. If you clear the check box, Revit Architecture removes the end riser.
Riser Type	Creates straight or slanted risers, or no riser.
Riser Thickness	Sets the thickness of the riser.

Name	Description
Riser to Tread Connection	Switches the connection of the riser and tread in relation to each other. The riser can extend behind the tread, or the tread can extend under the riser.
Stringers	
Trim Stringers at Top	Trim Stringer at Top affects the top end of stringers on a stair run. If you select Do Not Trim, the stringer is cut with a single vertical cut resulting in a point at the top. If you select Match Level, the stringer is cut horizontally, making the top of the stringer flush with the top level. If you select Match Landing Stringer, a horizontal cut is made at the same height as the stringer top on landings. To see the effects of this parameter clearly, you may want to clear the check box for End with Riser.
Right Stringer	Sets the type of stringer for the right side of the stairs. None means there is no stringer. A closed stringer encases the treads and risers. An open stringer exposes the treads and risers.
Left Stringer	See description for Right Stringer.
Middle Stringers	Sets the number of stringers that appear underneath the stairs between the left and right of the stairs.
Stringer Thickness	Sets the thickness of the stringers.
Stringer Height	Sets the height of the stringers.
Open Stringer Offset	Enabled when the stairs have an open stringer. Moves an open stringer from side to side. For example, if you offset an open right stringer, it moves toward the left stringer.
Stringer Carriage Height	Allows you to control the relationship between side stringers and treads. If you increase the number, the stringer moves down from the treads. Treads do not move. Railings do not change height relative to treads, but balusters extend down to meet the stringer top. This height is measured from the tread end (lower corner) to the bottom side of the stringer, perpendicular to the stringer.
Landing Carriage Height	Allows stringers to have a different height relationship to landings than they do to sloped runs. For example, it lowers a horizontal stringer toward a landing on u-shaped stairs.
Identity Data	
Type Mark	A value to designate the particular stairs. Useful if you need to identify more than one set of staircases. This value must be unique for each stairway in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. (You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.)
Keynote	Add or edit the stairs keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The model type for the stairs. May not be applicable.
Manufacturer	Manufacturer for the stair materials. May not be applicable.

Name	Description
Type Comments	Specific comments on the stair type.
URL	A link to a web page for the manufacturer or other appropriate link.
Description	A description for the stairs, such as circular.
Assembly Description	Description of the assembly based on the assembly code selection.
Assembly Code	Uniformat assembly code selected from hierarchical list.
Cost	Material cost.

Stair Instance Properties

Name	Description
Constraints	
Base Level	Sets the base of the stairs.
Base Offset	Sets the stairs's height from its base level.
Top Level	Sets the top of the stairs.
Top Offset	Sets the stairs's offset from the top level.
Multistory Top Level	<p>Sets the top of the stairs in a multi-story building. The advantage to using this parameter (as opposed to sketching individual runs) is that if you change the railing on one run, that railing is changed on all the runs. Also, if you use this parameter, the Revit Architecture project file size does not change as significantly as it would if you sketched individual runs.</p> <p>NOTE The levels in the multi-story building should be a uniform distance apart. For example, each level should be 4 meters apart.</p>
Graphics	
Up Text	Sets the text for the Up symbol in plan. The default value is UP.
Down Text	Sets the text for the Down symbol in plan. The default value is DN.
Up Label	Displays or hides the Up label in plan.
Up Arrow	Displays or hides the Up arrow in plan.
Down Label	Displays or hides the Down label in plan.
Down Arrow	Displays or hides the Down arrow in plan.
Show Up arrow in all views	Displays the Up arrow in all project views.
Dimensions	

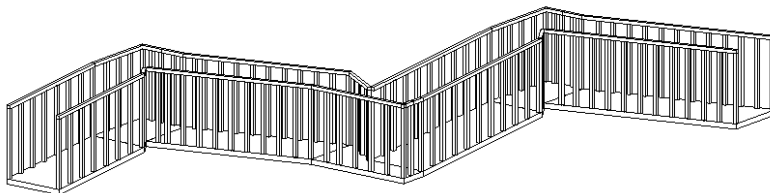
Name	Description
Width	Width of the stairs.
Desired Number of Risers	The number of risers is calculated based on the height between levels.
Actual Number of Risers	Normally, the same as Desired Number of Risers. However, it may be different if you do not complete adding the correct number of risers for the given run of the stairs. This is a read-only value.
Actual Riser Height	Displays the actual riser height. The value is equal to or less than the value specified in Maximum Riser Height. This is a read-only value.
Actual Tread Depth	You can set this value to change the tread depth without having to create a new stair type. Also, the Stair Calculator can change this value to satisfy the stair equation.
Identity Data	
Comments	Specific comments on the staircase.
Mark	A label created for the stairs. This value must be unique for each stairway in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. (You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.)
Phasing	
Phase Created	The phase when the stairs were created.
Phase Demolished	The phase when the stairs were demolished.

Ramps

You construct ramps in a manner similar to stairs. For more information on creating shapes and landings, see [Stairs](#) on page 728.

You can create ramps in plan or 3D views.

Finished ramp





Adding a Ramp

- 1 Click Home tab ► Circulation panel ► Ramp.

Revit Architecture enters sketch mode, and the Run tool is active.

- 2 Click Home tab ► Work Plane panel ► Set, to select a different work plane. See [Sketching and Work Planes](#) on page 317.

- 3 Click Create Ramp Sketch tab ► Draw panel ►  (Line) or  (Center-ends Arc) tool.
- 4 Place the cursor in the drawing area, and drag to sketch the ramp run.
- 5 Click Finish Ramp.

TIP The default settings for the Top Level and Top Offset properties may make the ramp too long. Try setting the Top Level to the current level, and the Top Offset to a lower value.

Specifying the Railing Type for New Ramps

While sketching new ramps, you can specify the railing type to use by clicking Create Ramp Sketch tab ► Tools panel ► Railing Type. Railing Type is available only while sketching new ramps. When you click Railing Type, a dialog displays listing different railing types.

To specify the railing type

- 1 To begin a new ramp, click Home tab ► Circulation panel ► Ramp.
- 2 Click Create Ramp Sketch tab ► Tools panel ► Railing Type.
- 3 In the Railings Type dialog, select one of the existing railing types in the project, or select Default to add the default railing type, or select None to specify that no railing will be added.
If you select Default, Revit Architecture uses the railing type that displays when you activate the Railing tool and then select Railing Properties. You can change the default railing by selecting a new type in the Type Properties dialog. For more information, see [Railings](#) on page 746.

NOTE If the desired railing type is not listed in the Railings Type dialog, you can quit the Ramp tool, create the railing type, and then restart the ramp creation process. You can also create the ramp with any railing type, and then change the railings later, after you have created the desired railings. For more information, see [Railings](#) on page 746 and [The Families Guide](#) on page 418.

- 4 Click OK.

Changing the Ramp Type

To change the ramp type in sketch mode

- 1 Click Create Ramp Sketch tab ► Element panel ► Ramp Properties.
- 2 In the Instance Properties dialog, select a type from the Type Selector drop-down.

To change the ramp type from a project view

- 1 Select the ramp in a plan or 3D view.
- 2 Click Modify Ramps tab ► Element panel ► and select the desired ramp type from the Type Selector drop-down.

Editing a Ramp

- 1 Select the ramp in a plan or 3D view.
- 2 Click Modify Ramps tab ► Edit panel ► Edit Sketch.

Ramp Properties

You can modify several properties for ramps, including thickness, slope, and base level.

Modifying Ramp Properties

- 1 If you are in sketch mode, click Modify Ramps > Edit Sketch tab ► Element panel ► Ramp Properties. If you are in a plan view, select the ramp, and click Modify Ramps tab ► Element panel ► Element Properties.
- 2 In the Instance Properties dialog, edit ramp instance parameters.
See [Ramp Instance Properties](#) on page 745.
- 3 Click Edit Type to edit ramp type parameters.
See [Ramp Type Properties](#) on page 744.

NOTE Changes made to type properties affect all ramps of this type in the project. You can click Duplicate to create a new ramp type.

- 4 Click OK.

Ramp Type Properties

Name	Description
Construction	
Thickness	Sets the thickness of the ramp. This property is enabled only when the Shape property is set to thick.
Function	Indicates whether a ramp is interior (default value) or exterior. Function is used in scheduling and to create filters that simplify a model when exporting.
Graphics	
Text Size	The size of the font for the ramp’s up text and down text.
Text Font	The font for the ramp’s up text and down text.
Materials and Finishes	
Ramp Material	Material applied to the surface of the ramp for rendering.
Dimensions	
Maximum Incline Length	Specifies the maximum amount of consecutive rise in a ramp before a landing is required.
Identity Data	
Keynote	Add or edit the ramp keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	Defines the ramp model.

Name	Description
Manufacturer	Defines the ramp manufacturer.
Type Comments	Ramp comments.
URL	Sets applicable URL.
Description	Ramp description.
Assembly description	Description of the assembly based on the assembly code selection.
Assembly code	Unifomat assembly code selected from hierarchical list.
Type Mark	Sets the ramp type mark.
Cost	Ramp cost.
Other	
Ramp Max Slope (1/x)	Sets the maximum slope for the ramp.
Shape	Applies a shape to the ramp for display purposes.

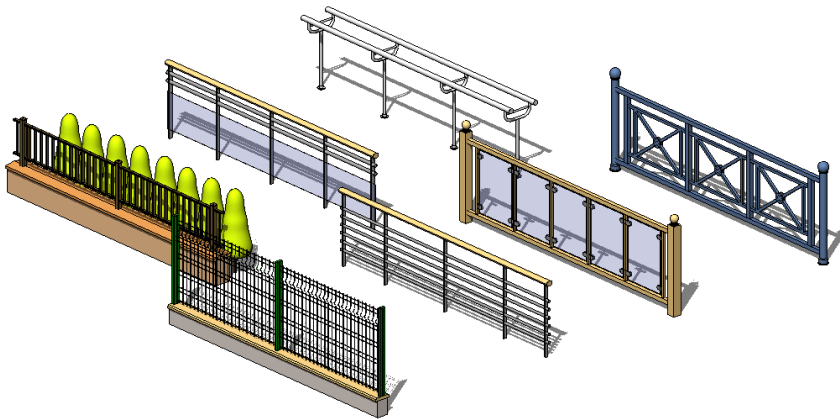
Ramp Instance Properties

Name	Description
Constraints	
Base Level	Sets the base of the ramp.
Base Offset	Sets the ramp's height from its base level.
Top Level	Sets the top of the ramp.
Top Offset	Sets the ramp's offset from the top level.
Multistory Top Level	Sets the top of the ramp in a multi-story building.
Graphics	
Up text	Specifies the up text.
Down text	Specifies the down text.
Up label	Indicates whether the up text appears.
Down label	Indicates whether the down text appears.
Show Up arrow in all views	Indicates whether the up arrow appears in all views.
Dimensions	
Width	Width of the ramp.

Name	Description
Identity Data	
Comments	Specific comments about the ramp.
Mark	A unique identifier for the ramp.
Phasing	
Phase Created	The phase when the ramp was created. See Creating Phases on page 1332.
Phase Demolished	The phase when the ramp was demolished. See Demolishing Elements on page 1338.

Railings

You can add railings as free-standing components to levels, or attach them to hosts (such as floors, ramps, or stairs).



When you sketch a railing, rails and balusters are automatically placed on the railing at evenly spaced intervals. For information on editing baluster and post placement, see [Controlling Placement of Balusters and Posts](#) on page 749.

The shape of rails and balusters are determined by profile families loaded in the project. See [Railing Properties](#) on page 754.

Adding a Railing

- 1 Click Home tab ► Circulation panel ► Railing.
- 2 If you are not in a view where you can sketch a railing, you are prompted to pick a view. Select a view from the list, and click Open View.
- 3 To set the host for the railing, click Create Railing Path tab ► Tools panel ► Set Railing Host, and place the cursor near the host (for example, a floor or staircase).
As you move the cursor, the appropriate hosts highlight.

NOTE To select a level, just click in the drawing area to start drawing the railing.

- 4 Click on the host to select it.

5 Sketch the railing.

If you are adding a railing to a run of stairs, the railing must be sketched along the inside line of the stair stinger in order for the railing to host and slope correctly.

For more information on sketching, see [Sketching](#) on page 303.

6 Click Create Railing Path tab ► Element panel ► Railing Properties to set the railing properties.

For more information, see [Railing Properties](#) on page 754.

7 Click Finish Railing.

8 Change to a 3D view to see the railing.

Related topics

- [Modifying Railing Structure](#) on page 747
- [Modifying Railing Height and Slope](#) on page 748
- [Controlling Placement of Balusters and Posts](#) on page 749
- [Railing Properties](#) on page 754

Changing the Railing Type

To change the railing type in sketch mode

- 1 Click Create Railing Path ► Element panel ► Railing Properties.
- 2 In the Instance Properties dialog, select a type from the Type Selector drop-down.

To change the railing type from a project view

- 1 Select the railing in the project view.
- 2 Click Modify Railings tab ► Element panel, and select a different railing type from the Type Selector drop-down.

Modifying Railing Structure

You can change the height, offset, profile, material, and number of rails within a railing type.

- 1 Select the railing, and click Modify Railings tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 2 In the Rail Structure value, click Edit.

NOTE Changes made to type properties affect all railings of this type in the project. You can click Duplicate to create a new railing type.

- 3 In the Edit Rails dialog, for each rail, specify the following:
 - The height and offset.
 - A rail profile. To create your own rail profile, see [The Families Guide](#) on page 418.
 - A material. To create your own rail material, see [Materials](#) on page 468.
- 4 To create an additional rail, click Insert. Enter a name for the rail, and the height, offset, profile, and material properties.
- 5 Click Up or Down to adjust the railing position.

6 When you are finished, click OK.

Modifying Railing Joins

You can override joins for a railing on a join-by-join basis.

To modify rail joins

- 1 Open the plan view where the railing is located.
- 2 Select the railing, and click Modify Railings tab ► Edit panel ► Edit Path.
- 3 Click Modify Railings > Edit Path tab ► Tools panel ► Edit Rail Joins.
- 4 Place the cursor over a railing join, and click.

NOTE A box appears around the join when you move your cursor over it. When the join is selected, an X appears on the join.

- 5 On the Options Bar, for Rail Join, select a join method.

Join methods are set by the Angled Joins and Tangent Joins parameters for the railing type. For more information on these parameters and join methods, see [Railing Type Properties](#) on page 754.

- 6 Click Finish Railing.

Related topics

- [Modifying Railing Structure](#) on page 747
- [Modifying Railing Height and Slope](#) on page 748
- [Controlling Placement of Balusters and Posts](#) on page 749
- [Railings](#) on page 746

Modifying Railing Height and Slope

You can control the height and slope of individual rail sketch lines. For example, on a set of U-shaped stairs, you may want to set the inner railing to a different height than the outer railing. With slope adjustment, you can control how the railing segment follows the slope of the stairs. You may want the segment to be flat at some points or sloped at other points.

To modify railing height and slope

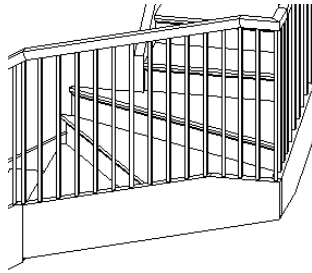
- 1 Open the plan view where the railing is located.
- 2 Select the railing, and click Modify Railings tab ► Edit panel ► Edit Path.
- 3 Select a railing sketch line.

Note that Height Correction is set to By Type. This indicates that height adjustment is controlled by the railing type.
- 4 For Height Correction, select Custom.

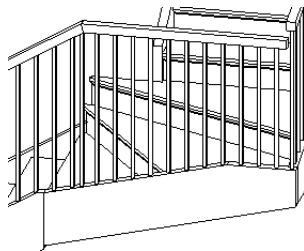
The text box adjacent to Height Correction is enabled.
- 5 Enter a value in the text box.

6 For Slope, select one of the following values:

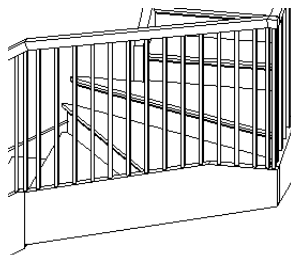
- By Host means that the railing segment follows the slope of its host (for example, stairs or ramps).



- Flat means that the railing segment is horizontal, even if the host is sloped. For railings similar to those in the following illustration, you may need to use height correction or edit the railing join to join the railing where the stairs turn.



- Sloped means that the railing segment is sloped, such that it makes a non-interrupted connection with adjacent segments.



Controlling Placement of Balusters and Posts

You can control how balusters and posts are arranged along a railing. A simple baluster pattern is provided with the default project template. You can use this pattern, modify it, or create a more complex pattern.

NOTE If you start a new project using a template, when you sketch a railing, balusters and posts are added by default. If you start a project without a template, balusters and posts are not placed by default when you sketch a railing.

Creating a Custom Baluster Pattern

- 1 In a plan view, select a railing, and click Modify Railings tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 2 In the Type Properties dialog, for Baluster Placement, click Edit.

NOTE Changes made to type properties affect all railings of this type in the project. You can click Duplicate to create a new railing type.

3 Enter a name for the first part of the baluster pattern.

4 For Baluster Family, do the following:

If you want to...	Then...
show rails and posts, but no balusters	select None.
use a baluster family that exists in your drawing	select one of the balusters from the list.
use a baluster family that is not in your drawing	load additional baluster families before making any selection. For more information on loading families, see Loading Families on page 427.

5 For Base, do the following:

If you want to specify the base as...	Then...
the floor edge, stair tread, level, or ramp	select Host.
one of the existing rail structures in the drawing	select the named rail from the list.
a rail structure that is not defined in your drawing	select Cancel, and click Edit for Rail Structure in the Type Properties dialog.

6 For Base Offset, enter a value.

7 Select the Top. Refer to the previous table.

8 Enter a value for Top offset.

9 Enter a value for Dist. from previous.

10 Enter a value for Offset.

11 For Break Pattern, do the following:

If you want the baluster pattern...	Then...
spread along the length of each railing segment	select Each Segment End.
to break and place a post at the turn angle of the railing	select Angles Greater Than, and enter a value for Angle. If the railing turns at an angle that is equal to or greater than this value, the pattern breaks and a post is added. Typically, this value remains at 0. Turn angles are measured in the plan view. Segment breaks in the railing that do not occur at a turn are ignored.
to remain unbroken regardless of any separations or turns in the railing	select Never. The balusters are located along the entire length of the railing.

12 Specify justification.

Refer to the description of Justify in [Baluster Pattern Properties](#) on page 751.

- 13 Select Excess Length Fill if you selected Beginning, End, or Center for Justify.
Refer to the description of Excess Length Fill in [Baluster Pattern Properties](#) on page 751.
- 14 Click OK.

Overriding the Main Baluster Pattern for Stairs

You can override the main baluster pattern and set a specific pattern for stairs.

- 1 In a plan view, select a railing, and click Modify Railings tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 2 In the Type Properties dialog, for Baluster Placement, click Edit.
- 3 In the Edit Baluster Placement dialog, select Use Baluster Per Tread on Stairs.
- 4 Specify the number of balusters on each tread.
- 5 Specify the baluster family for the stairs.
- 6 Click OK.

Baluster Pattern Properties

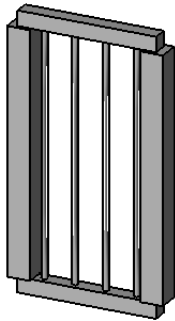
Following are the Main Pattern display properties for balusters.

Property	Description
Name	The name of a specific baluster within the pattern.
Baluster Family	The style of the baluster or post family. If you select None, no balusters or posts display in that portion of the pattern.
Base	Specifies where the bottom of the baluster is placed: at the top of the rail, bottom of the rail, or top of the host. A host can be a level, floor, stair, or ramp.
Base offset	The negative or positive vertical distance between the bottom of the baluster and the base.
Top	Specifies where the top of the baluster is placed (usually a rail). Values are the same as Base.
Top offset	The negative or positive vertical distance between the top of the baluster and the Top.
Dist. from previous	The distance between the start of the pattern and the first baluster, or for subsequent balusters, the distance between the previous baluster in the pattern.
Offset	The distance to the inside or the outside of the railing path.
Break Pattern at	The point along a railing segment at which the baluster pattern stops.
Angle	A value specifying the angle at which a pattern breaks. This property is available when Angles Greater Than is selected for Break Pattern At.
Pattern Length	The sum of all values listed in the Dist. From Previous column.
Justify	<p>Balusters in a pattern are justified along the length of a railing segment.</p> <ul style="list-style-type: none"> ■ Beginning starts the pattern at the beginning of the railing segment. If the pattern length is not an exact multiple of the railing length, then there is excess space between the last pattern instance and the end of the railing segment.

Property	Description
	<ul style="list-style-type: none"> ■ End starts the pattern from the end of the railing segment. If the pattern length is not an exact multiple of the railing length, then there is excess space between the last pattern instance and the beginning of the railing segment. ■ Center places the first baluster pattern at the center of the railing segment and any excess space appears evenly at the beginning and end of the railing segment. ■ Spread Pattern to Fit spreads the pattern evenly along the length of the railing segment. No excess space occurs, and the actual placement value of the pattern differs from the value indicated in Pattern Length. <p>How Revit Architecture determines the beginning and end depends on which way you drew the railing, right to left, or left to right.</p>
Excess Length Fill	If there is extra space along the railing segment, but it cannot be filled with a pattern, you can specify how to fill that space. You can specify that a specific baluster family fill the excess space and set a spacing increment for it. You can specify that the baluster pattern be truncated to fill the excess length, or you can specify none so that the excess space remains open. This property is available if Justify is set to Beginning, End, or Center.
Spacing	The distance between balusters that fill any excess length along the railing segment. This property is available if a baluster or post family is selected for the Excess Length Fill property.

Specifying Start, Corner, and End Posts

- 1 In a plan view, select a railing, and click Modify Railings tab ► Element panel ► Element Properties drop-down ► Type Properties.
 - 2 In the Type Properties dialog, for Baluster Placement, click Edit.
 - 3 Specify a family for the start, corner, and end posts. Select None if you do not want a post to appear at the start, corner, or end of the railing.
- Baluster families are trimmed by default so they do not intersect a rail. The following figure illustrates this: This may not be your intent for posts. To set posts to intersect rails, right-click the family type in the Project Browser, and click Properties. Select the Post property.



- 4 Specify a base for each post.
- 5 Optionally, enter a value for Base offset for each.
- 6 Specify a top for each.
- 7 Optionally, enter a value for Top offset.
- 8 Optionally, enter a value for Space.
- 9 Optionally, enter a value for Offset.

10 Select the location of corner posts, as follows:

If you...	Then...
want to place a corner post at the end of each segment of the railing	select Each Segment End.
want to place a corner post when a railing segment makes a turn greater than a given value	select Angles Greater Than, and enter a value for Angle. If the railing turns at an angle that is greater than this value, a post is placed at the turn. Typically, this value remains at 0. Turn angles are measured in the plan view. Segment breaks in the railing that do not occur at a turn are ignored.
do not want to place a post regardless of any separations or turns in the railing	select Never.

11 Click OK.

Post Properties

Following are the display properties for posts.

Property	Description
Name	The name of a specific post within the baluster.
Baluster Family	The post family. Alternately, you can select None or Default.
Base	Specifies where the bottom of the post is placed: at the top of the rail, bottom of the rail, or top of the host. A host can be a level, floor, stair, or ramp.
Base offset	The negative or positive vertical distance between the bottom of the post and the base.
Top	Specifies where the top of the post is placed (usually a rail). Values are the same as Base.
Top offset	The negative or positive vertical distance between the top of the post and the top.
Space	The amount of space you need to move the post left or right from a given position. For example, for a beginning post, you may need to move the post 4 inches to the left to make it flush with the railing. In this case, you would set space to -4 inches.
Offset	The distance to the inside or the outside of the railing path.
Corner Posts At	Specifies where corner posts are located along the railing segment.
Angle	A value specifying the angle at which a post is added. This is used when Angles Greater Than is selected for Corner Posts At.

Deleting Balusters and Posts

- 1** In a plan view, select a railing, and click Modify Railings tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 2** In the Type Properties dialog, for Baluster Placement, click Edit.

NOTE Changes made to type properties affect all railings of this type in the project. You can click Duplicate to create a new railing type.

- 3 In the Edit Baluster Placement dialog, select the baluster or post to remove in Main Pattern.
- 4 To delete the baluster or post from the pattern, click Delete.
To leave a space in the pattern where a baluster or post currently exists, for Baluster Family, change the value to None.
- 5 Click OK.

Railing Properties

You can modify several properties for railings, including railing height, railing structure, and baluster placement.

NOTE If you are upgrading railing types from a previous release of Revit Architecture and you do not see all of the properties listed, you can duplicate the railing type, and then all properties should be available.

Modifying Railing Properties

- 1 If you are in sketch mode, click Create Railing Path tab ➤ Element panel ➤ Railing Properties. If you are in a plan view, select the railing, and click Modify Railings tab ➤ Element panel ➤ Element Properties.
- 2 In the Instance Properties dialog, edit railing instance parameters.
- 3 Click Edit Type to edit railing type parameters.

NOTE Changes made to type properties affect all railings of this type in the project. You can click Duplicate to create a new railing type.

- 4 Click OK.

Railing Type Properties

Name	Description
Construction	
Railing Height	The height of the top-most rail in the railing structure.
Rail Structure	Opens a separate dialog where you set the number of rails, height, offset, material, and profile family (shape) for each rail. See Modifying Railing Structure on page 747.
Baluster Placement	Opens a separate dialog where you define baluster patterns. See Controlling Placement of Balusters and Posts on page 749.
Baluster Offset	Offsets the balusters from the rail sketch line. By setting a value for this property and rail offsets, you can create different combinations of rails and balusters.
Use Landing Height Adjustment	This parameter controls the height of railings at landings. If set to No, railings at landings use the same height as they do over stair runs. If set to Yes, the railing height is adjusted up or down by the amount set for Landing Height Adjustment.

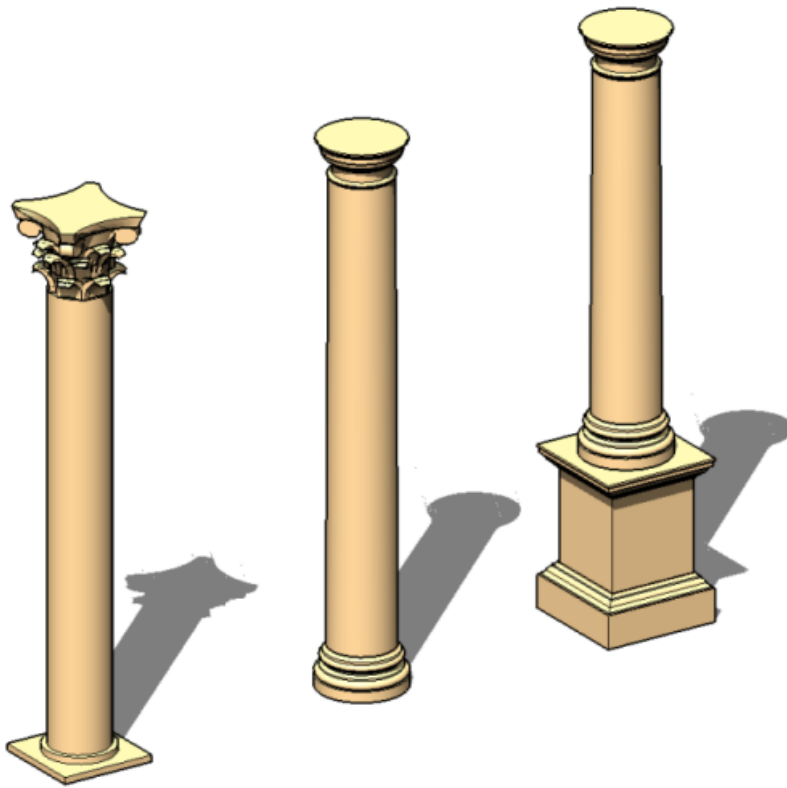
Name	Description
	To get smooth railing connections, set the Tangent Joins parameter to Extend Rails to Meet.
Landing Height Adjustment	Raises or lowers the height of the railing from the value indicated in the Railing Height parameter at intermediate or top landings.
Angled Joins	If 2 railing segments meet at an angle in plan but do not connect vertically, Revit Architecture can add vertical or horizontal segments to create a join or add no connector, leaving a gap. This can be used to create a continuous railing where the start of a stair run leading up from a landing cannot be displaced by one tread width. Join methods can be overridden on an connection-by-connection basis. See Modifying Railing Joins on page 748.
Tangent Joins	If 2 tangent railing segments are collinear or tangent in plan but do not connect vertically, Revit Architecture can add vertical or horizontal segments to create a join, extend segments to meet, or add no connector leaving a gap. This can be used to create a smooth junction when the railing height is modified at a landing or the railing turns out at the bottom of a stair. Join methods can be overridden on a connection-by-connection basis. See Modifying Railing Joins on page 748.
Rail Connections	When connections are made between railing segments, Revit Architecture tries to create mitered joins. If it cannot make a mitered join, then segments can be trimmed, which means they are cut with a vertical plane, or they can be welded, which means they are joined in a manner as close to a miter as possible. Welded connections work best for circular rail profiles.
Identity Data	
Keynote	Add or edit the railing keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	Defines the railing model.
Manufacturer	Defines the railing manufacturer.
Type Comments	Railing comments.
URL	Sets applicable URL.
Description	Railing description.
Assembly Description	Description of the assembly based on the assembly code selection.
Assembly Code	Unifomat assembly code selected from hierarchical list.
Type Mark	Sets the railing type mark.
Cost	Railing cost.

Railing Instance Properties

Name	Description
Constraints	
Base Level	Sets the base level for the railing. You can change this value to any level in the project.
Base Offset	Offsets the railing to a specified distance above or below the base level.
Dimensions	
Length	The actual length of the railing.
Identity Data	
Comments	Comments on the railing.
Mark	A mark applied to a railing. This can be a label that appears in a multi-category tag with the railing. For complete information about multi-category tagging and setting up shared parameters, see Shared Parameters on page 451.
Phasing	
Phase Created	The phase when the railing was created. See Creating Phases on page 1332.
Phase Demolished	The phase when the railing was demolished. See Demolishing Elements on page 1338.

Architectural Columns

This topic describes how to add architectural columns to a project. You can use architectural columns to model column box-outs around structural columns and for decorative applications.



Architectural columns inherit the material of other elements to which they are joined. Compound layers in walls wrap at architectural columns. This does not apply to structural columns.

Adding a Column

You can add columns in plan view. The height of the column is defined in the properties of the component. Using the properties, you can define the Base Level and the Top Level, as well as offsets.

- 1 Click Home tab ► Build panel ► Column.
- 2 On the Options Bar, select Room Bounding to designate the column as room-bounding before you place it.

NOTE You can also change the room-bounding property of a column after placement. See [Architectural Column Properties](#) on page 764.

- 3 Click in the drawing area to place the column.

TIP Typically, you align columns when placing them by selecting a grid line or wall. If you randomly placed them and you want to align them, click Modify tab ► Edit panel ► Align, and select the columns to align. In the middle of the columns are 2 perpendicular reference planes that you can select for alignment.

Attaching Columns

Columns do not automatically attach to roofs, floors, and ceilings. When you select a column (or multiple columns) you can attach it to roofs, floors, ceilings, reference planes, structural framing members, and other reference levels.

To attach columns

- 1 In the drawing area, select one or more columns.
- 2 Click Modify Columns tab ► Modify Column panel ► Attach.
- 3 On the Options Bar:
 - Select Top or Base to specify which part of the column you are attaching.
 - Specify the Attachment Style (Cut Column, Cut Target, or Do Not Cut).
 - Specify the Attachment Justification (Minimum Intersection, Intersect Column Midline, or Maximum Intersection).

The target (roofs, floors, ceilings) can be cut by the column, the column can be cut by the target, or neither can be cut. After a column is attached to a target, you can edit its properties and reset the values for the Attachment Justification at Top and Offset from Attachment at Top instance parameters.
 - Specify Offset from Attachment. Offset from Attachment sets a value to be offset from the target.

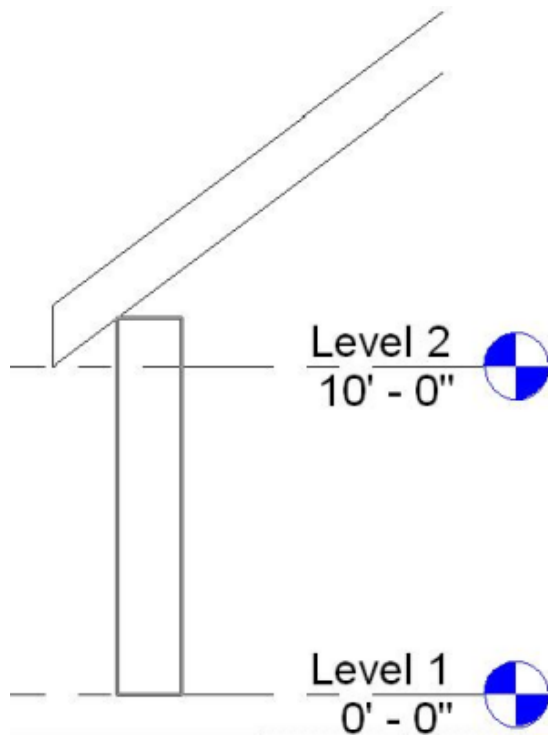
NOTE If the column and target are both structural concrete, they will be cleaned instead of cut. If the column is structural and the target is non-structural, a warning message appears.

- 4 In the drawing area, select the target (for example, roof or floor) you want to attach the column to.

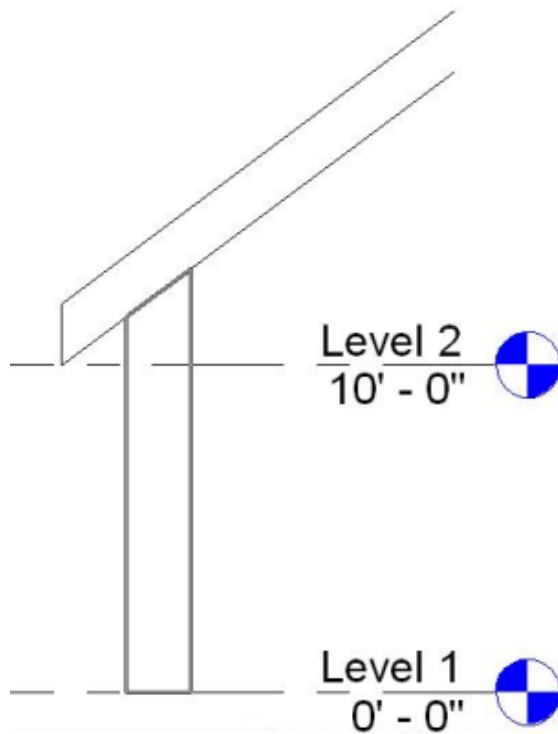
Cut Column Examples

Following are examples of the cut column attachment style with different attachment justifications and offsets from attachment.

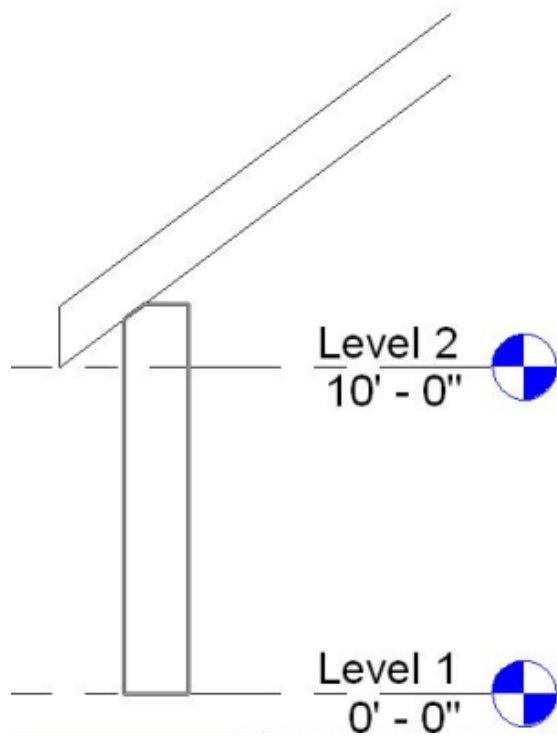
- Attachment Style: Cut Column
Attachment Justification: Minimum Intersection



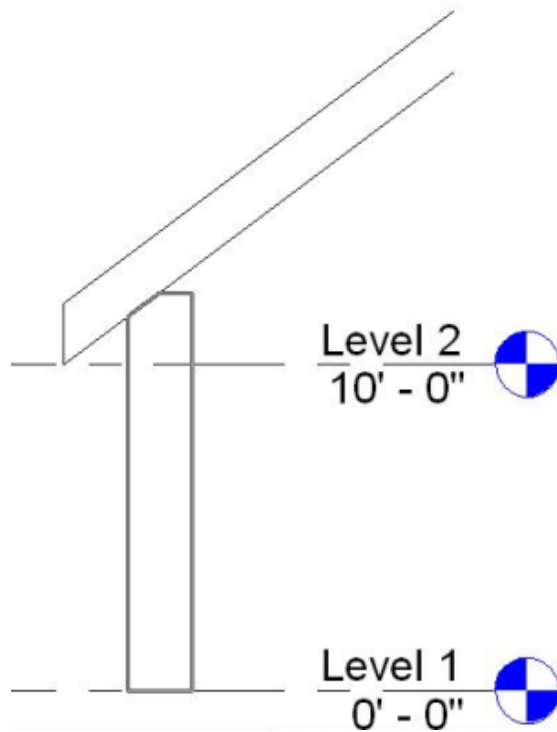
- Attachment Style: Cut Column
Attachment Justification: Maximum Intersection



- Attachment Style: Cut Column
Attachment Justification: Minimum Intersection
Offset from Attachment: 0' 6"



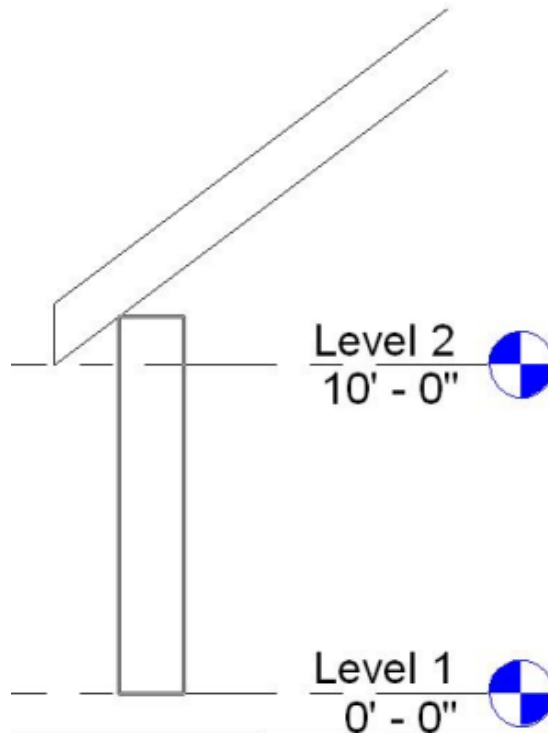
- Attachment Style: Cut Column
Attachment Justification: Intersect Column Midline



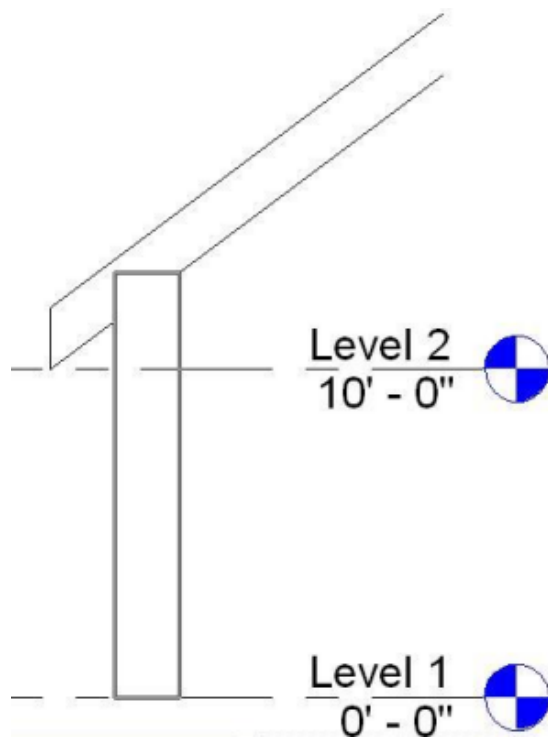
Cut Target Examples

Following are examples of the cut target attachment style with different attachment justifications and offsets from attachment.

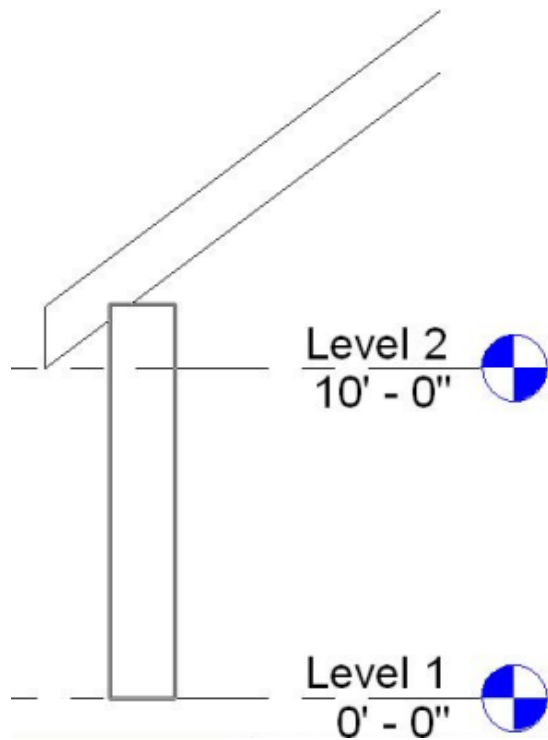
- Attachment Style: Cut Target
Attachment Justification: Minimum Intersection



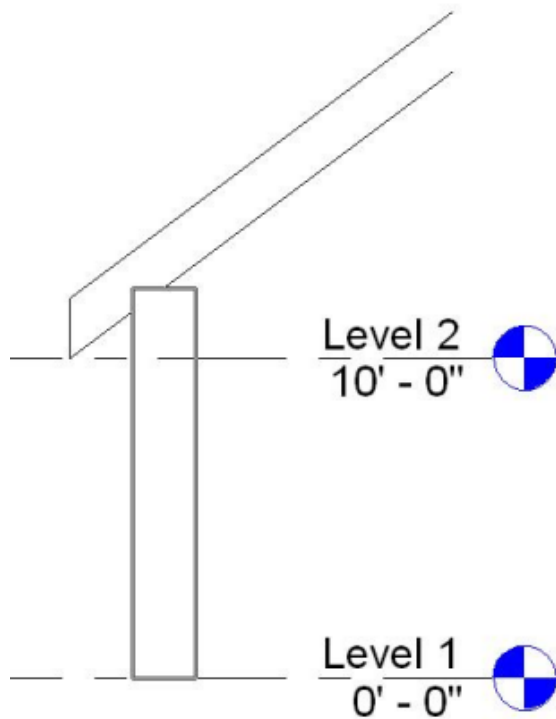
- Attachment Style: Cut Target
Attachment Justification: Maximum Intersection



- Attachment Style: Cut Target
Attachment Justification: Minimum Intersection
Offset from Attachment: On



- Attachment Style: Cut Target
Attachment Justification: Intersect Column Midline



Detaching Columns

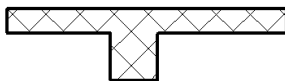
- 1 In the drawing area, select the column you want to detach. You can select multiple columns.
- 2 Click Modify Columns tab ► Modify Column panel ► Detach.
- 3 Click the target you want to detach the column from.

If the column is attached to the target by its top and bottom, click Detach All on the Options Bar to detach the top and bottom of the column from the target.

Coarse-Scale Cut Patterns

If you join a wall and a column, and the wall has a coarse-scale fill pattern defined, the joined column assumes that pattern. See [Curtain Wall Properties](#) on page 786. This behavior is evident in coarse-scale plan and section views. The section view plane must cut through the joined face of the 2 elements.

Wall and column joined (column assumes the fill pattern of the wall)



NOTE Structural columns do not assume the walls fill pattern, even when joined.

Modifying Architectural Columns

Changing Column Types

When you activate the Column tool to place columns, you can select different types of columns in the Type Selector.

Moving a Column

You can move the column by selecting the column and dragging it to the new location.

Architectural Column Properties

You can modify several properties for architectural columns, including width, depth, base and top level.

Modifying Architectural Column Properties

- 1 From a plan view, select the architectural column, and click Modify Columns tab ► Element panel ► Element Properties.
- 2 In the Instance Properties dialog, edit architectural column instance parameters.
See [Architectural Column Instance Properties](#) on page 765.
- 3 Click Edit Type to edit architectural column type parameters.
See [Architectural Column Type Properties](#) on page 764.

NOTE Changes made to type parameters affect all architectural columns of this type in the project. You can click Duplicate to create a new architectural column type.

- 4 Click OK.

Architectural Column Type Properties

Name	Description
Graphics	
Coarse Scale Fill Color	Specifies the color of the Coarse Scale Fill Pattern in any coarse plan view.
Coarse Scale Fill Pattern	Specifies the cut pattern that displays within the column in any coarse plan view.
Materials and Finishes	
Material	The material of the column.
Dimensions	
Depth	Sets the depth of columns when placed.
Offset Base	Sets the offset of the column base.

Name	Description
Offset Top	Sets the offset of the column top.
Width	Sets the width of columns when placed.
Identity Data	
Assembly Code	Unifomat assembly code selected from a hierarchical list.
Keynote	Add or edit the column keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The model type of the column.
Manufacturer	The manufacturer for the column materials
Type comments	Specific building or design comments about the column.
URL	Sets a link to a web page. For example, a manufacturer's web page.
Description	Provides a description of the column.
Assembly Description	Description of the assembly based on the assembly code selection.
Type Mark	A value to designate the particular column. This value must be unique for each column in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. (You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.)
Cost	Cost of the materials for constructing the column. This information can be included in a schedule.
OmniClass Number	The number from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.
OmniClass Title	The name from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.

Architectural Column Instance Properties

Name	Description
Constraints	
Base Level	Specifies the level on which the base of the column rests. The default is Level 1.
Base Offset	Specifies distance from the base level. The default is 0.
Top Level	Specifies the level that the top of the column reaches. The default is 1.
Top Offset	Specifies distance from the top level. The default is 0.
Moves With Grids	Columns move when grid lines are moved.

Name	Description
Room Bounding	Determines whether the column is room-bounding. See Room Boundaries on page 979.
Top is Attached	Read-only parameter specifying that the top of the column is attached to a structural floor or roof. See Attaching Columns on page 757.
Attachment Justification At Top	When the column is attached to a surface, sets the top justification for the condition. Choices are: Minimum Intersection, Intersect Column Midline, Maximum Intersection.
Offset From Attachment At Top	When the column is attached to a surface, specifies an offset value for cut target/column conditions.
Base is Attached	Read-only parameter specifying that the base of the column is attached to a surface. See Attaching Columns on page 757.
Attachment Justification At Base	When the column is attached to a surface, sets the base justification for the condition. Choices are: Minimum Intersection, Intersect Column Midline, Maximum Intersection.
Offset From Attachment At Base	When the column is attached to a surface, specifies an offset value for cut target/column conditions.
Identity Data	
Comments	Specific comments for the column instance.
Mark	Applies a tag to any column for reference purposes. This value must be unique for each column in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. (You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.)
Phasing	
Phase Created	The phase when the column was created.
Phase Demolished	The phase when the column was demolished.

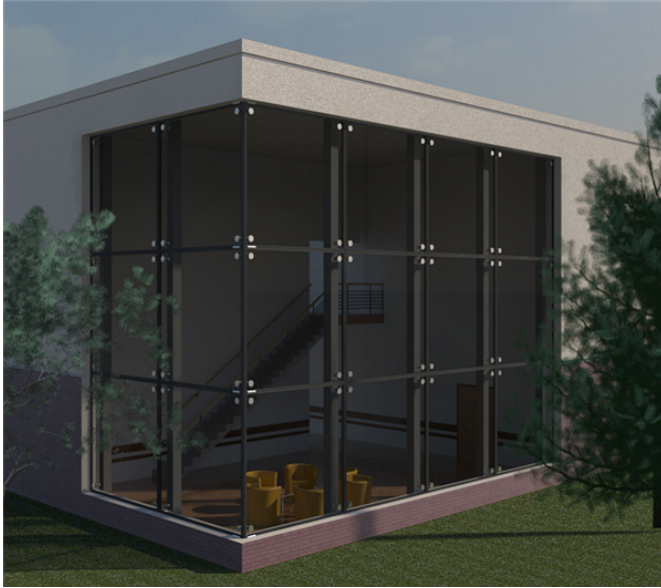
Curtain Elements

This section provides information about curtain elements.

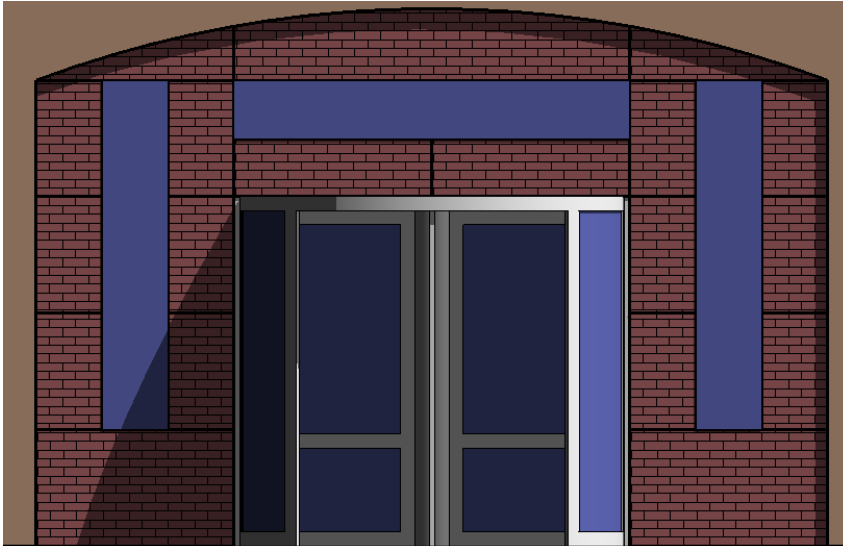
Curtain Walls, Curtain Grids, and Mullions

A curtain wall is any exterior wall that is attached to the building structure and which does not carry the floor or roof loads of the building. In common usage, curtain walls are often defined as thin, usually aluminum-framed walls containing in-fills of glass, metal panels, or thin stone. When you draw the curtain wall, a single panel is extended the length of the wall. If you create a curtain wall that has automatic curtain grids, the wall is subdivided into several panels.

Curtain wall



Curtain Grid








Creating Rectangular Curtain Walls

- 1 Click Home tab ► Build panel ► Wall.
- 2 Click Place Wall tab ► Element panel, and select a curtain wall type from the Type Selector drop-down.
- 3 To create a wall with automatic horizontal and vertical curtain grids, specify the Vertical and Horizontal Layout properties for the wall type.

For more information, see [Type-Driven Curtain Element Layout](#) on page 772.

IMPORTANT You cannot move automatic curtain grids after drawing a wall, unless you make them independent. To do this, select a curtain grid and click Modify Curtain Wall Grids tab ► Element panel ► Element Properties. In the Instance Properties dialog, under Other, select Independent for Type Association. Alternatively, you can select the grid, and click the pin that is displayed. When an automatic grid is independent, its position remains fixed if you resize the wall or change the grid layout using the type properties of the curtain wall. This parameter allows you to adjust the position of certain grids after creating even-grid spacing. If you had placed the grid on the curtain wall, it would not be part of the grid layout calculation.

4 Create the wall, using one of the following methods:

- **Draw the wall:** By default, Line is active. (If it is not active, click Place Wall tab ► Draw panel ►  (Line), or select another draw tool.) See [Sketching](#) on page 303.
As you draw a wall, you can quickly set its length by entering a value on the keyboard, taking advantage of the listening dimension feature. See [Listening Dimensions](#) on page 283.
If you want to flip the orientation of the wall about its location line, press the *Spacebar* as you draw the wall. This works for all wall drawing tools, such as rectangles, circles, and 3-point arcs.
- **Pick Lines** (): Select existing lines. Lines can be model lines or edges of elements, such as roofs, curtain panels, and other walls.
- **Pick Faces** (): Select either a massing face or a generic model face. The generic model could be created as in-place or family file based. See [Creating Walls from Mass Faces](#) on page 615.

TIP To highlight all vertical faces on the mass or generic model, press *Tab*. Click to place walls simultaneously on each highlighted face.

To exit the Wall tool, press *Esc* twice.

5 To change a panel type, do the following:

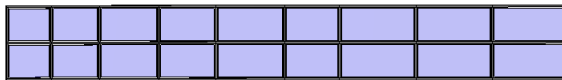
- a Open an elevation or a view where you can see the panels of the curtain wall.
- b Select a panel.
Move the cursor over a panel edge, and press *Tab* several times until the panel is selected. Watch the status bar for information, and then click to select it.
- c Click Modify Curtain Panels tab ► Element panel, and select the appropriate panel type from the Type Selector drop-down.

6 If you sketched a curtain wall without automatic grids ([Type-Driven Curtain Element Layout](#) on page 772), you can add grids manually. See [Adding Curtain Grids](#) on page 770.

7 If needed for the design, add mullions to the grids.

See [Placing Mullions](#) on page 775.

Completed curtain wall






Non-Rectangular Curtain Walls

To create non-rectangular curtain walls, sketch a straight curtain wall and then edit its elevation profile, or join a straight curtain wall to any roof. See [Defining Wall Shapes or Openings](#) on page 662.

- 1 Click Home tab ► Build panel ► Wall.
- 2 Click Place Wall tab ► Element panel, and select Curtain Wall 1 from the Type Selector drop-down.

3 Create the wall, using one of the following methods:

- **Draw the wall:** By default, Line is active. (If it is not active, click Place Wall tab ► Draw panel ►  (Line), or select another draw tool.) See [Sketching](#) on page 303.
As you draw a wall, you can quickly set its length by entering a value on the keyboard, taking advantage of the listening dimension feature. See [Listening Dimensions](#) on page 283.
If you want to flip the orientation of the wall about its location line, press the *Spacebar* as you draw the wall. This works for all wall drawing tools, such as rectangles, circles, and 3-point arcs.
- **Pick Lines** (): Select existing lines. Lines can be model lines or edges of elements, such as roofs, curtain panels, and other walls.
- **Pick Faces** (): Select either a massing face or a generic model face. The generic model could be created as in-place or family file based. See [Creating Walls from Mass Faces](#) on page 615.

TIP To highlight all vertical faces on the mass or generic model, press *Tab*. Click to place walls simultaneously on each highlighted face.

4 Select the wall, and edit its elevation profile or join it to a roof.

5 Add curtain grids and mullions, as desired.

See [Adding Curtain Grids](#) on page 770 and [Placing Mullions](#) on page 775.

Adding Curtain Grids

If you sketched a curtain wall without automatic grids ([Type-Driven Curtain Element Layout](#) on page 772), you can add grids manually.

1 Open a 3D view or an elevation view.

2 Click Home tab ► Build panel ► Curtain Grid.

3 Click Place Curtain Grid tab ► Placement panel, and select a placement type. See [Selectively Placing Curtain Grids](#) on page 771.

4 Place the cursor along wall edges; a temporary grid line displays.

5 Click to place the grid lines.

Each section of the grid (design unit) is filled with a separate curtain wall panel of the selected type.

6 Click Finish Current when you are done.

7 Add additional grid lines, if necessary, or click Modify to exit the tool.

Curtain grid snapping

When you place curtain grids, they snap to evenly spaced intervals on the curtain wall. For example, as you drag the cursor over a panel, it snaps to the midpoint or to the 1/3 mark of the panel.

When you place curtain grids on walls, sloped glazings, and curtain systems, the curtain grids snap to visible levels, grids, and reference planes. In addition, curtain grids snap to other curtain grids when you select a common corner edge. For example, if you place the cursor on a joined edge between 2 curtain walls, the new curtain grid snaps to an existing curtain grid.

To place mullions on grid lines, see [Placing Mullions](#) on page 775.

Related topics

- [Selectively Placing Curtain Grids](#) on page 771
- [Excluding Grids from Panels](#) on page 771
- [Grid Layout by Face](#) on page 774
- [Locking the Position of Mullions and Curtain Grids](#) on page 774
- [Graphically Modifying Face Layout](#) on page 774

Selectively Placing Curtain Grids

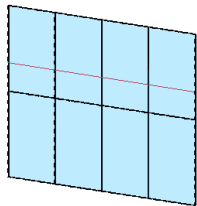
As you place curtain grids on curtain panels, a preview image of the grid is displayed on the panels. You can control the location of the preview and thus the location of the curtain grid using one of the options for the grid segments:

- **All Segments:** places grid segments on all panels where the preview appears.
- **One Segment:** places one grid segment on one panel where the preview appears.
- **All Except Picked:** places a grid segment on all panels except those you select to exclude.

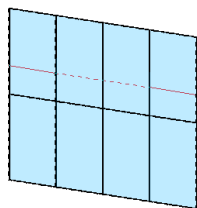
Excluding Grids from Panels

- 1 Click Home tab ► Build panel ► Curtain Grid.
- 2 Click Place Curtain Grid tab ► Placement panel ► All Except Picked.
- 3 Place the cursor on a curtain wall, so that a preview of the curtain appears.
- 4 Click to place the curtain grid.

The curtain grid line is displayed in red.



- 5 Click segments of the curtain grid to exclude them from panels.
When you click the segments, they are displayed as dashed lines.



- 6 When you finish excluding segments, click Finish Current to place a new curtain grid.

Type-Driven Curtain Element Layout

You can specify a curtain element layout for walls, sloped glazings, and curtain systems. By specifying the layout by type, you can place many instances that already have panels, grids, and mullions on them.


You create a curtain grid layout by specifying a combination of type and instance parameters that affect the faces of the curtain element, as follows:

Type Properties	
Name	Description
Construction	
Automatically Embed (curtain walls only)	Determines whether the curtain wall embeds into other walls.
Curtain Panel	Specifies the curtain panel family type for the curtain element.
Join Condition	Controls which mullions break at intersections on a curtain element type. For example, use this parameter to make all horizontal or vertical mullions on a curtain wall continuous, or to make mullions on grid 1 or grid 2 continuous on a curtain system or sloped glazing.
Vertical Grid Pattern (for curtain walls) or Grid 1 Pattern (for curtain systems and sloped glazings)	
NOTE These descriptions apply to the Horizontal Grid Pattern or Grid 2 Pattern.	
Layout	Specifies an automatic layout for curtain grid lines along the length of a face on a curtain element. When you specify a value other than None , Revit Architecture automatically adds grid lines to the faces of a curtain element. Fixed Distance indicates that the curtain grids are placed at the exact value specified for the Spacing parameter. If the spacing is not an even factor of the length, a space is inserted at one or both ends of the face, depending on the justification parameter. Fixed Number indicates that you can specify different numbers of curtain grids for different curtain instances. See the Number instance property description under Vertical Pattern for more information. Maximum Spacing indicates that the curtain grids are placed at even intervals along the length of the face. The distance can be up to the value specified for Spacing, but is not necessarily at a specified fixed distance.
Spacing	Enabled when Layout is set to Fixed Distance or Maximum Spacing. When the layout is set to a fixed distance, Revit Architecture uses the exact value specified for Spacing. When the layout is at a maximum spacing, Revit Architecture uses up to the specified value to lay out the grids.
Adjust for Mullion Size	Adjusts the position of type-driven gridlines to ensure that curtain panels are of equal size, whenever possible. Sometimes when mullions are placed (particularly on borders of curtain hosts), it can result in panels of unequal size, even if the Layout is set to Fixed Distance.
Vertical Mullions (for curtain walls) or Grid 1 Mullions (for curtain systems and sloped glazings)	
Interior Type	Specifies the mullion family for interior vertical mullions.

Border 1 Type	Specifies the mullion family for vertical mullions on the left border.
Border 2 Type	Specifies the mullion family for vertical mullions on the right border.
Horizontal Mullions (for curtain walls) or Grid 2 Mullions (for curtain systems and sloped glazings)	
Interior Type	Specifies the mullion family for interior horizontal mullions.
Border 1 Type	Specifies the mullion family for horizontal mullions on the left border.
Border 2 Type	Specifies the mullion family for horizontal mullions on the right border.
Instance Properties	
Name	Description
Vertical Grid Pattern	
NOTE These parameter descriptions apply to the Horizontal Grid Pattern instance parameters also.	
Number	If Layout (under Vertical Grid Pattern) is set to Fixed Number, enter the number of curtain grids for the curtain instance. The maximum value is 200.
Justification	Determines the spacing of grids along the curtain element face, when grid spacing does not divide evenly into the face length value. Justification also determines which grid lines are first removed or added when the number of grid lines changes because of parameter changes or changes to the size of the face. Beginning adds space to the end of the face before placing the first grid. Center adds an even amount of space at both the beginning and end of the face. End adds space from the beginning of the face before placing the first grid.
Angle	Rotates the curtain grids to the specified angle. If you specify this value for individual faces, no value is displayed in this field. Valid values are between 89 and –89.
Offset	Starts grid placement at the specified distance from the justification point of the grids. For example, if Justification is specified as Beginning and you enter 5' for offset, the first grid is placed 5' from the beginning of the face. If you specify offset for a face, no value is displayed in this field.
Measurement Line (curtain system only)	An imaginary line that defines the point from which to measure grid spacing on faces where grid spacing may not be the same across the length of grid lines. Where grids intersect this line, the distance between the grids is equal to the grid spacing value (for Fixed Distance layouts) or up to the grid spacing value (for Maximum Spacing layouts). Where the grids do not intersect this line, the grids can be placed at values either higher or lower than the value for Spacing.

Grid Layout by Face

You can create various grid layouts on the faces of curtain elements. For example, if a sloped glazing with 4 faces requires 4 different grid layouts, you can specify grid layout by face, which is similar to changing an element instance.

To change curtain grid layouts on a face, select the curtain grid element and then click  (Configure Grid Layout), which displays on each face of the curtain element. You can change the layout either by accessing the Element Properties or by graphically modifying the curtain grid layout interface.

The following are instance properties that you can set by face for a curtain element:


- Number
- Justification
- Offset
- Angle

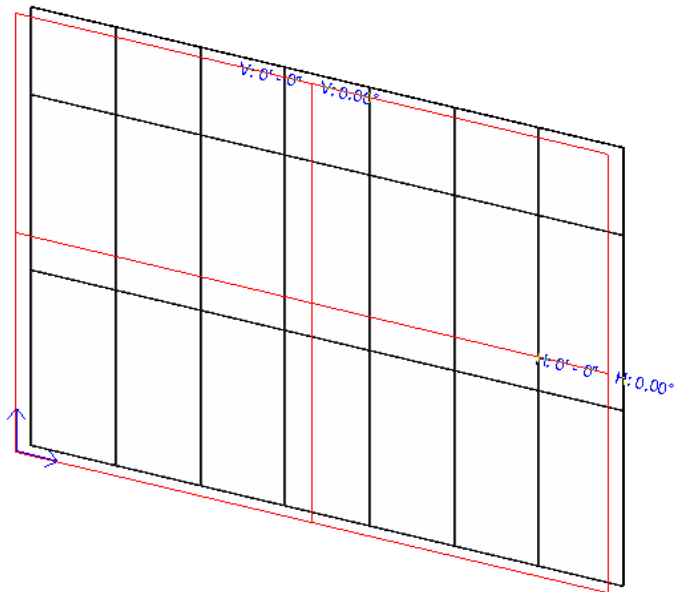
For a description of these properties, see [Type-Driven Curtain Element Layout](#) on page 772.

Locking the Position of Mullions and Curtain Grids

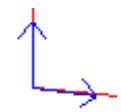
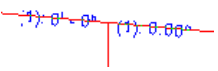
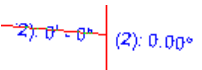
Mullions and curtain grids can be pinned (locked) on a curtain element only if that element has a type-driven curtain grid layout. If the mullion or curtain grid is locked on a curtain element, the type properties of the curtain element define the mullion or curtain grid type.

Graphically Modifying Face Layout

When you select a curtain grid element face, you click the control  that is displayed; a curtain grid layout interface is opened over the curtain grid face. The interface lets you graphically change the instance parameter values of the face.



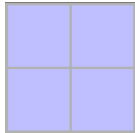
Layout interface controls:

Control	Description
	The justification origin. Click the arrows to change the justification scheme of the grids. The horizontal arrow changes Justification (Vertical Grid); the vertical arrow changes Justification (Horizontal Grid).
	Origin and angle (Vertical Curtain Grid). Click the controls to change their values.
	Origin and angle (Horizontal Curtain Grid). Click the controls to change their values.

Mullions

When you add mullions to a grid, the mullions resize to fit the grid. If you add a mullion to an inside grid, the mullion is centered on the grid. If you add a mullion to a perimeter grid, the mullion aligns so its border is flush with the outside of the wall.

Curtain wall with curtain grids and mullions



Placing Mullions

After creating a curtain grid, you can place mullions on grid lines.

- 1 Add a curtain grid to a curtain wall or curtain system.
See [Adding Curtain Grids](#) on page 770.
- 2 Click Home tab ► Build panel ► Mullion.
- 3 Click Place Mullion tab ► Element panel ► Type Selector drop-down, and select the desired mullion type.
- 4 On the Place Mullion tab ► Placement tab, select one of the following tools:
 - **Grid Line:** When you click a grid line in the drawing area, this tool places a mullion across the entire grid line.
 - **Grid Line Segment:** When you click a grid line in the drawing area, this tool places a mullion on the individual segment of the grid line that you click.
 - **All Grid Lines:** When you click any grid line in the drawing area, this tool places mullions on all grid lines.
- 5 Click in the drawing area to place mullions on grid lines as desired.
- 6 Click Modify.

Mullions resize to the grid line, and automatically split at an intersection with another mullion. You can change the properties of mullions. For a complete list of mullion properties and their values, see [Common Mullion Type Properties](#) on page 790.

Mullion Profiles

You can vary the shape of mullions by loading new mullion profiles into a project. Also, you can create a custom profile.

Revit Architecture provides some templates for mullion profile families. By default, these templates reside in the following location:

C:\Documents and Settings\All Users\Application Data\Autodesk\<product and release>\<Metric or Imperial> Library\Profiles\Curtain Wall

For more information, see [The Families Guide](#) on page 418.

Applying a Mullion Profile

- 1 In the drawing area, select a mullion on the model, or click Home tab ► Build panel ► Mullion.
- 2 Click Modify Curtain Wall Mullions tab or Place Mullion tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 In the Type Properties dialog, under Construction, select a profile, and click OK.

Creating a Mullion Profile

You can create a custom profile for a mullion. For more information about creating a profile family, see [The Families Guide](#) on page 418.

Mullion profile families can include detail components that are displayed when the mullion intersects the cut plane of the view. You can specify the visibility of the detail components to display at various detail levels.

For example, you might specify the detail component to display at fine and medium detail levels. When you load the mullion into the project and place it in a plan view with a coarse detail level, the plan view might show only the profile sketch. You could then create a section detail of the mullion and specify its detail level as fine. The detail components would be displayed in this view, offering greater detail of the construction of the mullion. For more information, see [Managing Family Visibility and Detail Level](#) on page 513.

Detail Components are shown only when the mullion is cut by the viewplane in floor/ceiling plan views and section/elevation views.

TIP When you use a profile in a project, the curtain panels are trimmed to where the profile sketch intersects the center (front/back) reference plane in the profile family. To change where the curtain panels stop, you can move this plane to cut the profile at the desired width, and reload the family.

Angle and Position of a Mullion

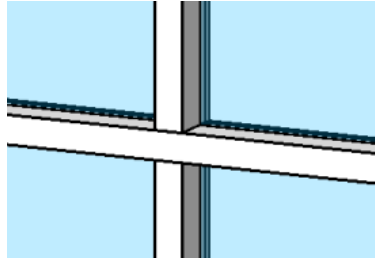
Mullions can be perpendicular to the face of the curtain panel or parallel to the ground plane. The latter choice is more appropriate for sloping curtain panels. After changing the position of the mullion, you can change the angle of the mullion; acceptable values are between –90 and 90 degrees.

The angle and position are type properties of the mullion. For more information, see [Common Mullion Type Properties](#) on page 790.

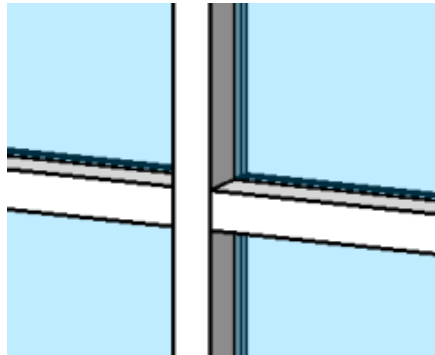
Controlling Mullion Joins

You can control mullion joins after you place mullions on a curtain grid.

- 1 In the drawing area, select a mullion.
- 2 Click Modify Curtain Wall Mullions tab ► Mullion panel ► Make Continuous or Break at Join.
 - Use Make Continuous to extend the ends of mullions at a join, so that they display as one continuous mullion.



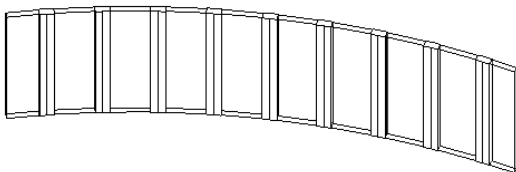
- Use Break at Join to trim the ends of mullions at a join, so that they display as separate mullions.



Corner Mullions

Corner mullions are single mullions that you can place between the end points of 2 curtain walls, between the ridges of sloped glazings, or on any internal mullion on a curved curtain element, such as an arc curtain wall.

Arc curtain wall with internal mullions

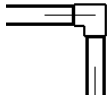


Corner Mullion Types

Revit Architecture includes 4 types of corner mullions:

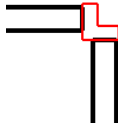
- **L Corner Mullion:** Panels of curtain walls or sloped glazing meet the ends of the mullion legs. You can specify the length and thickness of the mullion legs in the type properties of the mullion. See [Corner Mullion Type Properties](#) on page 792.

L corner mullion between 2 curtain walls



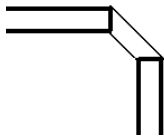
- **V Corner Mullion:** Panels of curtain walls or sloped glazing meet the sides of the mullion legs. You can specify the length and thickness of the mullion legs in the type properties of the mullion.

V corner mullion between 2 curtain walls



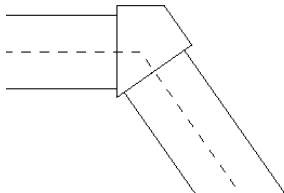
- **Trapezoid Corner Mullion:** Panels of curtain walls or sloped glazing meet at the sides of the mullion. You can specify the center width and length along the sides that meet the panels in the type properties of the mullion.

Trapezoid mullion between 2 curtain walls

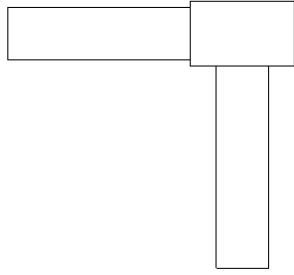


- **Quad Corner Mullion:** Panels of curtain walls or sloped glazing meet at the sides of the mullion legs. You can specify the depth of the mullion in 2 segments.

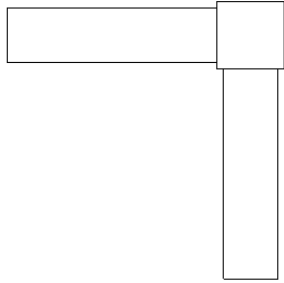
If the 2 mullion segments are equal and the join is not 90 degrees, the mullion has a kite shape:



If the join angle is 90 degrees and the segments are unequal, the mullion is a rectangle:



If the 2 segments are equal and the join angle is 90 degrees, the mullion is a square:




NOTE The quad corner mullion differs from a rectangular non-corner mullion because the curtain panels join at adjacent sides of the quad corner mullion.

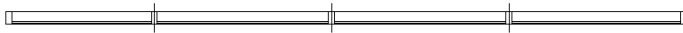
TIP The offset for corner mullions is relative to the panels.

Changing the Orientation of Curtain Walls

As you place a [Curtain Walls, Curtain Grids, and Mullions](#) on page 766 or select one in a plan view, control

arrows are displayed: . Click the arrows to flip the interior and exterior surfaces of the wall.

Curtain wall before flipping



Curtain wall after flipping (the black surface line is now on top)

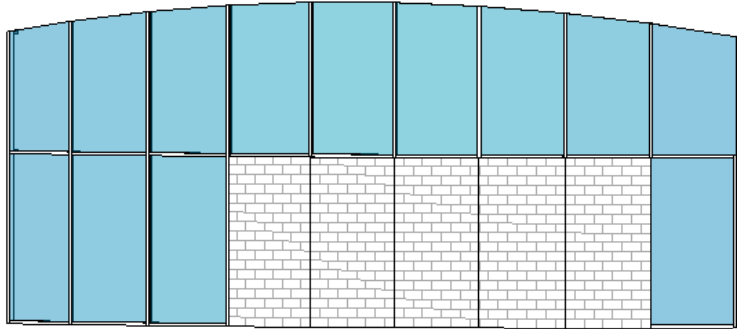


Wall Panels in Curtain Walls

You can change a curtain wall panel to any type of wall. Select a panel, and then select a wall type in the Type Selector. You cannot explicitly control the size of a panel with drag controls, or by its properties; the panel is resized when the curtain wall is changed.

Changing the location line of the wall panel changes how it is placed in the curtain wall.

Curtain wall with masonry wall panel type



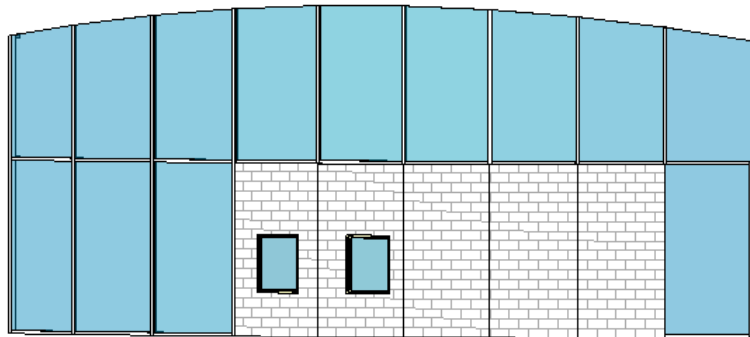
Schedule as Panels or Walls

To control whether the wall schedules as a curtain panel or as a wall, edit instance properties for the wall panel, and change the value of Categorize as.

Add Inserts to Wall Panels

You can add inserts, such as windows, into wall panels; the position of inserts is relative to the entire curtain wall. If you resize a wall panel by moving curtain grids, the insert does not move with the panel. Its position remains fixed with respect to the curtain wall.

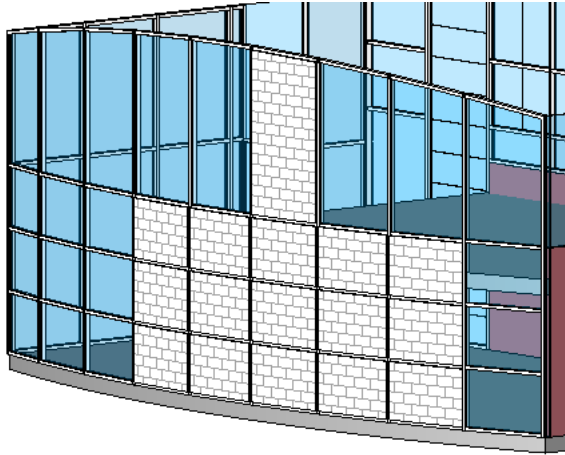
Inserts in masonry wall panels



Split Wall Panels with Curtain Grids

You can split wall panels by adding curtain grids to the curtain wall. You can also add [Mullions](#) on page 775 to the curtain grids on the panel.

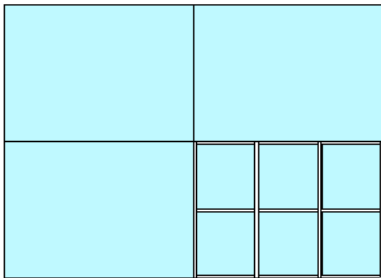
Split curtain wall panels



Curtain Wall as Wall Panel

A curtain wall type can be applied to a wall panel, which has the effect of nesting a curtain wall within a curtain wall.

Curtain wall with curtain wall panel



Modifying Curtain Walls

You can modify the appearance of curtain walls through their properties. Curtain wall properties are modifiable before or after you draw the walls.

To specify curtain wall properties, you can access instance properties or type properties.

- Select the wall, and click **Modify Walls** tab ➤ **Element** panel ➤ **Element Properties** drop-down ➤ **Instance Properties** or **Type Properties**.
- Click **Home** tab ➤ **Build** panel ➤ **Wall**, select a curtain wall type from the **Type Selector** drop-down, and click **Element Properties** drop-down ➤ **Instance Properties** or **Type Properties**.

See [Element Properties](#) on page 120.

Changing Curtain Wall Panel Type

You can change the panel type applied to a curtain wall by selecting an individual panel and then selecting a different type from the **Type Selector**. If there are not enough wall types loaded, load more families using the **Load Family** tool. For more information, see [Loading Families](#) on page 427.

Changing Mullion Material

- 1 In the drawing area, select a mullion.
- 2 Click Modify Curtain Wall Mullions tab ► Element panel, select a mullion type from the Type Selector drop-down, and click Element Properties.
- 3 In the Instance Properties dialog, click Edit Type.
- 4 Select a mullion material.
You can create a new mullion material if one does not exist. See [Materials](#) on page 468.
- 5 Click OK twice.

NOTE Changing the material for a mullion family type changes the material for all mullions of that type. If the material changes affect the mullions on only one curtain wall, create and apply a new mullion family type.

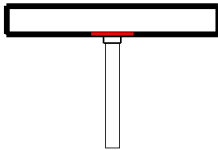
Shortcut Menu

You can modify a curtain wall by selecting the wall and right-clicking to access a shortcut menu. On the shortcut menu are several choices for manipulating the curtain wall, such as selecting panels and mullions.

Cleaning Curtain Wall Joins

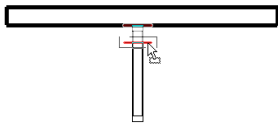
By default, curtain walls attach to the face of adjoining walls. Use the shape handle to separate a curtain wall join from other curtain walls or exterior and interior walls. This allows more control over curtain wall joins and mullion placement to ensure proper design intent.

Default curtain wall installation to face of joined wall



To separate the join, select the curtain wall join shape handle; press *Tab* and watch the status bar to be sure you have selected the handle. Drag the handle to separate the curtain wall from the adjoining wall. This does not break the join between the 2 walls.

Curtain wall shape handle selected for dragging

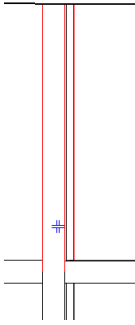


TIP You can achieve the same effect by using the Align tool to align the edge of the curtain wall with the center or edge of the joined wall. See [Aligning Elements](#) on page 377.

Controlling Mullion Joins

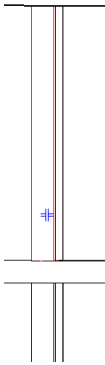
You can switch mullion joins between cleaned and uncleaned by selecting a mullion and clicking the toggle control that is displayed. Mullions clean up at the join only if there 4 or fewer mullions meeting at the join, all of them are straight, and all are parallel to the grid lines.

Vertical butt join



Click on the control. The join changes to a horizontal butt join.


Horizontal butt join



Reshaping Curtain Wall Panels

A curtain wall panel may need an opening in it, such as a vent. You can create an opening by editing the panel as an in-place family.

- 1 Select a curtain wall panel and, click Modify Curtain Panels tab ► Model panel ► Edit In-Place.

NOTE If you cannot select Edit In-Place, in the drawing area click  (Prevent or allow change of element position) for the panel.

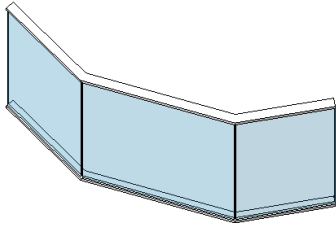
The selected panel is the only geometry available for editing.

- 2 Select the panel.
- 3 To edit the shape of the panel, click Modify Glass tab ► Form panel ► Edit Extrusion.
- 4 In sketch mode, reshape the panel as desired.
For example, you could add a door-like opening to the panel.
- 5 Click Finish Extrusion.

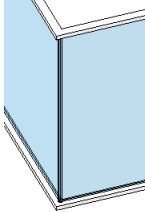
Mitered Mullions on Curtain Walls

If you join 2 curtain walls with horizontal mullions, the mullions miter at the join.

Mitered mullions on arc curtain wall



Mitered mullions between 2 joined curtain walls

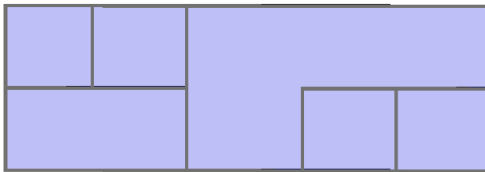


NOTE Mullions also miter on sloped glazings.

Merging Curtain Wall Panels

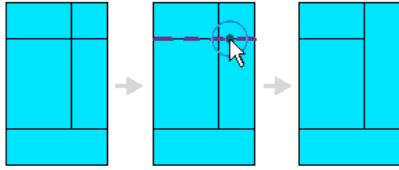
Curtain walls frequently contain non-continuous grid lines and mullions. Your design may require that grid lines be staggered, rather than continuous. You can merge curtain wall panels to accommodate these design requirements. Also, merging panels allows you to include a door or other large insert in a curtain wall.

Curtain wall with merged panels



Joining Curtain Wall Panels

- 1 Create the curtain wall panels.
See [Curtain Walls, Curtain Grids, and Mullions](#) on page 766.
- 2 Add curtain grids.
See [Creating Rectangular Curtain Walls](#) on page 768.
- 3 Select a curtain grid.
- 4 Click Modify Curtain Wall Grids tab ► Curtain Grid panel ► Add/Remove Segments.
- 5 Click on a curtain grid segment to remove it.
As you remove segments, adjacent panels join.
- 6 Click in white space in the drawing area.



Unjoining Panels

To separate panels, you add curtain grid segments back.

- 1 Select a curtain grid.
- 2 Click Modify Curtain Wall Grids tab ► Curtain Grid panel ► Add/Remove Segments.
- 3 Click the dashed segment to restore the curtain grid segment.

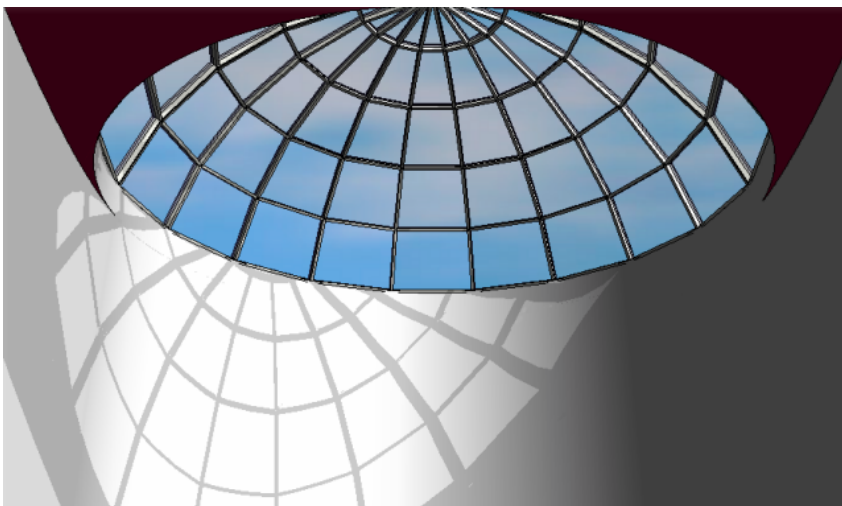
The dashed lines indicate a segment that was removed previously. The joined panels revert back to their unjoined state.

Merging Tips

- You can make non-rectangular curtain wall panels with the system panel type only.
- If you join panels of different types, the resulting panel is of the type you first selected.
- Use hidden line view to clearly see which panels are joined. See [Hidden Line Model Graphics Style](#) on page 252.

Curtain Systems

A curtain system is a component that comprises panels, curtain grids, and mullions. It usually does not have a rectangular shape. You can create a curtain system by selecting element faces. After you create a curtain system, you can add curtain grids and mullions using the same technique as curtain walls.



You cannot create a wall or a roof as a curtain system.

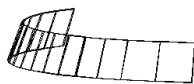
Curtain Systems by Face

To create a curtain system by face, you select the faces of massing elements or a generic model family. For more information, see [Creating Curtain Systems by Face](#) on page 619.

Adding Curtain Grids to a Curtain System

NOTE This procedure assumes that you have created a curtain system without automatic grid creation. To use automatic grid creation, see [Type-Driven Curtain Element Layout](#) on page 772.

- 1 Click Home tab ► Build panel ► Curtain Grid.
- 2 Open a 3D view.
- 3 As you place the cursor along system edges, a temporary grid line is displayed; click to place the grid lines.



TIP When you place curtain grid lines on a curtain system, the cursor snaps to the intersection of the boundary lines and any other line or reference plane.

Revit Architecture automatically fills in each section of the grid (design unit) with a separate curtain wall panel.

Adding Mullions to a Curtain System

Add mullions to a grid if needed for the design.

- 1 Click Home tab ► Build panel ► Mullion.
- 2 Highlight the grid line to which to add the mullions, and click to select it.

TIP Hold *Shift* to place a mullion only on the selected segment. Or hold *Ctrl* to place mullions on all open grid segments.

The mullion is sized to the grid line, and is split at intersections with mullions.
You can change the properties of mullions. For a complete list of mullion properties and their values, see [Common Mullion Type Properties](#) on page 790. See also [Mullions](#) on page 775.

Curtain Element Properties

Curtain Wall Properties

Parameter names, values, and descriptions for curtain walls. Values are modifiable.

Curtain Wall Type Properties

Name	Description
Construction	

Name	Description
Function	Indicates the purpose of a wall: exterior, interior, retaining, foundation, soffit, or core-shaft. Function can be used in scheduling and to create filters that simplify a model when exporting.
Automatically Embed	Indicates whether the curtain wall automatically embeds into the wall.
Curtain Panel	Sets the curtain panel family type for the curtain element.
Join Condition	Controls which mullions break at intersections on a curtain element type. For example, this parameter makes all horizontal or vertical mullions on a curtain wall continuous, or it can make mullions on Grid 1 or Grid 2 continuous on a curtain system or sloped glazing.
Vertical/Horizontal Grid Pattern	
Layout	Sets an automatic vertical/horizontal layout for curtain grid lines along the length of a curtain wall. When set to a value other than None, Revit Architecture automatically adds vertical/horizontal grid lines to a curtain wall. Fixed Distance indicates that the curtain grids are placed at the exact value specified for Vertical/Horizontal Spacing. If the spacing is not an even factor of the wall's length, Revit Architecture inserts space at one or both ends of the wall, depending on the justification parameter. For example, if the wall is 46 feet and the vertical spacing is 5 feet and the justification is set to beginning, Revit Architecture adds 1 foot from the beginning of the wall before placing the first grid. See the Vertical/Horizontal Justification instance property description for more information on justification. Fixed Number indicates that you can set different numbers of curtain grids for different curtain wall instances. See the Vertical/Horizontal Number instance property description for more information. Maximum Spacing indicates that the curtain grids are placed at even intervals along the length of the curtain wall at a distance up to the value specified for Vertical/Horizontal Spacing.
Spacing	Enabled when Layout is set to Fixed Distance or Maximum Spacing. When the layout is set to a fixed distance, Revit Architecture uses the exact value for Spacing. When the layout is at a maximum spacing, Revit Architecture uses up to the specified value to lay out the grids.
Adjust for Mullion Size	Adjusts the position of type-driven gridlines to ensure that curtain panels are of equal size, whenever possible. Sometimes when mullions are placed, particularly on borders of curtain hosts, it can result in panels of unequal size, even if the Layout is set to Fixed Distance.
Vertical Mullions	
Interior Type	Specifies the mullion family for interior vertical mullions.
Border 1 Type	Specifies the mullion family for vertical mullions on the left border.
Border 2 Type	Specifies the mullion family for vertical mullions on the right border.
Horizontal Mullions	
Interior Type	Specifies the mullion family for interior horizontal mullions.

Name	Description
Border 1 Type	Specifies the mullion family for horizontal mullions on the left border.
Border 2 Type	Specifies the mullion family for horizontal mullions on the right border.
Identity Data	
Keynote	Add or edit the curtain wall keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The model type for the curtain wall. May not be applicable.
Manufacturer	Manufacturer for the stair materials. May not be applicable.
Type Comments	Specific comments on the curtain wall type.
URL	A link to a web page for the manufacturer or other appropriate link.
Description	A description for the curtain wall.
Assembly Description	Description of the assembly based on the assembly code selection.
Assembly Code	Unifomat assembly code selected from hierarchical list.
Type Mark	A value to designate the particular curtain wall. Useful if you need to identify more than one curtain wall. This value must be unique for each curtain wall in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. (You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.)
Fire Rating	The fire rating of the curtain wall.
Cost	Material cost.
Curtain Wall Instance Properties	
Name	Description
Constraints	
Base Constraint	The base level of the curtain wall. For example, Level 1.
Base Offset	Sets the curtain wall's height from its base constraint. This property is available only when the Base Constraint is set to a level.
Base is Attached	Indicates whether the base of the curtain wall is attached to another model component, such as a floor. This is a read-only value.
Top Constraint	Curtain wall height extends to the value specified in Unconnected Height.
Unconnected Height	The height of the curtain wall when it is sketched.
Top Offset	Sets the curtain wall's offset from the top level.

Name	Description
Top is Attached	Indicates whether the curtain wall top is attached to another model component, such as a roof or ceiling. This is a read-only value.
Room Bounding	If selected, the curtain wall is part of a room boundary. If not selected, the curtain wall is not part of a room boundary. This property is read-only before creating a curtain wall. After you draw the wall, you can select it and then modify this property.
Related to Mass	Indicates that the element was created from a mass element. This is a read-only value.
Vertical/Horizontal Grid Pattern	
Number	If Layout (under Vertical/Horizontal Grid Pattern) is set to Fixed Number, enter a value here for the number of curtain grids on the curtain instance. The maximum value is 200.
Justification	Determines how Revit Architecture adjusts the spacing of grids along the curtain element face, when the grid spacing does not divide evenly into the length of the face. Justification also determines which gridlines are first removed or added when gridlines are added or removed because of parameter changes or changes to the size of the face. Beginning adds space to the end of the face before placing the first grid. Center adds an even amount of space at both the beginning and end of the face. End adds space from the beginning of the face before placing the first grid.
Angle	Rotates the curtain grids to the specified angle. You can also specify this value for individual faces. If you specify this parameter for a face, then no value displays in this field. Valid values are between 89 and –89.
Offset	Starts grid placement at the specified distance from the justification point of the grids. For example, if Justification is specified as beginning and you enter a value of 5 feet here, Revit Architecture places the first grid 5 feet from the beginning of the face. Note that you can also set this value for individual faces. If you specify this parameter for a face, then no value displays in this field.
Structural	
Structural Usage	Sets the structural usage of the curtain wall. This property is read-only before creating a curtain wall. After you draw the curtain wall, you can select it and then modify this property.
Dimensions	
Length	The length of the curtain wall. This is a read-only value.
Area	The area of the curtain wall. This is a read-only value.
Identity Data	
Comments	Specific comments about the curtain wall.
Mark	Sets a label for the curtain wall. This value must be unique for each curtain wall in a project. Revit Architecture warns you if the number is already used but al-

Name	Description
	allows you to continue using it. (You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.)
Phasing	
Phase Created	The phase when the curtain wall was created.
Phase Demolished	The phase when the curtain wall was demolished.

Common Mullion Type Properties

Name	Description
Material	Sets the mullion material type.
Constraints	
Angle (not available for corner mullions)	Rotates the mullion profile. Works as an adjustment to the Position parameter. Note that this parameter is not enabled for circular mullions.
Offset	Sets the offset from the panels in the curtain element.
Construction	
Profile (not available for corner mullions)	Sets a profile for the mullion. You can create a custom profile family. See The Families Guide on page 418.
Position (not available for corner mullions)	Rotates the mullion profile. Normal to Face is the usual condition. Parallel to Ground is appropriate for sloped curtain panels, such as in a sloped glazing or a sloped curtain system.

Circular Mullion Type Properties

Name	Description
Offset	Sets the offset from the panels in the curtain element.
Radius	Sets the radius for the circular mullions.

Rectangular Mullion Type Properties

Name	Description
Constraints	
Angle	Rotates the mullion profile. Works as an adjustment to the Position parameter.
Offset	Sets the offset from the panels.
Construction	

Name	Description
Profile	Sets a profile for the mullion. You can create a custom profile family. See The Families Guide on page 418.
Position	Rotates the mullion profile. Normal to Face is the usual condition. Parallel to Ground is appropriate for sloped curtain panels, such as in a sloped glazing or a sloped curtain system.
Corner Mullion	Indicates whether the mullion is a corner mullion. See Corner Mullions on page 777.
Thickness	Sets the thickness. If you have a loaded a custom profile, this value is calculated from the mullion profile.
Materials and Finishes	
Material	The material for the mullion.
Dimensions	
Width on side 2	Sets the width of side 2. If you have a loaded a custom profile, this value is calculated from the mullion profile.
Width on side 1	Sets the width of side 1. If you have a loaded a custom profile, this value is calculated from the mullion profile.
Identity Data	
Keynote	Add or edit the mullion keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	Definition of the mullion.
Manufacturer	Definition of the mullion manufacturer.
Type Comments	Mullion comments.
URL	Sets applicable URL.
Description	Mullion description.
Assembly Description	Description of the assembly based on the assembly code selection.
Assembly Code	Unifomat assembly code selected from a hierarchical list.
Type Mark	Sets the mullion type mark.
Cost	The mullion cost.
OmniClass Number	The number from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.
OmniClass Title	The name from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.

Corner Mullion Type Properties

This topic contains information on the properties for L and V corner, trapezoid corner, and quad corner mullions.

L and V Corner Mullions

Name	Description
Corner Mullion	Sets the mullion to corner mullion. This is a read-only value.
Leg 2	Length of second leg of mullion.
Leg 1	Length of first leg of mullion.
Offset	Sets the offset from the panels.
Thickness	Sets the thickness.

Trapezoid Corner Mullions

Name	Description
Corner Mullion	Sets the mullion to corner mullion. This is a read-only value.
Center Width	Width of mullion at the center.
Depth	Length of the sides of the mullion that meet the panels.
Offset	Sets the offset from the panels.
Thickness	Sets the thickness.

Quad Corner Mullions

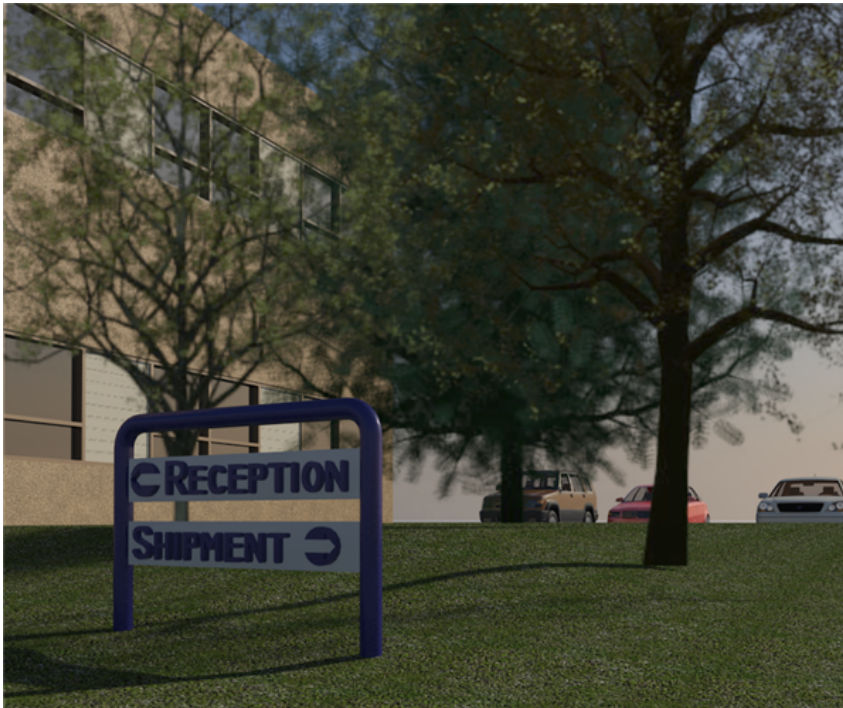
Name	Description
Corner Mullion	Sets the mullion to corner mullion. This is a read-only value.
Depth 2	Length of second leg of mullion.
Depth 1	Length of first leg of mullion.
Offset	Sets the offset from the panels.
Thickness	Sets the thickness.

Mullion Instance Properties

Name	Description
Comments	Specific comments about the mullions.
Length	Maximum length of the mullion. For example, on a mitered mullion, the value is the pre-cut length. This is a read-only value.
Mark	Sets a label for the mullions. This value must be unique for each mullion in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. (You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.)

Model Text

You can use model text for many things, including signage on a building or letters on a wall.



You can add model text in a project view and in the Family Editor for families that can be represented in 3D, such as walls, doors, windows, and furniture. Model text is not available for families that can only be represented as 2D, such as annotations, detail components, and profiles.

You can specify many properties for model text, including font, size, and material.

Model Text Shown Cut

Model text in a project view is shown cut in a plan view if it intersects the cut plane of the view. See [View Range Properties](#) on page 250.

Model text saved with a family is cut in plan or RCP views if the family is shown cut. It is not shown cut if the family is not cuttable. For more information on which families can be shown cut, see [Managing Family Visibility and Detail Level](#) on page 513.

Adding Model Text

- 1 Set the work plane where you want the text to appear.
See [Sketching and Work Planes](#) on page 317.
- 2 Click Home tab ► Model panel ► Model Text.
- 3 In the Edit Text dialog, enter the text, and click OK.
- 4 Place the cursor in the drawing area.
A preview image of the model text appears as you move the cursor.
- 5 Move the cursor to the desired location, and click to place the model text.

Related topics

- [Editing Model Text](#) on page 794
- [Moving Model Text](#) on page 794
- [Model Text Properties](#) on page 794
- [Model Text](#) on page 793

Editing Model Text

NOTE Model text saved with a family and then loaded into a project is not editable in the project view.

- 1 In the drawing area, select the model text.
- 2 Click Modify Generic Models tab ► Text panel ► Edit.
- 3 In the Edit Text dialog, make your changes.
- 4 Click OK.

Moving Model Text

- 1 In the drawing area, select the model text.

Move model text to a new location in the same work plane

- 2 Drag the model text to a new location.

Change the work plane

- 3 Click Modify Generic Models tab ► Work Plane panel ► Edit Work Plane. See [Sketching and Work Planes](#) on page 317.

Rehost model text

- 4 Click Modify Generic Models tab ► Work Plane panel ► Pick New Host.
For more information on rehosting, see [Rehosting](#) on page 811.

Model Text Properties

You can modify several properties for model text, including font, size, alignment, and material.

Modifying Model Text Properties

- 1 In the drawing area, select the model text.
- 2 Click Modify Generic Models tab ► Element panel ► Element Properties.
- 3 In the Instance Properties dialog, edit instance properties.
See [Model Text Instance Properties](#) on page 796.
- 4 In the Instance Properties dialog, click Edit Type to edit type properties.
See [Model Text Type Properties](#) on page 795.

NOTE Changes made to type properties affect all model text of this type in the project. You can click Duplicate to create a new model text type.

- 5 Click OK.

Model Text Type Properties

Name	Description
Text	
Text Font	Sets the model text font.
Text Size	Sets the text size.
Bold	Sets the typeface to bold.
Italic	Sets the typeface to italic.
Identity Data	
Keynote	Add or edit the model text keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	Definition of the model text model.
Manufacturer	Definition of the model text manufacturer.
Type Comments	Model text comments.
URL	Sets applicable URL.
Description	Model text description.
Assembly Description	Description of the assembly based on the assembly code selection.
Assembly Code	Unifomat assembly code selected from a hierarchical list.
Type Mark	Sets the model text type mark.
Cost	The model text cost.

Model Text Instance Properties

Name	Description
Constraints	
Work Plane	The text work plane.
Graphics	
Text	Click Edit to modify the text.
Horizontal Align	Sets the justification of the text when there are multiple lines. Lines justify to each other.
Materials and Finishes	
Material	Sets the text material.
Dimensions	
Depth	Sets the depth of the typeface.
Identity Data	
Comments	Specific comments about the model text.
Mark	Sets a label for the model text. This value must be unique for each type of model text in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. (You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.)
Subcategory	If you have defined subcategories for Generic Models (using Manage tab ► Project Settings panel ► Settings drop-down ► Object Styles), specify a subcategory for the model text. (When defining object styles for the subcategory, you can define its color, line weight, and other properties.) You can then control the display of the model text by turning visibility of the subcategory on or off (using View tab ► Graphics panel ► Visibility/Graphics). See Object Styles on page 493 and Visibility and Graphic Display in Project Views on page 198.
Phasing	
Phase Created	The phase when the model text was created. See Creating Phases on page 1332.
Phase Demolished	The phase when the model text was demolished. See Demolishing Elements on page 1338.

Hosted Components

A hosted component is a component that requires a host. For example, a window is hosted by a wall. A desk is hosted by a floor or level. Doors, windows, model lines, and components (for example, furniture) are all hosted components.

After you place a hosted component onto a host, you can rehost it (change its host).

Doors

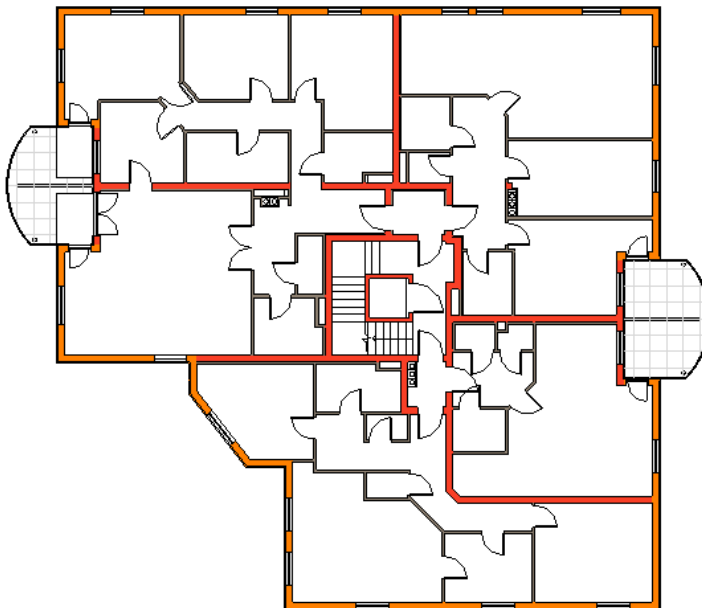
You add doors to walls in a plan, elevation, or 3D view. You can place a door on any type of wall, including arc walls, in-place walls, and face-based walls (for example, a sloped wall). Revit Architecture automatically cuts the opening and places the door in the wall.

To add a door to a curtain wall, select a panel of the curtain wall and use the Type Selector to change it to a wall. Then insert the door in the wall. (See [Wall Panels in Curtain Walls](#) on page 779.)



After placement, you can move doors from their current host to another host. For more information, see [Rehosting](#) on page 811.

Door layout in plan



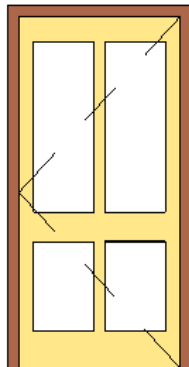
Adding Doors

- 1 Click Home tab ► Build panel ► Door.
- 2 Click Place Door tab ► Element panel, and select a door type from the Type Selector drop-down.

NOTE At this point you can load additional door types, if necessary. Click Place Door tab ► Model panel ► Load Family, and navigate to the family file.

- 3 On the Options Bar, select Tag on Placement to tag the door automatically. To include a tag leader, select Leader and specify the length.
To load additional tags, click Tags. For more information, see [Loading Tag Styles](#) on page 501.
- 4 Move your cursor over a wall.
- 5 Click to place the door in the desired spot in the wall.

Finished door in elevation



Related topics

- [Changing the Door Type](#) on page 798
- [Modifying the Door Position](#) on page 799
- [Door Properties](#) on page 799
- [Doors](#) on page 797

Door Tags

Door tags are displayed only if the entire door is visible. If the door is partially obscured, the door tag is not visible.

As you place doors of the same type, the door number in the tag increases. This also applies if you copy and paste doors; the tag number increases to show how many doors you have placed.

Changing the Door Type

- 1 Select the door in the project view.

- 2 Click Modify Doors tab ► Element panel, and select a different door type from the Type Selector drop-down.

Modifying the Door Position

- 1 In a plan view, select the door.
- 2 Right-click to open the shortcut menu.
- 3 Choose from the following options:
 - Flip Hand: flips the door horizontally. This option is available only if the particular door family was created with horizontal controls.
 - Flip Facing: flips the door vertically. This option is available only if the particular door family was created with vertical controls.

Also see [Rehosting](#) on page 811 for information about moving a door from one host to another.

Door Properties

You can modify several properties for doors, including the sill height, frame material, and thickness.

NOTE This topic contains information on common door properties. However, properties can vary among the different door types (families).

Modifying Door Properties

- 1 From a plan view, select the door, and click Modify Doors tab ► Element panel ► Element Properties.
- 2 In the Instance Properties dialog, edit door instance parameters.
See [Door Instance Properties](#) on page 801.
- 3 Click Edit Type to edit door type parameters.
See [Door Type Properties](#) on page 799.

NOTE Changes made to type parameters affect all doors of this type in the project. You can click Duplicate to create a new door type.

- 4 Click OK.

Door Type Properties

Name	Description
Construction	
Wall Closure	The layer wrapping around the door. It overrides any settings in the host.
Construction Type	The type of construction for the door.
Function	Indicates whether a door is interior (default value) or exterior. Function is used in scheduling and to create filters to simplify a model when exporting.

Name	Description
Materials and Finishes	
Door Material	The material for the door (for example, metal or wood)
Frame Material	The material for the door frame.
Dimensions	
Thickness	The thickness of the door.
Height	The height of the door.
Trim Projection Ext	The exterior trim projection.
Trim Projection Int	The interior trim projection.
Trim Width	The width of the door trim.
Width	The width of the door.
Rough Width	Can be scheduled or exported.
Rough Height	Can be scheduled or exported.
Identity Data	
Keynote	Add or edit the door keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The name of the model type of the door.
Manufacturer	The name of the door manufacturer.
Type Comments	Comments about the door type. Information can appear in a schedule.
URL	Sets a link to a manufacturer web page.
Description	Provides a description for the door.
Assembly Description	Description of the assembly based on the assembly code selection.
Assembly Code	Unifomat assembly code selected from hierarchical list.
Type Mark	A value to designate the particular door. This value must be unique for each door in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. (You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.) Marks are assigned sequentially. See Creating Sequential Door or Window Tags on page 1130.
Fire Rating	The fire rating of the door.
Cost	The cost of the door.

Name	Description
OmniClass Number	The number from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.
OmniClass Title	The name from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.
IFC Parameters	
Operation	The operation of the door, as defined by the current IFC description (for example, single_swing_left or double_door_double_swing). These values are case-insensitive, and underscores are optional. (SINGLE_SWING_LEFT and SingleSwingLeft are the same.)

Door Instance Properties

Name	Description
Constraints	
Level	The level on which the door is placed.
Sill Height	The height of the door sill. This does not change the door size.
Construction	
Frame Type	The type of frame around the door.
Materials and Finishes	
Frame Material	The material used for the frame.
Finish	The finish applied to the frame and door.
Identity Data	
Comments	Specific comments related to the door that are not already covered in the description or type comments.
Mark	Applies a door number to any door for reference purposes. This value must be unique for each door in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415. The default is 1.
Phasing	
Phase Created	The phase when the door was created.
Phase Demolished	The phase when the door was demolished.
Other	
Head Height	The height of the top of the door. Note that this does not change the door size.

Windows

You add windows to a wall in a plan, elevation, or 3D view. You can place a window on any type of wall, including arc walls, in-place walls (and in-place roofs in the case of a skylight), and face-based walls (for example, a sloped wall). Revit Architecture automatically cuts the opening and places the window in the wall.

To insert a window in a curtain wall, select a panel of the curtain wall and use the Type Selector to change it to a wall. Then insert the window in the wall. (See [Wall Panels in Curtain Walls](#) on page 779.)



After placement, you can move windows from their current host to another host. For more information, see [Rehosting](#) on page 811.

Adding Windows

- 1 Click Home tab ► Build panel ► Window.
- 2 Click Place Window tab ► Element panel, and select a window type from the Type Selector drop-down.

NOTE At this point you can load additional window types, if necessary. Click Place Window tab ► Model panel ► Load Family, and navigate to the family file.

- 3 On the Options Bar, select Tag on Placement to tag the window automatically. To include a tag leader, select Leader and specify the length.
To load additional tags, click Tags. For more information, see [Loading Tag Styles](#) on page 501.
- 4 Move the cursor over a wall, and click to place the window.

Window Tags

Window tags are displayed only if the entire window is visible. If the window is partially obscured, the window tag is not visible.

As you place windows of the same type, the type number in the tag does not change. This is also true if you copy and paste windows; the tag number remains the same.

Changing the Window Type

- 1 Select the window in the project view.
- 2 Click Modify Windows tab ► Element panel, and select a different window type from the Type Selector drop-down.

Modifying the Window Position

- 1 In a plan view, select the window.
- 2 Right-click to open the shortcut menu.
- 3 Choose from the following options:
 - Flip Hand: flips the window horizontally. This option is available only if the particular window family was created with horizontal controls.
 - Flip Facing: flips the window vertically. This option is available only if the particular window family was created with vertical controls.

Also see [Rehosting](#) on page 811 for information about moving a window from one host to another.

Window Properties

Parameter names, values, and descriptions for windows. Values are modifiable.

NOTE This topic contains information on the common window properties. However, properties can vary among the different window types (families).

Modifying Window Properties

- 1 From a plan view, select the window and click Modify Windows tab ► Element panel ► Element Properties.
- 2 In the Instance Properties dialog, edit window instance parameters.
See [Window Instance Properties](#) on page 805.
- 3 Click Edit Type to edit window type parameters.
See [Window Type Properties](#) on page 803.

NOTE Changes made to type parameters affect all windows of this type in the project. You can click Duplicate to create a new window type.

- 4 Click OK.

Window Type Properties

Name	Description
Construction	
Wall Closure	This parameter sets the layer wrapping around the window. It overrides any settings in the host.
Construction Type	The type of construction for the window.

Name	Description
Materials and Finishes	
Glass Pane Material	The material for the glass panes in the window.
Sash Material	The material for the window sash.
Dimensions	
Height	The height of the opening of the window.
Default Sill Height	The height of the bottom of the window above the level.
Width	The width of the window.
Window Inset	The inset of the window into the wall.
Rough Height	The height of the rough opening for the window. Can be scheduled or exported.
Rough Width	The width of the rough opening for the window. Can be scheduled or exported.
Identity Data	
Assembly code	Unifomat assembly code selected from hierarchical list.
Keynote	Add or edit the window keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The model number of the window.
Manufacturer	The manufacturer of the window.
Type Comments	Specific comments about the window type.
URL	A link to a manufacturer's web page.
Description	A specific description of the window type.
Assembly Description	Description of the assembly based on the assembly code selection.
Type Mark	A specific value to designate the particular window. This value must be unique for each window in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. (You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.) Values are assigned sequentially. See Creating Sequential Door or Window Tags on page 1130.
Cost	Cost of the window.
OmniClass Number	The number from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.
OmniClass Title	The name from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.
IFC Parameters	

Name	Description
Operation	The operation of the window, as defined by the current IFC description (for example, single_panel or triple_panel_horizontal). These values are case-insensitive, and underscores are optional. (SINGLE_PANEL and SinglePanel are the same.)

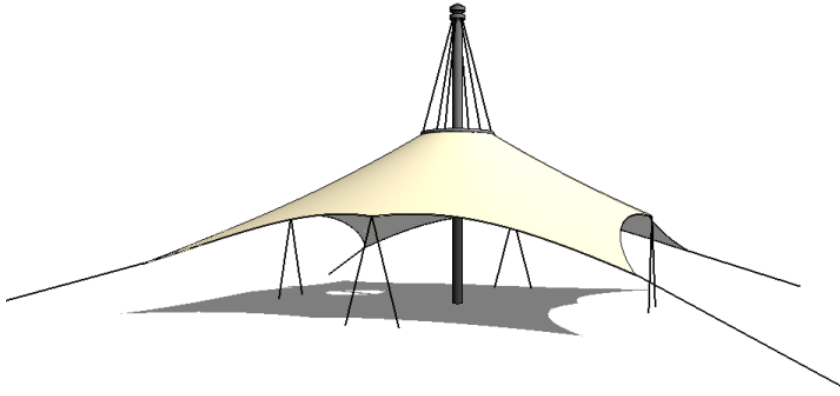
Window Instance Properties

Name	Description
Constraints	
Level	The level on which the window is placed.
Sill Height	The height above the level for the window sill. This does not change the window size.
Identity Data	
Comments	Specific comments about the window type.
Mark	A label applied to the window; usually a numeric value. This value must be unique for each window in a project. Revit Architecture warns you if the number is already used, but allows you to continue using it. (You can see the warning using the Review Warnings tool.)
Phasing	
Phase Created	The phase when the window was created.
Phase Demolished	The phase when the window was demolished.
Other	
Head Height	The height above the level for the top of the window. This does not change the window size.

Model Lines

The Model Line tool creates model lines in the project. Model lines exist in 3D space and are visible in all views.

You can sketch straight, curved, arc, circular, fillet, and tangent lines. For descriptions of the sketch tools, see [Sketching](#) on page 303.



NOTE If you want to draw lines that exist only in the view that they are drawn, see [Detail Lines](#) on page 1154.

Like components, model lines can move with nearby elements, provided they are sketched parallel to that element. For example, if you draw a wall and then draw a line parallel to that wall, the line can move with the wall if you select the Moves With Nearby Elements option on the Options Bar, or choose it from the properties of the line. An arc line can move with an arc wall if the 2 are concentric. See [Moving Lines and Components with Walls](#) on page 376.

Adding Model Lines

- 1 Click Home tab ► Model panel ► Model Line.
- 2 On the Options Bar, select the appropriate placement plane in which to draw the model lines.
If the desired plane is not listed, select Pick to pick the appropriate plane. See [Sketching and Work Planes](#) on page 317.
- 3 On the Options Bar, select the type of line to create.
Choices include <Beyond>, <Centerline>, <Demolished>, <Hidden>, <Overhead>, Hidden Lines, Lines, Medium Lines, Thin Lines, and Wide Lines. If desired, you can create additional line types using the Line Styles tool. Line Styles are not available for model lines created in sketch mode. For more information, see [Line Styles](#) on page 494.
- 4 Click Place Lines tab ► Draw panel, and select a sketching option or Pick Lines to create lines by selecting lines or walls within the model.
On the Options Bar, select Chain to chain lines together as you draw.
- 5 To offset the line, set an Offset value on the Options Bar.
For example, if you set an offset of 2 meters and then draw the line, the line appears 2 meters from the cursor. If you use the Pick Lines option, the line is offset from the picked edge by the specified amount.
- 6 Draw or pick the lines.

TIP As you create a model line, you can quickly set its length by typing a value on the keyboard. This changes the length of the temporary dimension that appears with the line.

Related topics

- [Model Lines](#) on page 805
- [Modifying Lines](#) on page 807

- [Model Line Properties](#) on page 808
- [Detail Lines](#) on page 1154

Modifying Lines

Revit Architecture allows you to change the look and appearance of lines before or after you sketch them. You set line properties in the Element Properties. See [Model Line Properties](#) on page 808.

To set properties before creating a line, click Home tab ► Model panel ► Model Line, and then click Instance Properties.

To set properties after creating a line, select the line, and click Modify Lines tab ► Element panel ► Instance Properties.

For more information about sketching lines, see [Model Lines](#) on page 805 or [Sketching](#) on page 303.

Line Styles

You can create multiple, custom line styles to depict different conceptual ideas in a design, and then apply the line style to sketched lines in any view. For example, you might want to use one line style for grids and one for reference planes.

- 1 After sketching lines, select them and click Modify Lines tab ► Element panel ► Instance Properties.

The Instance Properties dialog appears.

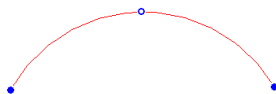
- 2 In the Instance box, for Line Style, select the desired line style.
- 3 Click OK to exit the Instance Properties dialog.

NOTE You can change the look of the line choices by editing their styles in the Object Styles dialog. Or you can create new line styles. See [Object Styles](#) on page 493.

Resizing Arc Lines

You can resize arc lines using middle and end controls.

- 1 Select the arc.



- 2 Drag the end controls to change the arc length.
- 3 To change the radius of the arc while keeping the radius concentric, on the Options Bar, select Keep Concentric.
Clear that option to retain an existing end condition, such as an end point location or tangency to a straight wall.
- 4 Drag the middle control.

Modifying a Spline

- 1 Select the spline.
- 2 Click **Modify Lines** tab ► **Edit Spline** panel ► **Add Control** or **Delete Control**.
 - **Add Control** adds a control point to the spline. Place the cursor over a spline chord and watch the status bar. When it says **Reference**, click to place a control. A control point is added to the center of the chord.
 - **Delete Control** deletes a spline control point. Select a control point for deletion. The spline adjusts after control point deletion.
- 3 To move a control point, drag it to a new location.
- 4 To move spline end points, select the spline.
 - To move the entire spline, drag the end controls, which display as blue dots.
 - To modify the spline curve between the end point and the next control point, select the end control, press *Tab*, then drag the end control point.

Model Line Properties

You can modify properties for straight lines, arc lines, circles, tangent lines, and fillet lines.

Modifying Line Properties

- 1 From a plan view, select the line and click **Modify Lines** tab ► **Element** panel ► **Instance Properties**.
- 2 In the **Instance Properties** dialog, edit line instance parameters.
- 3 When you are finished, click **OK**.

Straight Line Properties

Name	Description
Constraints	
Work Plane	The work plane to which the line is related.
Moves With Nearby Elements	Determines whether the line moves with nearby elements.
Graphics	
Line Style	Sets the line style type as defined in the Object Styles dialog. See Object Styles on page 493.
Detail Line	Indicates if the line is a detail line.
Dimensions	
Length	The actual length of the line.
Identity Data	

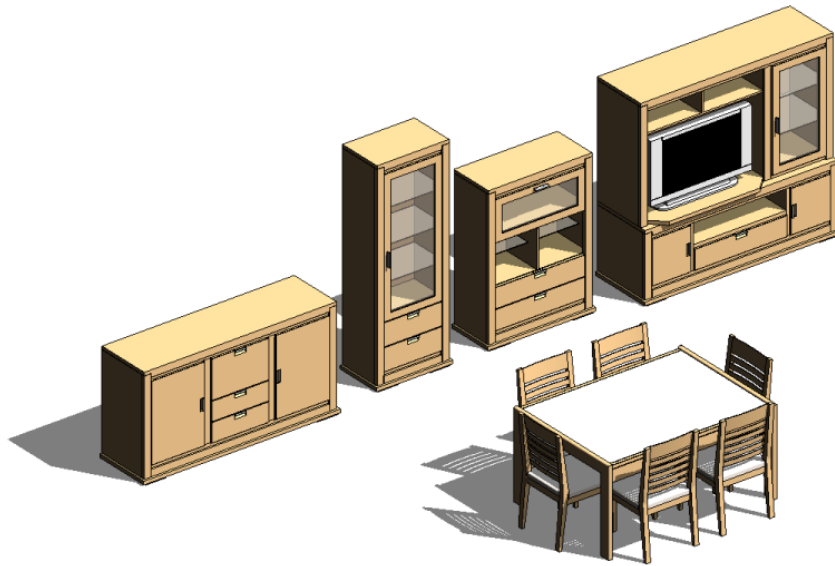
Name	Description
Design Option	If design options have been created, this property indicates the design option the element exists in. For more information on design options, see Design Options on page 1305.
Phasing	
Phase Created	The phase when the line was created.
Phase Demolished	The phase when the line was demolished.

Arc, Circle, Tangent, and Fillet Line Properties

Name	Description
Constraints	
Work Plane	The work plane to which the line is related.
Moves With Nearby Elements	Determines whether the line moves with nearby elements.
Graphics	
Line Style	Sets the line style for the shape.
Center mark visible	Switches whether the center mark for the arc appears. You can dimension to the center mark of an arc.
Detail Line	
Dimensions	
Length	The actual length of the line.
Identity Data	
Design Option	If design options have been created, this property indicates the design option the element exists in. For more information on design options, see Design Options on page 1305.
Phasing	
Phase Created	The phase when the line was created.
Phase Demolished	The phase when the line was demolished.

Components

Use the Component tool to insert free-standing components, such as furniture, site components, and plumbing supplies, into a project.



Several components are already defined. To create more, define them in the Family Editor. See [The Families Guide](#) on page 418.

For information about moving a component from one host to another, see [Rehosting](#) on page 811.

To place a component

1 If necessary, load the component family.

For information about loading a family, see [Loading Families](#) on page 427.

2 Click Home tab ► Build panel ► Component drop-down ► Place a Component.

3 Click Place Component tab ► Element panel, and select a component from the Type Selector drop-down.

4 Place the cursor in the drawing area where you want the component to appear.

5 If you are placing a work plane-based or face-based component, select Place on Vertical Face, Place on Face, or Place on Work Plane from the Placement panel.

See [Work Plane-based and Face-based Component Placement Options](#) on page 810 for descriptions of these options.

6 Press *Spacebar* to rotate the component through its different snap points to other elements.

7 Click to place the component.

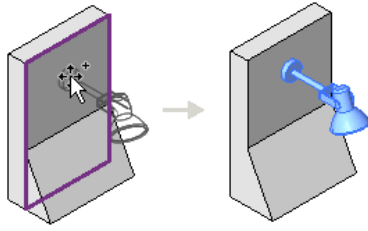
NOTE After you place a component, you can select it and then select the Moves With Nearby Elements option. For example, if you place a bed next to a wall and then move the wall, the bed moves with the wall. Revit Architecture determines which element the component is locked to; you do not have explicit control. You can move the component independently of the element. See [Moving Lines and Components with Walls](#) on page 376.

Work Plane-based and Face-based Component Placement Options

Following are the options for placing work plane-based and face-based components:

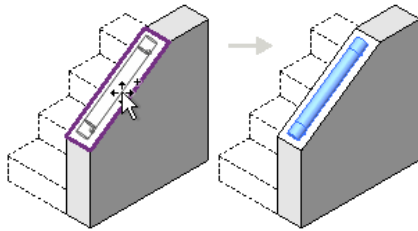
- **Place on Vertical Face** (only available for some components)

In a plan view, move your cursor to the desired location on a vertical face, and click to place the component. You can only place components on vertical faces with this option.



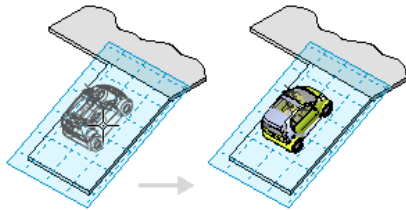
■ **Place on Face**

Move the cursor to the desired location on a face, and click to place the component. You can only place components on faces with this option.



■ **Place on Work Plane**

To use this option, an active work plane must be defined in the view. You can place the component anywhere on the work plane.



For more information, see [The Families Guide](#) on page 418.

Rehosting

You can move a hosted component or element from the current host to another host using the Rehost or Pick Host tools, depending on the context.

Rehosting Doors and Windows

- 1 Select a door or window.
- 2 Click Modify Doors or Modify Windows tab ► Host panel ► Pick Host.
- 3 Move the door or window to an appropriate host, and click to place it.

Rehosting Work Plane-based and Face-based Elements and Components

When you rehost work plane-based or face-based elements and components, you can place them on any host. For these elements, you have the placement options Place on Vertical Face, Place on Face, and Place on Work Plane. Work plane-based elements include lines, beams, and family geometry. You can also rehost work plane-based components (for example, masses).

Use the following procedure.

To rehost work plane-based and face-based elements and components

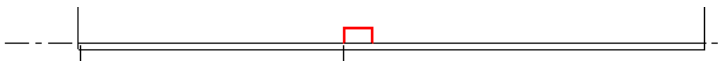
- 1 Select a work plane-based or face-based element or component.
- 2 Click Modify <element> tab ► Work Plane panel ► Pick New Host.
Alternatively, click Modify <element> tab ► Work Plane panel ► Edit Work Plane. On the Work Plane dialog, click Pick a New Host. See [Sketching and Work Planes](#) on page 317 for information about other Work Plane dialog options.
- 3 On the Placement panel, select a placement option: Place on Vertical Face, Place on Face, or Place on Work Plane.
See [Work Plane-based and Face-based Component Placement Options](#) on page 810 for descriptions of these options.
- 4 Move the cursor to an appropriate host, and click to place the element or component.

Rehosting Level-based Components

Level-based components include furniture, site components, plumbing supplies, and so on. When you place a level-based component on a host, it remains on the host's infinite plane. For example, when you place a desk on a floor, and then drag the desk beyond the confines of the floor, the desk remains on the same plane as the floor.

If the floor has 2 levels, such as a sunken floor, use this method to move the component from one part of the floor to another.

Selected component residing on floor host



Component dragged away from floor remains on same plane



NOTE When rehosting level-based components, you may find it useful to work in hidden line mode in an elevation view.

To rehost level-based components

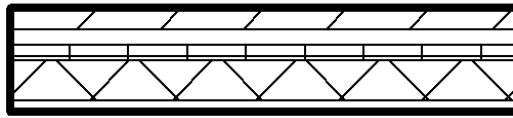
- 1 Select a level-based component.
- 2 Click Modify Furniture ► Host panel ► Pick Host.
- 3 Click a floor, surface, or level.
For example, if you want to move a component from a floor on Level 2 to a floor on Level 5, select the floor on Level 5. You could also select a level with no floor.
The component is moved to the selected level or floor.

Compound Structure

Walls, floors, ceilings, and roofs can comprise parallel layers. The layers can consist of a single continuous plane of material (such as plywood) or multiple materials (such as gypsum board, studs, insulation, air spaces, bricks, and sheathing). In addition, each layer within the component serves a particular purpose. For example, some layers provide structural support, while others act as thermal barriers. Revit Architecture considers the function of each layer and matches the layers appropriately.

You can represent each layer by setting the layer's material, thickness, and function. You typically see compound geometry in floor plans, reflected ceiling plans, and sections. They display in hidden line and wireframe views. See [Hidden Line Model Graphics Style](#) on page 252 and [Wireframe Model Graphics Style](#) on page 251.

7-layer wall shown in plan view



Materials in Compound Geometry

Each layer in a compound structure is typically displayed with some type of material. For example, one layer might be the air infiltration barrier, another is plywood, followed by a layer of wood. Revit Architecture has several predefined materials, or you can create your own using the Materials tool. See [Materials](#) on page 468.

Layer Pattern Display

The material on layers displays with fill patterns. To see the fill pattern in a coarse-scale view, set the Coarse Scale Fill Pattern and Coarse Scale Fill Color properties of the compound structure. To see the fill pattern in a medium or fine detail level, change the Detail Level parameter of the View Properties to medium or fine. See [View Properties](#) on page 259.

Layer Join Cleanup

Compound layer joins clean up only if the layers share the same material. For example, a compound floor layer can join to a compound wall layer if both layers are drywall. If the layers do not clean up, then a solid line appears between them in the join. See [Materials](#) on page 468.

Applying a Function to a Layer of a Compound Structure

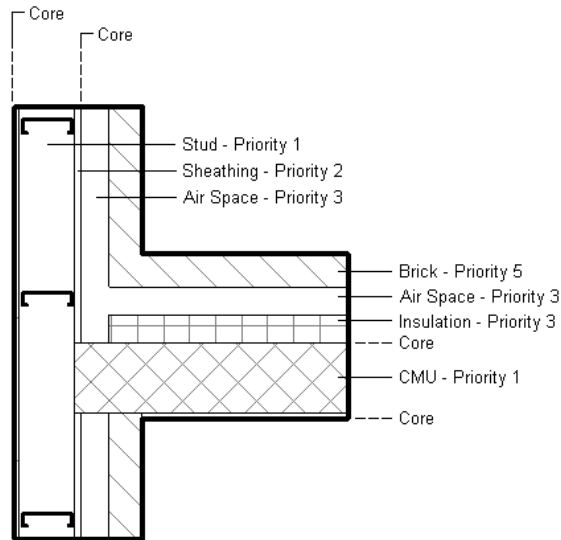
You assign each layer a specific function so the layer can join to its corresponding functional layer. Layer functions have an order of precedence.

Rules for Layer Joins

- The structure layer has the highest priority, Priority 1.
- Finish 2 has the lowest priority, Priority 5.
- Revit Architecture connects high priority layers before connecting layers with the lowest priority. For example, suppose that you join 2 compound walls. A layer in the first wall with Priority 1 joins to a layer with Priority 1 in the second wall. That Priority 1 layer can pass through lower priority layers before

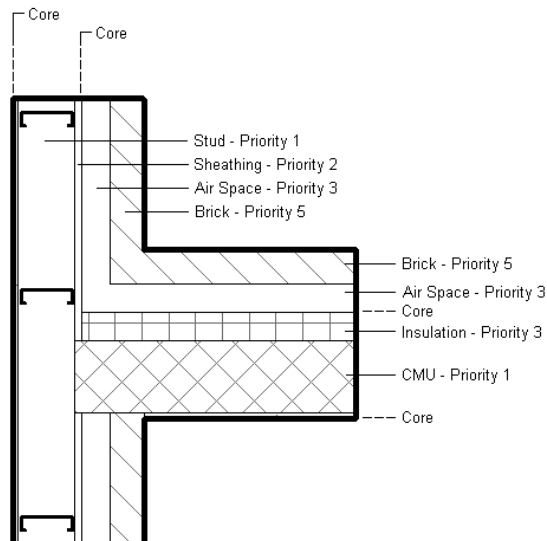
joining to the other Priority 1 layer. A layer with a lower priority cannot pass through a layer of equal or higher priority.

The following illustration shows higher priority layers joining before lower priority layers. The Priority 1 CMU layer of the horizontal wall passes through all layers, until it reaches the Priority 1 stud layer of the vertical wall. Note that the insulation in the horizontal wall does not pass through the air space in the vertical wall, because they are both Priority 3 and are outside the core layer.



- When layers join, the join cleans up if the 2 layers have the same material. If the 2 layers have different materials, a line appears at the join.
- Each layer must have a function assigned to it for Revit Architecture to match layers accurately.
- Layers inside the core of one wall pass through layers of higher priority that are outside the core of the joined wall. The layers in the core extend to the core of a joined wall, even if the core layers are set to Priority 5.

The following illustration shows how a layer of lower priority inside the core passes through layers of higher priority outside the core. The insulation layer of the horizontal wall has moved inside the core. The insulation layer can now pass through any layer outside the core, regardless of its priority.



Layer Functions

Layers can be assigned the following functions:

- **Structure [1]:** Layer that supports the remainder of the wall, floor, or roof.
- **Substrate [2]:** Material, such as plywood or gypsum board, which acts as a foundation for another material.
- **Thermal/Air Layer [3]:** Provides insulation and prevents air penetration.
- **Membrane Layer:** A membrane that commonly prevents water vapor penetration. The membrane layer should have zero thickness.
- **Finish 1 [4]:** Finish 1 is typically the exterior layer.
- **Finish 2 [5]:** Finish 2 is typically for the interior layer.

Inserting Layers into a Compound Structure

1 Access the type properties of the compound element.

2 For Structure, click Edit.

The Edit Assembly dialog appears, allowing you to specify the material for layers and the thickness of those layers.

TIP If desired, create a new type in the Type Properties dialog by clicking New and entering a name for the type.

3 Click Insert to insert layers.

4 For Function, select a function for a layer.

5 For Material, select a material for a layer.

NOTE If you wish to create a new material for the list, see the Materials tool. Among other settings, the Materials tool includes options for specifying cut patterns. For more information about materials, see [Materials](#) on page 468. For more information about creating and setting cut patterns, see [Fill Patterns](#) on page 459. You cannot choose material or thickness for core boundary layers.

6 For Thickness, specify a thickness for a layer.

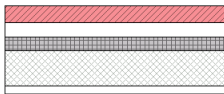
7 If you want to move the position of the layer, select the layer, and click Up or Down.

8 Set the detail level of the view: Click View tab ► Graphics panel ► View Properties. Set the Detail level property value to medium or fine.

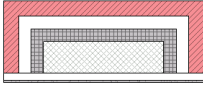
Layer Wrapping

Compound wall layers can wrap at inserts, such as doors and windows, and at the end caps of the wall. Wrapping is visible in plan view only.

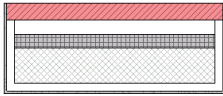
Compound wall with no end-cap wrapping



Exterior wrapping at a wall's end caps



Interior wrapping at the end caps



Wrapping Around Complex Inserts

Layers can wrap around complex inserts, such as windows with non-rectangular shapes.

Interior wrapping at window insert



Setting Layer Wrapping

You can set layer wrapping using the type properties of the wall or by editing its structure.

To set layer wrapping using type properties

- 1 Select a compound wall, and click Modify Walls tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 2 If you want wrapping at inserts, for Wrapping at Inserts, select Exterior, Interior, or Both.
- 3 If you want end cap layer wrapping, for Wrapping at Ends, select Exterior or Interior.
- 4 To set individual layers to wrap, select the Wraps check box at the end of each layer.

NOTE Windows and doors have a type property called Wall Closure. This property overrides the wrapping settings in the Edit Assembly dialog.

To set layer wrapping by editing the structure

- 1 For Structure, click Edit.
- 2 If you want wrapping at inserts, for Wrapping at Inserts, select Exterior, Interior, or Both.
- 3 If you want end cap layer wrapping, for Wrapping at Ends, select Exterior or Interior.
- 4 Click OK.

Previewing the Compound Geometry

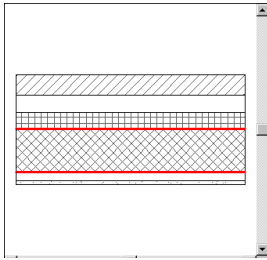
To preview the appearance of the wall as you add layers, in the Type Properties dialog, click Preview. The preview image updates as you edit the layers of the wall.

Layers as References

You can select a layer to be a reference point for dimensioning or alignment. Place the cursor on the layer line to use as a reference. Press *Tab* to select the layer.

By default, each compound component type has 2 layers called Core Boundary. These layers are not modifiable, and they have no thickness. They are references for dimensions.

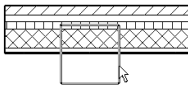
Preview of compound geometry with Core Boundaries indicated in red



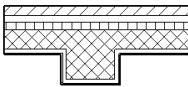
Compound Walls Joined to Columns

The compound structure of a wall extends to columns when you join the wall to the column.

Compound wall joining to column



Resulting join of column to wall



Editing Layers

In the Type Properties dialog, you can click Edit for the Structure property. The Edit Structure dialog opens inside the Type Properties dialog. You can also preview the effects of edits to the layers by clicking Preview.

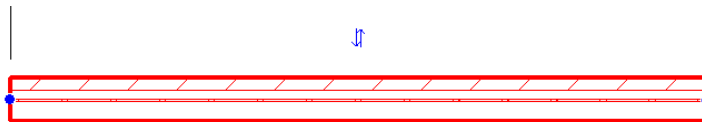
Flipping Orientation of Compound Walls

As you are placing a compound wall in a plan view, you can press the *Spacebar* to flip its orientation. You

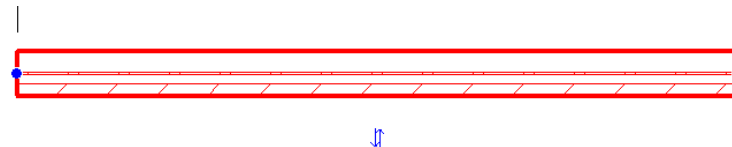
can also select an existing wall in a plan view, and control arrows appear: . If you click on the arrows, the first and last layers of the wall change position.

NOTE Any cutouts in the wall, such as windows and doors, do not flip their orientation.

Compound wall as seen in plan view before flipping



Compound wall after flipping (the first and last layers have changed position) position.




Uniformat Assembly Codes

You can assign a Uniformat assembly code and description in the Type properties of all model elements. When you click the Assembly code value, a button appears. Click it, and a dialog appears containing a hierarchical list of Uniformat codes assigned by R.S. Means. The list is filtered automatically by category. For example, if you are looking at the type properties of a wall and click the button to view the Uniformat codes, you see only the Uniformat codes related to walls. You have the option to choose a different category or all categories to see a different set of Uniformat codes.

When you select a code and click OK, the code appears in the Assembly code property, and the corresponding description appears in the Assembly description property.

Assembly Code and Assembly Description are schedulable fields. As a result, you can create a schedule that groups components by Uniformat code, for example.

To add a Uniformat assembly code to a type property

- 1 Select the model element, and click the Modify <element> tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 2 Click in the Assembly code value box. Click .
- 3 Navigate the Uniformat assembly code hierarchy, and select a code. To see codes for other categories, select a value for the Show Classifications For list.
- 4 Click OK.

The Assembly Description field updates after you click off the Assembly code field.

Structural Modeling

14

This section contains information about the various structural tools and elements within Revit Architecture.


Structural Template


A structural template is provided with the installation of Revit Architecture. In this template, the view properties and ranges have been modified to specifically work with structural components.

Although you can work with structural components in projects based on non-structural templates, you will notice that you must modify view ranges in order to display the structural components within the view. This is because structural components, such as beams and columns, are placed on the level below the view you are working in. Therefore, they fall below the bottom cut plane of the view range and do not display. The structural template has been modified specifically to take this into account.

RELATED See [View Range](#) on page 247.

Starting a Project with the Structural Template

- 1 Click  ► New ► Project.
- 2 In the New Project dialog, under Template File, click Browse.
- 3 In the Choose Template dialog, select the structural template, and click Open.

NOTE The name and location of the structural template will vary depending on your install options and system settings. To view or modify file locations, click  ► Options, and click the File Locations tab.

- 4 In the New Project dialog, click OK.

Loading Structural Component Families

When you load structural families, Revit Architecture provides a type catalog to assist you with the family selection process. You can sort through the data and load only the specific structural family type required for your project. This helps decrease project size and minimizes the length of the Type Selector list when selecting structural types. For example, if you load the entire C-Channel family, you have to scroll through

a list of dozens of C-Channel types in order to make your selection. Simplify the choices by loading a single C-Channel type, such as a C15x40.

After the family is loaded, it is saved with the project.

Loading Structural Families

- 1 Click Insert tab ► Load from Library panel ► Load Family.
- 2 Navigate to the directory containing the file you wish to open or use the web-based library of Revit families. See [Opening Files from the Web Library](#) on page 113.
By default, the window displays the RFA file types.
- 3 Select a structural family file.
In the lower left-corner, the Type Catalog populates with family types.
- 4 In the Type column of the Type Catalog, select the family type or types to load. Select multiple types by holding *Ctrl* during selection. You can filter the list of types by selecting specific parameters from the list at the top of each column.
- 5 Click Open.
- 6 In the Type Selector, select the new family you just loaded and place it in the document window.

Loading in the Instance Properties Dialog

You can load a family in the Instance Properties dialog. See [Element Properties](#) on page 120. After creating a family type, open the dialog, and click Load.

Dragging from Windows Explorer

- 1 Select the family or families in Windows Explorer and drag them onto either a project view or the Project Browser. See [Project Browser](#) on page 93.
- 2 When the Drop Files dialog appears, select the option to Load dropped families into current project, and click OK.

Structural Columns

Structural columns are used to model vertical load-bearing elements in a building. Although structural columns share many of the same properties as architectural columns, structural columns have additional properties defined by their configuration and industry standards.

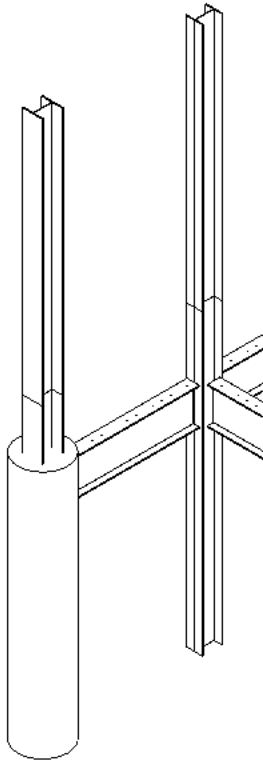
Structural columns differ from architectural columns in behavior as well.

Structural elements such as beams, braces, and isolated foundations join to structural columns; they do not join to architectural columns.

Typically, drawings or models received from an architect may contain a grid and architectural columns. You create structural columns by manually placing each column or by using the On Grids tool to add a column to selected grid intersections.

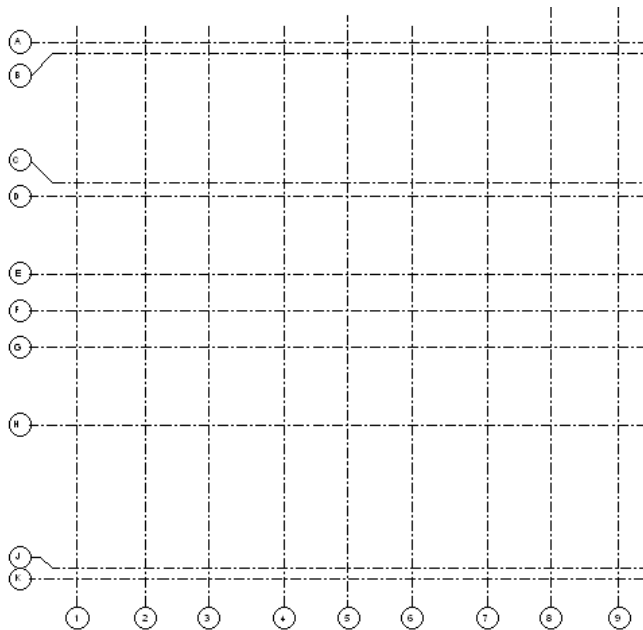
Structural columns can be created in plan or 3D views.

Adding columns in 3D View



It is helpful to set up a grid before adding structural columns, as they snap to grid lines (see [Adding Grids](#) on page 1093).

Sample grid for placing structural elements



The grid lines also provide vertical planes for braces. Click Home tab ► Datum panel ► Grid.

You can place structural columns that attach to other structural elements. For more information, see [Attaching Columns](#) on page 757.

Creating a Structural Column Family

You create column families by defining what the column looks like in plan view, elevation view, and 3D view.

For detailed information about creating a family, see [The Families Guide](#) on page 418.

The following image shows what a column may look like in a 3D view.

**3D view of
structural
column**





Starting a Structural Column Family

When you start creating a column family, you see one of 3 views: a front elevation view of a lower reference level tag and an upper reference level tag with reference planes, a plan view with reference planes and 2 sets of equality dimensions, and a 3D view. The view in which you start creating geometry does not matter. You can define geometry in any of these views. You may want to add an overall width and depth dimension to the plan view and label it. This is useful if you are going to have a list of different-size columns.

When you create a column, Revit Architecture automatically adds a rotation control symbol to the lower left corner of the geometry in the plan view. You notice it when you add the column to a project. You can rotate the column in the plan view by clicking Modify, selecting the column geometry, and then dragging the rotation control arrow.

The following procedure is a general procedure for creating a column family. Your steps may differ based on design intent.

- 1 Click  ► New ► Family.
- 2 In the Open dialog, select column.rft from the templates folder, and click Open.
- 3 Create the geometry for the family. For more information on creating solid geometry, see [Creating Solid and Void Geometry](#) on page 320.
- 4 If desired, label any permanent dimensions that you may have added. Place the cursor over the dimension text and right-click. Click Edit Label and enter a name for the dimension. This name

- appears in the properties of the family. You can modify the name to change all occurrences of that family type in the project or you can use it to create other family types with varying sizes.
- 5 Set the reference planes and sketch lines properties for Defines Origin and Is Reference properties.
- 6 Save the family by clicking  ► Save. Revit Architecture saves the file with an RFA extension.

Specifying How a Structural Column Displays in Plan View

For a column family, you can select the option Show family pre-cut in plan views, in the Family Category and Parameters dialog. When you select this option and load the family into a project, the column displays in a plan view using the cut plane specified in the plan view of the family.

- 1 Open a column family or start a new column family.
- 2 Click Create tab ► Family Properties panel ► Family Category and Parameters.
- 3 In the Family Category and Parameters dialog, under Family Parameters, select or clear the parameter, Show family pre-cut in plan views.

When loaded into a project, if you want the column to display in plan view

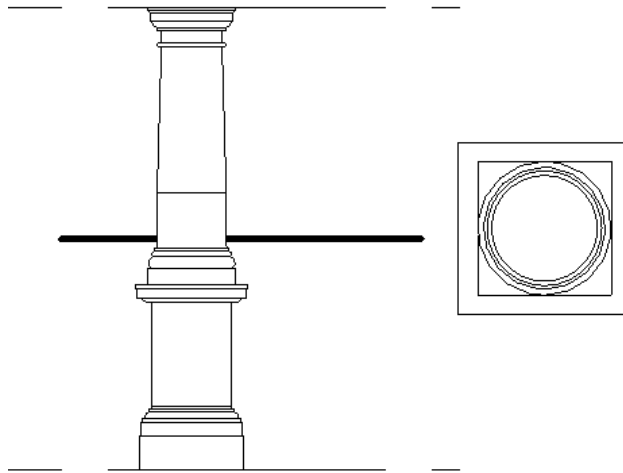
based on the cut plane of the project’s plan view,	clear the parameter, Show family pre-cut in plan views.
consistently, regardless of the cut plane of the project’s plan view,	select the parameter, Show family pre-cut in plan views. The column displays using the cut plane specified within the Family Editor plan view.

- 4 Click OK.
- 5 Save the column family.

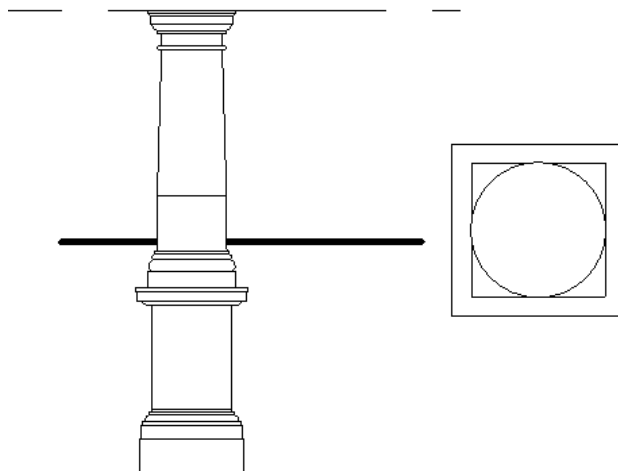
After you load the column family into a project, the column displays based on the parameter settings you specified within the Family Editor.

In the 2 examples shown below, the same column is loaded into a project. A horizontal line has been added to the elevation representation so you can see the location of the plan view’s cut plane. In the first image, the parameter, Show family pre-cut in plan views, is not selected; the column displays in plan using the cut plane of the project’s plan view. In the second image, the same column family has the parameter, Show family pre-cut in plan views, selected. Notice the change in the column’s plan view display even though the project’s plan view is using the same cut plane as the previous image.

Column family loaded in project with “Show family pre-cut in plan views” not selected. Horizontal line was added to mark the plan view’s cut plane.



In the image below, the column family was saved with Show family pre-cut in plan views selected. It was loaded into a project and a horizontal line was added to mark the plan view’s cut plane (same as the image above). Notice the cut plane of the project’s plan view has no affect on the display of the column.



Structural Column Family Parameters

To access the Structural Column Family Parameters in the family editor, click Create tab ► Family Properties panel ► Category and Parameters. Verify that Structural Columns is selected as the Family Category. The Family Parameters display at the bottom of the dialog.

Parameter	Value
Structural Material Type	Controls hidden view display of the structural column family. See Material Physical Type Parameters on page 489.

Parameter	Value
Symbolic Representation	Determines whether the Symbolic Representation of the structural column is defined by the family or the settings of the project in which its placed. See Symbolic Representation Settings Tab on page 497.
Always export as geometry	Ensures that the structural column family is exported as geometry at all times. This overrides the Export as Architectural Desktop and Building System Objects option in the Export Options dialog.
Beam cutback in plan	Determines whether the symbolic representation of a beam is cutback from the column bounding box or the physical geometry of the column. Beam to Column Cutback on page 868.
Display in hidden views	Defines the structural column family rules for displaying edges in hidden views. Showing Hidden Element Lines on page 245.
Shared	Denotes the structural column family as a shared family. See Loading Families with Shared Components into a Project on page 428.
Show family pre-cut in plan views	Displays the structural column family in a plan view using the cut plane specified in the plan view of the family. See Specifying How a Structural Column Displays in Plan View on page 823.

Placing a Vertical Structural Column

- 1 Click Home tab ► Build panel ► Column drop-down ► Structural Column.
- 2 If a structural column family has not been previously loaded, Revit Architecture prompts you to load one. See [Loading Families](#) on page 427.
- 3 Click Place Structural Column tab ► Element panel, and select a column type from the Type Selector drop-down.
- 4 If you intend to rotate the column after placement, select Rotate after placement on the Options Bar.
- 5 Optionally, click Place Structural Column tab ► Element panel ► Element Properties drop-down ► Instance Properties (and Type Properties when appropriate) to edit the properties of the column before adding it to your model.

NOTE You can create your own column family by defining specific properties based on structural requirements. For more information, see [Creating a Structural Column Family](#) on page 822. You can control how a column family displays within a project plan view. In the Family Editor, select Show family pre-cut in plan views if you want the column display to remain consistent despite the cut plan for that project plan view. For more information, see [Specifying How a Structural Column Displays in Plan View](#) on page 823.

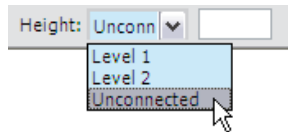
6 The Height/Depth area of the Options Bar is shown in the following illustration,



You may pre-select the Height (top) or Depth (base) of a structural column on the Options Bar.

7 On the Options Bar, select either Height or Depth from the list.

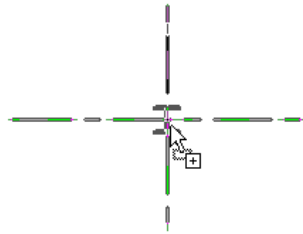
8 In the Constraint list to the right of the Height/Depth selection, specify the constraint of the top or base of the column by Level or select Unconnected.



If you select Unconnected, enter the Height or Depth measurement in the text box to the right of the Constraint list. This measurement of Unconnected Height/Depth is relative to the current Level.

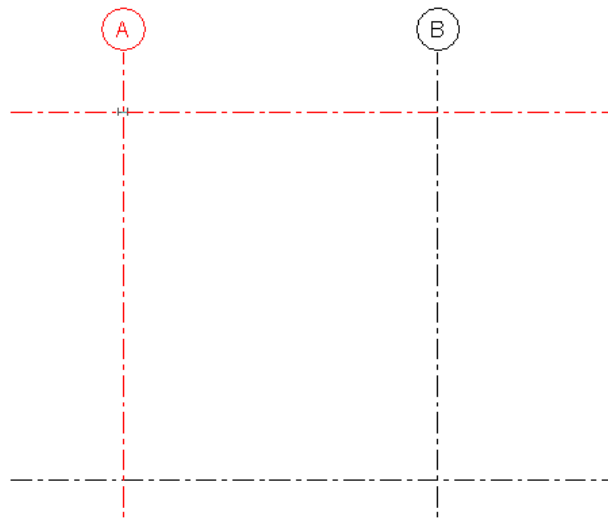
9 Click to place the column.

Placing a column



Columns snap to existing geometry in Revit. When you place columns at grid intersections, both grids are highlighted.

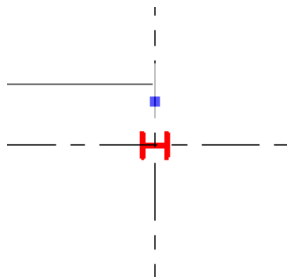
Highlighted grids



To rotate the column during placement

While placing columns, use the *SPACEBAR* to change the column rotation before the column is placed. Each time you press the *SPACEBAR*, the column rotates to align with the intersecting grids at the selected location. In the absence of any grids, press the *SPACEBAR* to rotate the column 90 degrees.

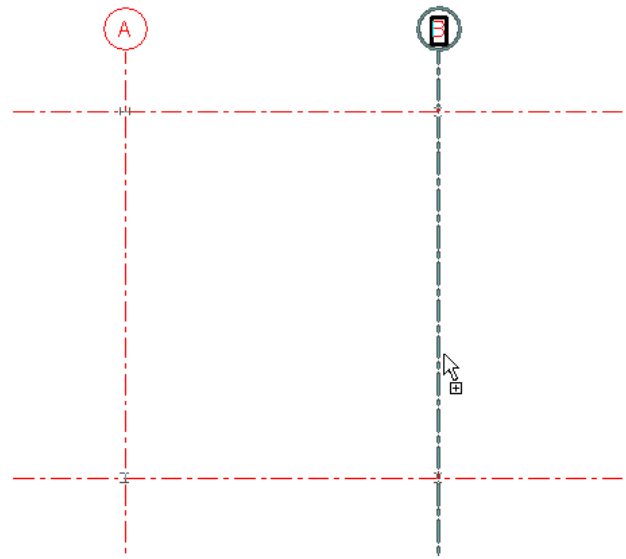
Rotating a column



Placing Multiple Columns by Grid

- 1 Click Home tab ► Build panel ► Column drop-down ► Structural Column.
- 2 Click Place Structural Column tab ► Multiple panel ► On Grids.
- 3 Select multiple grid intersections. For more information, see [Selecting Elements](#) on page 339.

Placing columns by grid



NOTE A column will be placed at every intersection of selected grid lines, according to the properties set on the Options Bar. No columns are actually created until you press the Finish button.

- 4 Press the *SPACEBAR* to rotate all of the columns that you are creating.
- 5 Continue pressing *SPACEBAR* until the columns are in the desired orientation.
- 6 To add other columns to grid intersections, hold *Ctrl* and drag other pick boxes.
- 7 Click Place Structural Column > At Grid Intersection tab ► Multiple Selection panel ► Finish Selection to create the columns.

Locking Columns to a Grid

You can constrain the current position of vertical columns or the tops and bases of slanted columns to a grid. This state allows you to move the grid and keep columns or ends in their respective orientation to their grid placement.

To lock vertical columns to a grid

- 1 Valid columns must be within a grid and have a valid column location mark.
To enable this state:
Select the vertical columns to lock to the grid.
- 2 Click Modify Structural Columns tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 3 Under the Constraints section, select Moves with Grids.
- 4 Click OK.
The modified columns may still be moved and modified but they will proportionately move with the grid if it is repositioned.

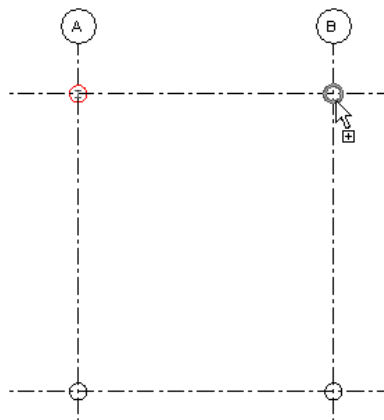
Because of the unique orientation properties of slanted column ends, locking to grids requires situational guidelines.

- If both ends are locked to a grid and the grids at each end are not a subset of each other, the Column Style parameter (see [Structural Column Instance Properties](#) on page 836) of the columns will be changed to Slanted - End Point Driven.
- Movement of a grid to which an angle-driven column is locked will move the entire column.
- Movement of a grid to which an endpoint-driven column is locked will move only that end of the column. The column will lengthen or shorten to meet the new location of the grid.

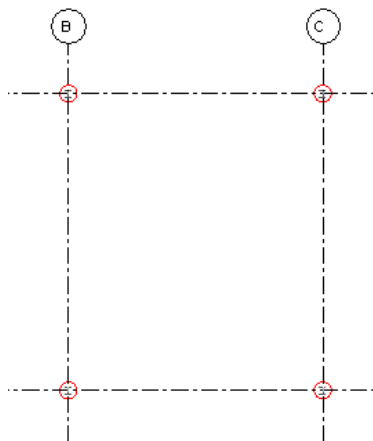
Adding Structural Columns Inside Architectural Columns

- 1 Click Home tab ► Build panel ► Column drop-down ► Structural Column.
- 2 Click Place Structural Column tab ► Element panel, and select a column type from the Type Selector drop-down.
- 3 Click Place Structural Column tab ► Multiple panel ► At Columns.
- 4 Either select individual architectural columns or drag a pick box over architectural columns in the view to select multiple columns.

Selecting a single architectural column



Selecting multiple architectural columns



The structural columns snap to the centers of the architectural columns. For more information about creating a pick box, see [Selecting Elements](#) on page 339.

- 5 Click Place Structural Column > At Architectural Columns tab ► Multiple Selection panel ► Finish Selection when complete.

NOTE You can control how a column family displays within a project plan view. In the Family Editor, select “Show family pre-cut in plan views” if you want the column display to remain consistent despite the cut plan for that project plan view. For more information, see [Specifying How a Structural Column Displays in Plan View](#) on page 823.

Modifying Structural Columns

You can align, move, copy, and adjust structural columns using common Revit Architecture tools.

Related topics

- [Moving Elements](#) on page 372
- [Copying Elements](#) on page 392
- [Modifying Elements](#) on page 397
- [Locking Columns to a Grid](#) on page 828
- [Structural Column Properties](#) on page 834
- [Modifying Slanted Structural Columns](#) on page 830
- [Modifying the Slant of Placed Structural Columns](#) on page 832

Modifying Slanted Structural Columns

Slanted columns incorporate a unique implementation of dragging tools. The following controls are available when the slanted column is selected.

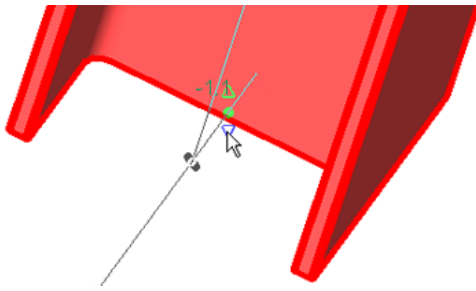
NOTE If the base is moved higher than the top, or the top is moved lower than the base, a warning dialog displays, disallowing the modification. The top and base can similarly not share the same elevation or the same warning dialog is issued.

Related topic

- [Joins and Cutback on Framing Elements and Columns](#) on page 863

Vertical Arrow Controls

Vertical arrow controls appear as blue arrows at either end of the endpoint-driven slanted column. Drag these controls to adjust the elevation of the top or base of the column. The column end will only move vertically.

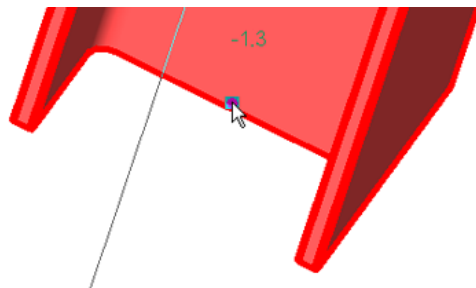


These controls are only available when the property Column Style is set to Slanted - End Point Driven. See [Structural Column Instance Properties](#) on page 836.

Vertical arrow controls are disabled when a column is attached to a structural floor, floor, roof, reference plane, or midjoined to or driven by a beam.

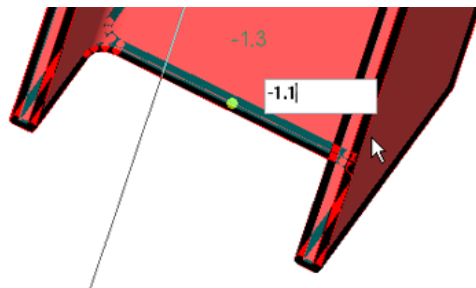
Endpoint Controls

Endpoint controls appear as a blue dot on either end of the column. Drag these controls to adjust the position of the top or base of the column. The column end will move freely in accordance with the current view.



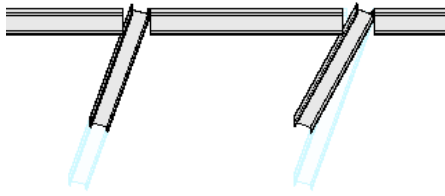
Text Controls

The text controls directly adjust the offset parameter displayed next to the endpoint control. Clicking this control enables it to be manually edited. Enter an elevation to reposition the associated top or base. The column end will only move vertically.



Text controls are disabled when a column is attached to a structural floor, floor, roof, reference plane, or midjoined to or driven by a beam.

The behavior of text controls is dependent on the Column Style instance parameter (see [Structural Column Instance Properties](#) on page 836) and is consistent with changing the Base/Top Offset parameters. If column is endpoint-driven, this control moves the endpoint vertically. If it is angle-driven, the point is moved by along the location curve. In the following illustration, columns adjust to meet a base offset increase. Notice how the angle-driven column on the left maintains its angle, while the endpoint-driven column on the right adjusts vertically, regardless of its original angle. The original beam orientations are highlighted in blue.



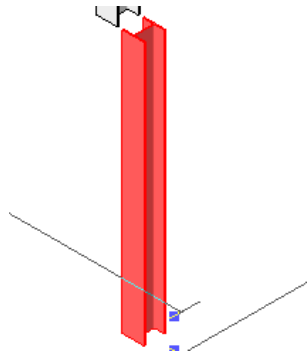
Cross-Sectional Rotation

Press the *Spacebar* to rotate the selected column 90° clockwise (viewed from base to top) around its center. To make more finite adjustments to this rotation on slanted columns, edit the Cross-Section Rotation property. See [Structural Column Instance Properties](#) on page 836.

Modifying the Slant of Placed Structural Columns

This procedure will slant of vertical columns or adjust existing slanted columns with the Instance Properties dialog and column modification tools.

- 1 Open a 3D View of your project.
- 2 Select the column to be modified.

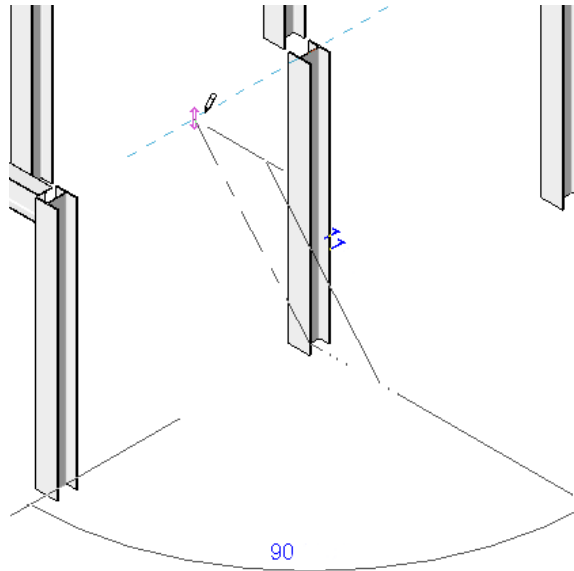


- 3 Click Modify Structural Columns tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 4 In the Instance Properties dialog, under Constraints, select a slanted column style, Slanted - End Point Driven or Slanted - Angle Driven, to define how the slant angle can be adjusted.

NOTE Other slanted column properties are available. See [Structural Column Instance Properties](#) on page 836.

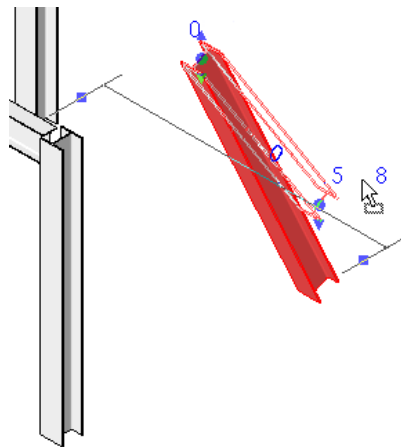
- 5 Click OK.
- 6 Adjust the position of the top of the column with the column endpoint control. If the column is set to Slanted - End Point Driven, you adjust the elevation of the top of the column using the vertical arrow or text controls.

Angle-Driven Modification

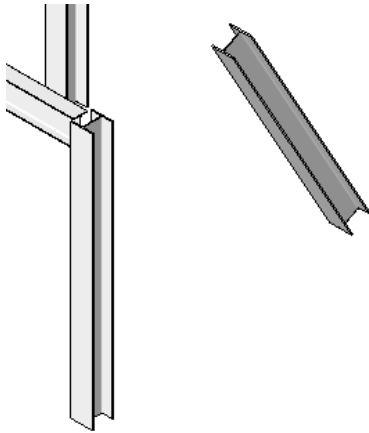


- 7 Adjust the position of the base of the column with the column endpoint. If the column is set to Slanted - End Point Driven, you adjust the elevation of the base of the column using the vertical arrow or text controls.

Endpoint-Driven Editing



The column adjusts its length and slant based on your parameter settings and endpoint adjustments.



Adding a Splice Symbol or Plate Symbol to a Steel Structural Column

- 1 Select the column that is to be modified.
- 2 Click Modify Structural Columns tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 3 In the Instance Properties dialog, under Graphics, select Top Connection Symbol (for top splice), or Base Plate Symbol (for bottom plate), as needed.
- 4 Click OK.

Structural Column Properties

There are several properties for structural columns, including base level, base offset, and materials.

To modify structural column properties

- 1 Select the structural column.
- 2 To modify type properties, click Modify Structural Columns tab ► Element panel ► Element Properties drop-down ► Type Properties. To modify instance properties, click Modify Structural Columns tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 3 In the resulting dialog, edit structural column parameters as required.

NOTE Changes made to type parameters affect all structural columns of this type in the project. Click Duplicate to create a new structural column type.

- 4 When you are finished, click OK.

Structural Column Type Properties - Steel

Properties will vary depending on the column families that are specified during the installation process. The following type properties apply to the steel column families that load during a typical installation:

Name	Description
Structural (Family parameters)	
A	Section area.

Name	Description
W	Nominal weight.
Dimensions (Family parameters)	
bf	Flange width.
d	Actual depth of section.
k	k distance.
kr	kr distance, read only.
tf	Flange thickness.
tw	Web thickness.
Identity Data	
Assembly Code	Uniformat assembly code selected from a hierarchical list.
Keynote	Add or edit the column keynote. Click the value box to open the Keynote dialog. For more information see Keynotes on page 1117.
Model	Manufacturer internal number.
Manufacturer	The shape manufacturer.
Type Comments	A field for entering general comments about the shape type. This information can be included in a schedule.
URL	Specifies a link to a web page that may contain type-specific information.
Description	User can enter a description of the column here.
Assembly Description	Description of the assembly based on the assembly code selection, a read-only parameter.
Type Mark	A value that designates the particular beam; possibly the shop mark. This value must be unique for each element in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. For more information, see Reviewing Warning Messages on page 1415.
Cost	The pricing of the column.
OmniClass Number	The number from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.
OmniClass title	The name from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.

Structural Column Type Properties - Concrete

Properties will vary depending on the column families that are specified during the installation process. The following type properties apply to the concrete column families that load during a typical installation:

Name	Description
Dimensions (Family parameters)	
b	Column width
h	Column depth
Identity Data	
Assembly Code	Unifomat assembly code selected from a hierarchical list.
Keynote	Add or edit the column keynote. Click the value box to open the Keynote dialog. For more information, see Keynotes on page 1117.
Model	Manufacturer internal number.
Manufacturer	The shape manufacturer.
Type Comments	A field for entering general comments about the shape type. This information can be included in a schedule.
URL	Specifies a link to a web page that may contain type-specific information.
Description	User can enter a description of the column here.
Assembly Description	Description of the assembly based on the assembly code selection, a read-only parameter.
Type Mark	A value that designates the particular beam; possibly the shop mark. This value must be unique for each element in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. For more information, see Reviewing Warning Messages on page 1415.
Cost	The pricing of the column.
OmniClass Number	The number from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.
OmniClass title	The name from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.

Structural Column Instance Properties

The following instance properties apply to column families that load during a typical installation. The properties will vary depending on the column families that are specified during the installation process.

Name	Description
Constraints	

Name	Description
Base Level	Constraining level of the column base.
Base Offset	Offset of base from base level.
Top Level	Constraining level of the column top.
Top Offset	Offset of top from top level.
Move Top With Grids	Constrains the top endpoint of the slanted column to the grid.
Move Base With Grids	Constrains the base endpoint of the slanted column to the grid.
Column Style	Either Vertical, Slanted - End Point Driven, or Slanted - Angle Driven. Specifies the slant style of the column which enables type specific modification tools. See Modifying Slanted Structural Columns on page 830.
Base Geometry Treatment	Either Vertical Offset or Setback. Specifies the position of the slanted column geometry relative to the column location curve when the base is joined with a beam. Setback keeps geometry parallel to the location curve. Vertical Offset adjusts the geometry center to the base of the framed-in beam.
Top Geometry Treatment	Either Vertical Offset or Setback. Specifies the position of the slanted column geometry relative to the column location curve when the top is joined with a beam. Setback keeps geometry parallel to the location curve. Vertical Offset adjusts the geometry center to the top of the framed-in beam.
Moves With Grids	Changes the vertical column constraint to the grid. See Locking Columns to a Grid on page 828.
Column Location Mark	The coordinate location of a vertical column on the project grid.
Top is Attached	Read-only parameter specifying that the top of the column is midjoined to a beam or attached to a structural floor or roof.
Attachment Justification At Top	Either Minimum Intersection, Intersect Column Midline, or Maximum Intersection. Specifies the degree of cutback at the top of the column at the join.
Offset From Attachment At Top	Offset of the top of the column from the midjoined beam or attached elements.
Base is Attached	Read-only parameter specifying that the base of the column is midjoined to a beam or attached to a structural floor or roof.
Attachment Justification At Base	Either Minimum Intersection, Intersect Column Midline, or Maximum Intersection. Specifies the degree of cutback at the base of the column at the join.
Offset From Attachment At Base	Offset of the base of the column from the midjoined beam or attached elements.
Cross-Section Rotation	The clockwise rotation angle of a slanted column (viewed from top to base). This angle can be carried out to 3 decimal places. Negative numbers rotate counter-clockwise. If a slanted column is in a vertical state, then this rotation is measured from Project North. Otherwise, it is measured from the vertical position.
Room Bounding	Changes column constraint to room-bounding conditions.

Name	Description
Graphics	
Top Connection Symbol	Applies to steel columns only. Turns on the visibility of a moment or shear connection symbol. The symbols are visible only in elevations and cuts parallel to the main axis of the column in coarse view.
Base Plate Symbol	Applies to steel columns only. Turns on the visibility of the base plate symbol. The symbols are visible only in elevations and cuts parallel to the main axis of the column in coarse view.
Materials and Finishes	
Column Material	Structural material. For more information, see Material Physical Type Parameters on page 489.
Structural	
Top Attachment Type	Either Distance or Ratio. Determines if the top join of a slanted column is measured as a distance or a ratio of the length of the beam.
Top Attachment Distance	Distance from the referenced end of the top attached beam to the join location on the slanted column.
Top Attachment Ratio	The ratio of distance from the referenced end of the attached beam to the top join location on the slanted column to the total length of the beam.
Top Attachment Reference End	Either Start or End. Specifies the end of the top attached beam from which to calculate distance or ratio.
Base Attachment Type	Either Distance or Ratio. Determines if the base join of a slanted column is measured as a distance or a ratio of the length of the beam.
Base Attachment Distance	Distance from the referenced end of the base attached beam to the join location on the slanted column.
Base Attachment Ratio	The ratio of distance from the referenced end of the attached beam to the base join location on the slanted column to the total length of the beam.
Base Attachment Reference End	Either Start or End. Specifies the end of the base attached beam from which to calculate distance or ratio.
Rebar Cover - Top Face	Applies to concrete columns only. Sets the rebar cover distance from the column top face.
Rebar Cover - Bottom Face	Applies to concrete columns only. Sets the rebar cover distance from the column bottom face.
Rebar Cover - Other Faces	Applies to concrete columns only. Sets the rebar cover distance from the column to other element faces.
Estimated Reinforcement Volume	Specifies the estimated reinforcement volume of the selected element. This is a read-only parameter that only displays when rebar has been placed.
Dimensions	

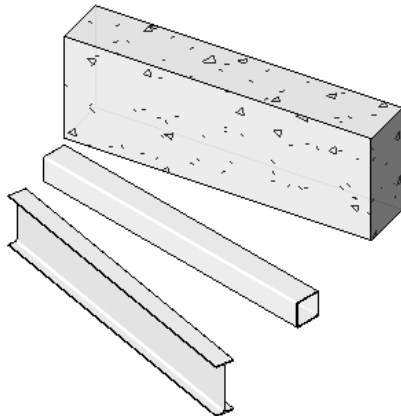
Name	Description
Volume	Volume of the selected column. A read-only value.
Identity Data	
Comments	User comments.
Mark	A label created for the column. Possible use: shop mark. This value must be unique for each element in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. For more information, see Reviewing Warning Messages on page 1415.
Phasing	
Phase Created	Indicates in which phase the column component was created. For more information, see Project Phasing on page 1331.
Phase Demolished	Indicates in which phase the column component was demolished. For more information, see Project Phasing on page 1331.
Structural Analysis	
Top Release	Either fixed, Pinned, Bending Moment or User-Defined. User-Defined allows you to enable/disable each of the top release conditions.
Top Fx	Translational release at the top end of the column along the x-axis.
Top Fy	Translational release at the top end of the column along the y-axis.
Top Fz	Translational release at the top end of the column along the z-axis.
Top Mx	Rotational release at the top end of the column along the x-axis.
Top My	Rotational release at the top end of the column along the y-axis.
Top Mz	Rotational release at the top end of the column along the z-axis.
Bottom Release	Either fixed, Pinned, Bending Moment or User-Defined. User-Defined allows you to enable/disable each of the bottom release conditions.
Bottom Fx	Translational release at the bottom end of the column along the x-axis.
Bottom Fy	Translational release at the bottom end of the column along the y-axis.
Bottom Fz	Translational release at the bottom end of the column along the z-axis.
Bottom Mx	Rotational release at the bottom end of the column along the x-axis.
Bottom My	Rotational release at the bottom end of the column along the y-axis.
Bottom Mz	Rotational release at the bottom end of the column along the z-axis.
Analyze As	Either Hanger, Gravity, Lateral, or Not for analysis. Used by external analysis applications to determine whether the column contributes to lateral analysis.

Name	Description
Analytical Model	
Rigid Links	Infinitely rigid frame element with no weight. When Rigid Links is enabled, an additional analytical segment is engaged in the model between the end of the analytical model of a beam and the analytical model of a column.
Auto-detect Horizontal Projection	Changes the auto-detect parameter to display the horizontal projection of the column.
Top Vertical Projection	The plane of the column used for analysis and design. .
Bottom Vertical Projection	The plane of the column used for analysis and design.

Beams

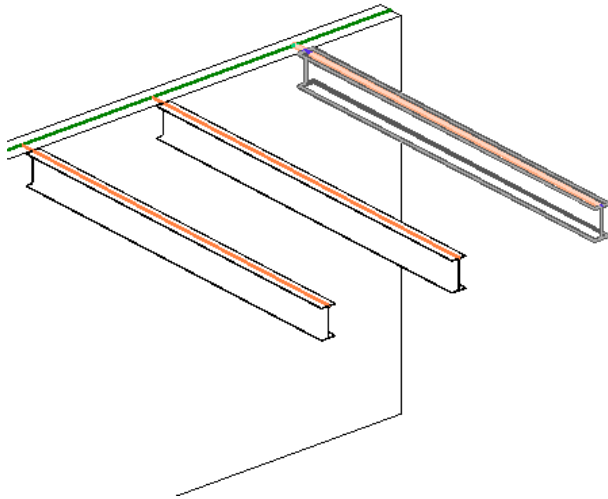
Beams are structural elements used for load-bearing applications. Elements of each beam are defined through the type properties of the specific beam family. In addition, various instance properties can be modified to define the functionality of the beam.

Sample beams



You can attach beams to any structural element, including structural walls, in your project. The beams join to structural bearing walls when the Structural Usage property of the wall is set either to Bearing or to Structural Combined.

Beams attached to structural walls

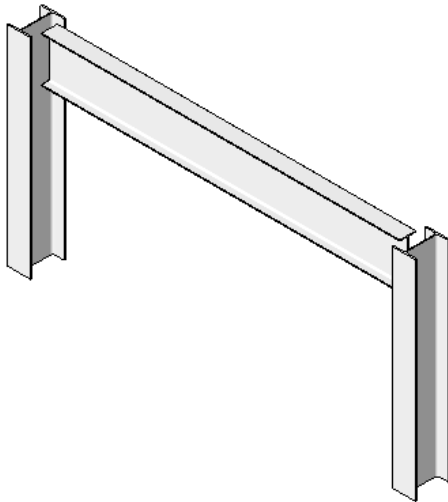


To draw beams between 2 points

- 1 Click Home tab ► Build panel ► Beam drop-down ► Beam.
- 2 Click in the drawing area to specify the start point.
- 3 Use the mouse to sketch the beam, moving the cursor to the endpoint.
- 4 Click to specify the endpoint.

You can use the grid tool to add multiple beams to selected grids when columns are also present at the working level.

Beam between points



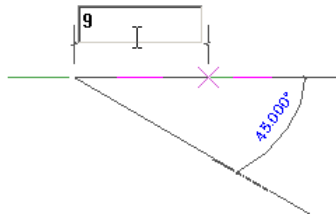
To draw a beam to a specified length

- 1 Click Home tab ► Build panel ► Beam drop-down ► Beam.
- 2 Click in the drawing area to specify the start point.
- 3 Use the mouse to sketch the beam, moving the cursor toward the endpoint.
- 4 Type a length. A text box will appear to show your entry.

5 Click to specify the endpoint.

Use the grid tool to add multiple beams to selected grids when columns are also present at the working level.

Enter beam length



You should add beams after creating a grid since beams snap to grids. Add a grid by clicking Home tab ► Datum panel ► Grid. However, structural beams can be added without an existing grid.

You can add beams using one of the following methods:

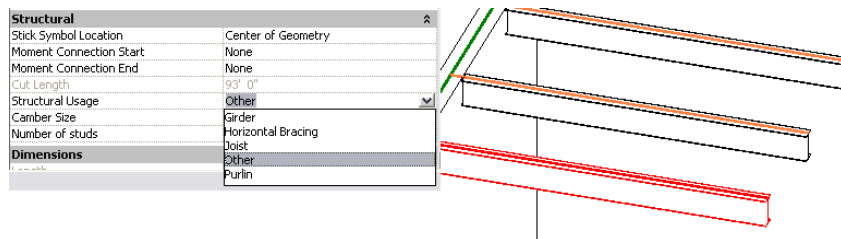
- Sketch individual beams.
- Select grid lines that lie between structural elements.
- Create a chain of beams.

Structural Usage of Beams

Revit Architecture determines the Structural Usage Property of a beam automatically, based on the structural elements that support the beam. The structural usage parameter value determines the line style of the beam in a coarse-scale view.

Structural usage can be changed before or after the beam is placed. Use the Object Styles dialog to change the structural usage. For more information, see [Object Styles](#) on page 493. The structural usage parameter can be included in a structural framing schedule, allowing quantity calculation of girders, joists, purlins, and horizontal bracing. For more information, see [Specifying Schedule Properties](#) on page 176.

Structural usage values for beams



Beams can be attached to any other structural element, including structural walls. For more information, see [Structural Walls](#) on page 906.

The default Structural Usage setting can be changed using the Instance Properties dialog. The following table lists the default automatic Structural Usage setting for beams, based on which elements are being connected:

-	C	B	HB	G	J	P	O
Wall	G	O	HB	G	J	P	O
Column	G	O	HB	G	J	P	O

-	C	B	HB	G	J	P	O
Brace		O	O	O	O	O	O
Horizontal Brace			HB	HB	HB	HB	O
Girder				J	J	P	O
Joist					P	P	O
Purlin						P	O
Other							O

For the properties of Beams, see [Beam Properties](#) on page 857.

Beam Tips

- If a beam end resides on a structural wall, the Beam End Pocket Seat parameter is displayed in the Instance Properties dialog. Select this check box when the beam is bearing supported by the wall. Then the beam graphics extend to the centerline of the bearing wall.
- When you place a beam, a beam name tag appears by default with the beam. Also, you can load another tag that displays beam name, camber, and number of studs. You must specify the values for Beam Camber and Number of Studs parameters that display in a tagged beam. For information about loading a family, see [Loading Families](#) on page 427.

Creating Beams

You should add grids and columns before creating beams.

When adding a beam to a plan view, you must set the bottom clip plane below the current level; otherwise, the beam is not visible in the view.

Add beams using one of the following methods:

- Sketch individual beams.
- Create a chain of beams.
- Select grid lines that lie between structural elements.
- Create a beam system. For more information, see [Beam Systems](#) on page 874.

Sketching Individual Beams

The Beam tool is the primary means with which you sketch individual instances of [Beams](#) on page 840.

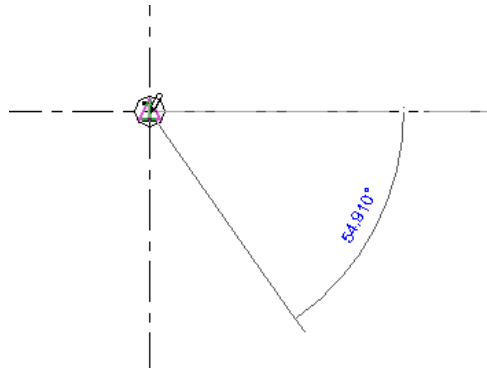
To sketch individual beams

- 1 Click Home tab ► Build panel ► Beam drop-down ► Beam.
- 2 Load a structural beam family, if one has not been previously loaded.
- 3 Click Place Beam tab ► Element panel, and select a beam type from the Type Selector drop-down.

- 4 Click Place Beam tab ► Element panel ► Element Properties drop-down ► Instance Properties to modify beam parameters.
- 5 On the Options Bar, select a value from the Structural Usage drop-down list.
- 6 Sketch the beam by clicking the start point and endpoint in the drawing area.

The cursor snaps to other structural elements, such as the centroid of a column or the centerline of a wall, when you sketch a beam. The status bar displays where the cursor is snapping.

Beam start point - snap to column



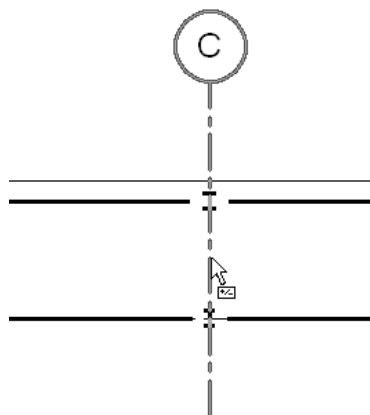
Using the Grid Tool to Place Beams

You can use the Grid tool to select grid lines to place beams automatically between other structural elements (columns, structural walls, and other beams). For example, you might have 2 structural columns located on a grid line. Beams are also added between columns and structural walls.

To place beams using the Grid tool

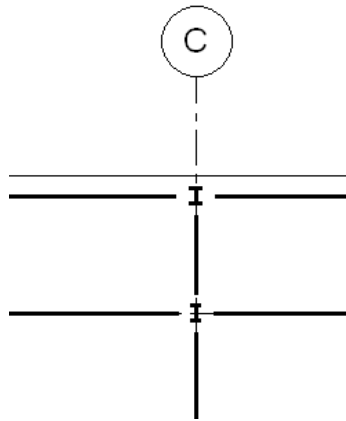
- 1 Click Home tab ► Build panel ► Beam drop-down ► Beam.
- 2 Click Place beam tab ► Multiple panel ► On Grids.
- 3 Select the grid to place beams.

Selecting the grid



The beams are placed between columns as shown.

Placing beams between columns

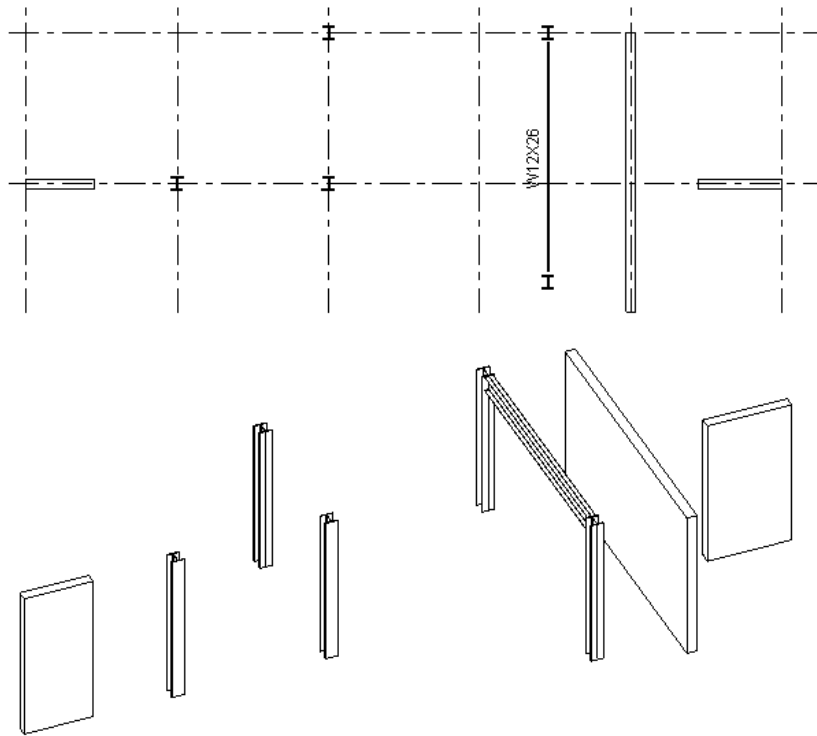


The grids in a project are a valuable tool in setting up beams, as well as columns. A selected span of grid lines can automatically place beams.

To sketch beams automatically using the Grid tool

- 1 Click Home tab ► Build panel ► Beam drop-down ► Beam.
- 2 Click Place Beam tab ► Element panel, and select a beam type from the Type Selector drop-down.
- 3 Click Place Beam tab ► Element panel ► Element Properties drop-down ► Instance Properties to modify beam parameters.
- 4 On the Options Bar, select a value from the Structural Usage drop-down list.
- 5 Click Place Beam tab ► Multiple panel ► On Grids.

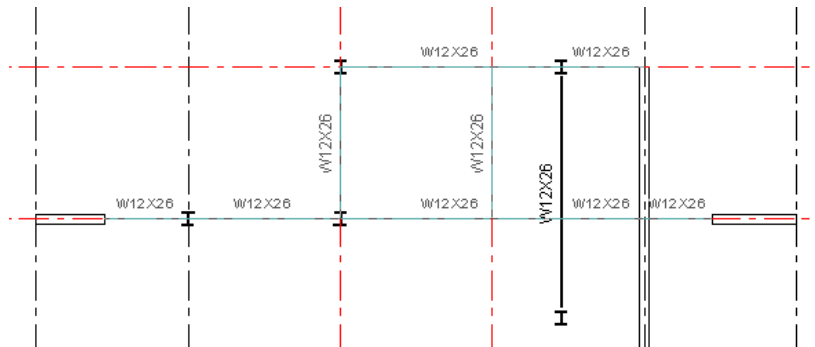
In the image below, you can see assorted columns, a beam, and structural walls in a plan and 3D view. In this case, you can use the Grid tool to add the majority of the beams automatically.



6 Select a grid line along which you want to place a beam.

Press and hold *Ctrl* to select multiple grids.

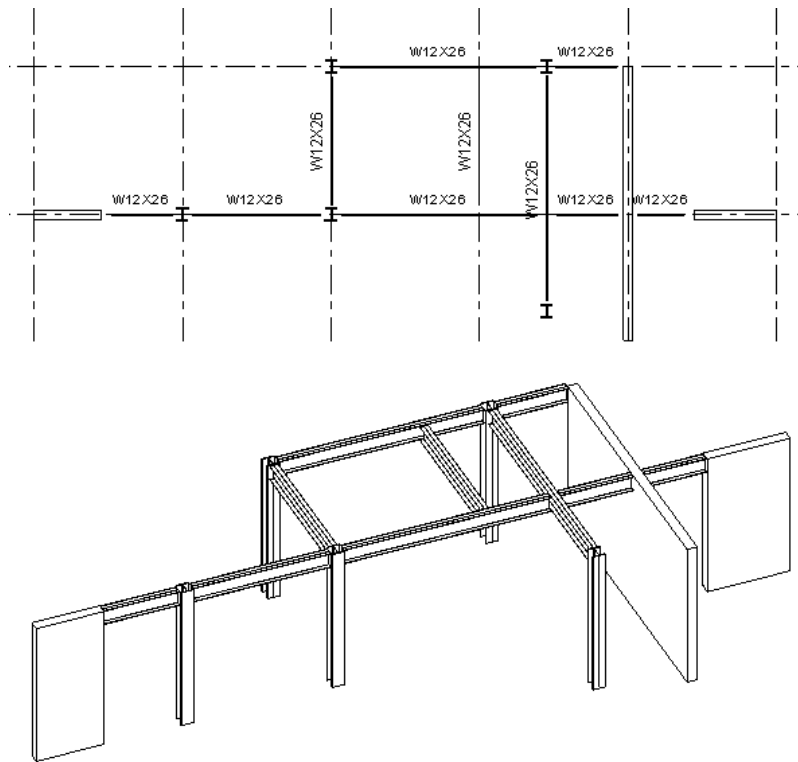
In the image shown below, grids have been selected and beams have been added automatically between all columns, walls, and beams.



7 Click Place Beam > On Grid Lines ► Multiple Selection panel ► Finish Selection.

TIP You can also draw a pick box to select multiple grid lines.

In the image below, notice how the beams were added between all columns, walls, and other supporting beams. The pre-existing beam was not cut by the beam perpendicular to it.



When Revit Architecture places beams along a grid line, it uses the following conditions:

- All the possible supports that intersect the grid line, such as columns, walls, or beams, are scanned.
- If a wall is on the grid line, a beam is not placed in the wall. The ends of the wall are used as support.
- If a beam intersects and crosses the grid line, that beam is considered to be an intermediate support, because this beam supports new beams created on the grid line.
- If a beam intersects but does not cross the grid line, this beam is supported by a new beam created on the grid line.

For more information about beam structural usage, based on which elements are being created, see [Structural Usage of Beams](#) on page 842.

Related topics

- [Creating Beams](#) on page 843
- [Structural Usage of Beams](#) on page 842
- [Beam Properties](#) on page 857
- [Beams](#) on page 840

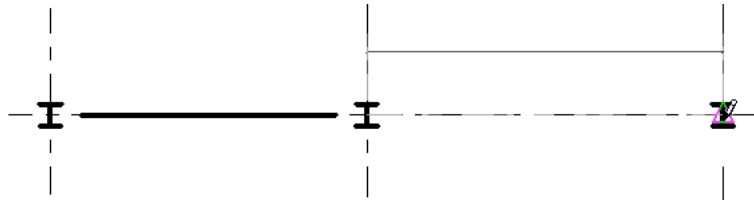
Sketching Beams with the Chain Option

When the Chain option is selected, Revit Architecture supplies the endpoint of the last beam as the start point of the next beam.

To sketch beams using the Chain option

- 1 Click Home tab ► Build panel ► Beam drop-down ► Beam.
- 2 On the Options Bar, select Chain.
- 3 Place the first beam in the chain. See [Sketching Individual Beams](#) on page 843.
- 4 Place each additional beams by clicking the endpoints of the beams.

Sketching beams using the chain option



Sloped Beam Modeling

If your project contains complex sloped members for which you need to add beams, you can match beams to uneven columns, roofs, structural floors, or walls using the following procedure.

To adjust sloped beams

- 1 Select a beam that is connected to 2 structural members or warped model objects at different heights.
- 2 Click Modify Structural Framing tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 3 In the Instance Properties dialog, enter a value for the Start Level Offset instance parameter of the beam.
- 4 Enter a value for the End Level Offset instance parameter of the beam, and click OK.
- 5 Verify that you have entered the correct offset values.

Example of sloped beam modelling.



NOTE A beam that has adjusted offset values will become disassociated or free from the current work plane. Similarly, any structural element attached to a sloped beam will also become free. You attach free elements to another work plane using the existing Edit Work Plane or Rehost buttons on the Work Plane panel of the Modify Structural Framing tab.

3D Snapping

You can use the 3D Snapping option to create a new beam by snapping to other structural elements in any view. This means that you can sketch beams and braces outside of the current work plane. For example, when 3D snapping is enabled, roof beams will snap to the tops of columns, regardless of elevation.

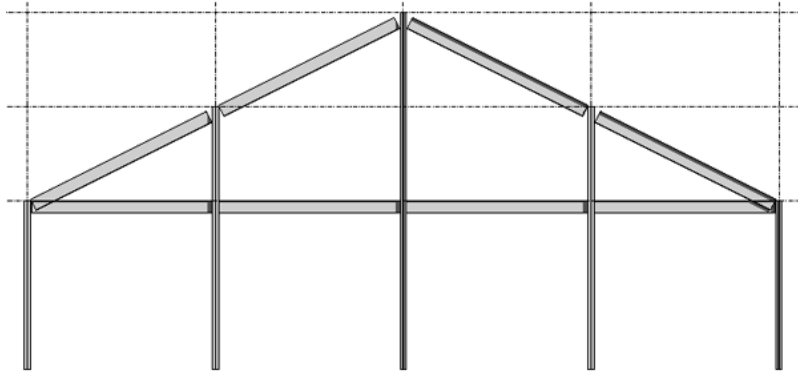
3D snapping is also useful when creating sloped beam systems. See [Sloped Beam Modeling](#) on page 848

To use 3D snapping

- 1 Click Home tab ► Build panel ► Beam drop-down ► Beam.
- 2 On the Options bar, select 3D Snapping.
- 3 Click any structural element to specify the start point for the beam.

NOTE With 3D Snapping enabled, you can choose the exact endpoint of any structural element regardless of the plane of the endpoint.

- 4 Click another structural element to specify the endpoint for the beam.



Editing Beams

You can edit any beam after it is placed within a project. The beam can be moved or rotated from the location where it was originally placed, or the beam can be extended or reshaped using graphical controls. For more information, see [Editing Elements](#) on page 339.

To move a beam

- 1 In a project view, select the beam.
- 2 Drag the beam to a new location in the drawing area, or use the arrow keys on your keyboard.
For more information, see [Moving Elements](#) on page 372.

To rotate a beam

- 1 Select the beam in a plan view.
- 2 Click Modify Structural Framing tab ► Modify panel ► Rotate.
- 3 Click the start point and the endpoint for the rotation. For more information, see [Rotating Elements](#) on page 379.

Beam Graphical Controls

When you sketch beams, you can use available graphical controls to modify the attachment points between each beam and the structural element (column, structural wall).

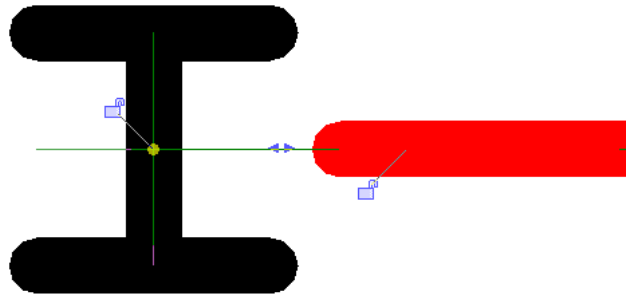
You can either set the location of the controls when creating the beam or select and manually adjust it after the beam is created.

Beam Handles

The beam handles of a beam are the attachment points of the beam. Beam handles display as small filled circles that indicate where the end of the selected beam is attached to a column or wall.

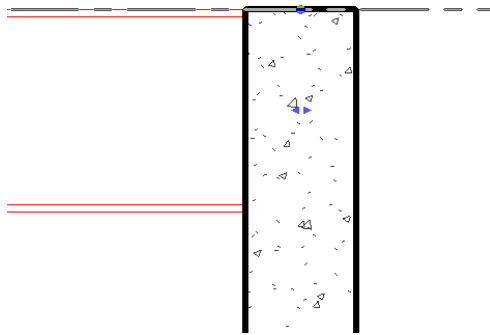
NOTE Moving beam handles changes cope length.

Beam and column in plan with a beam handle at the column center

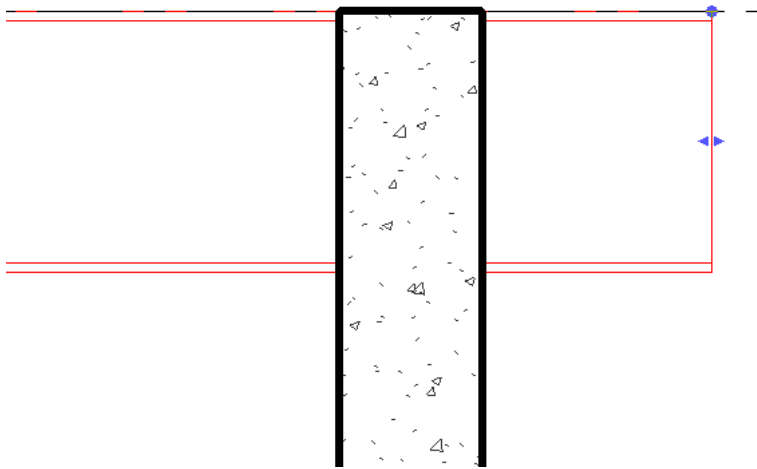


Columns have an invisible bounding box that controls the beam handle location.

The following illustration presents a section view of a beam that is attached to a wall. The beam handle is visible at the top center of the wall.



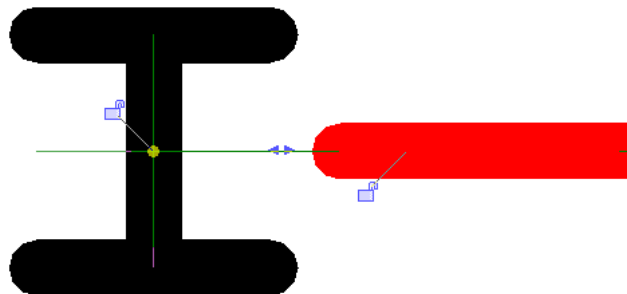
The beam is constrained by level. As a result, beam attachment can be changed in a horizontal direction only.



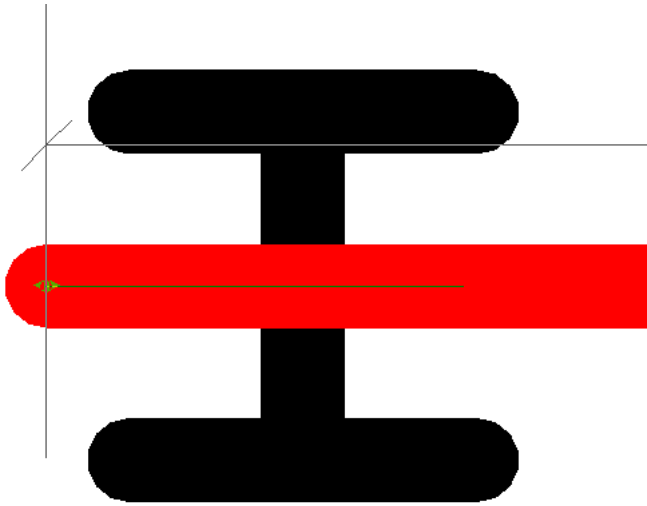
Changing Beam Geometry Using Shape Handles

The shape handle of a beam is used to change beam geometry. Shape handles display as small, filled back-to-back triangles at each beam end when the beam is selected in the drawing area.

Beam and column in a plan with the shape handles displayed



You can adjust the endpoint location of a beam using shape handles. This lengthens or shortens the beam. The other end of the beam remains fixed.



Shape handles change geometry along the axis of the component. To move a beam out of its original axis, click and drag the beam into a new position.

Each beam shape handle provides properties that can be changed, based on the element type preferences. To access the shape handle properties, right-click the back-to-back triangles, and select View Properties. For more information, see [View Properties](#) on page 259.

Using shape handles manually adjusts the beam cutback settings. See also [Cutback](#) on page 865.

Moment Symbols

The moment parameters of a beam (Connection Start or Connection End) enable the display of moment frame or cantilever connection symbols. These parameters refer to the applicable beam endpoint. The available options for these parameters are: None, Moment Frame, or Cantilever Moment.

To display a moment symbol

- 1 Right-click on a beam, and select Element Properties.
- 2 In the Instance Properties dialog, under Structural, select a value for Moment Connection Start or Moment Connection End, and click OK.

Moment frame symbol displayed by using a moment connection parameter



Cantilever connection symbol
displayed by using a moment
connection parameter parameter



Beam Tags

Beam tagging is an integral part of a structural framing plan. Designing a structure requires labeling from the simple to the complex. Revit Architecture Beam tags provide for this informational labeling.

Structural Framing Tag Families

The structural framing tag family annotates beams. You can adjust the default positions of these tags in the Family Categories and Parameters dialog. See [Family Category and Parameters](#) on page 433.

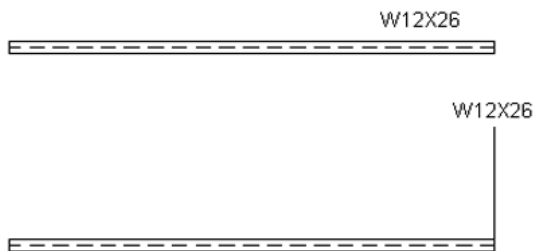
The Structural Framing Tag category contains 2 parameters.

Rotate with component: When selected, the tag rotates with its beam. When deselected, the tag orients itself with respect to the view frame.

Attachment Point: Defines the initial location of the tag along a beam (start, middle, or end) and is the point the tag tracks as the beam is lengthened and shortened.



When enabled, a tag leader extends from this point.



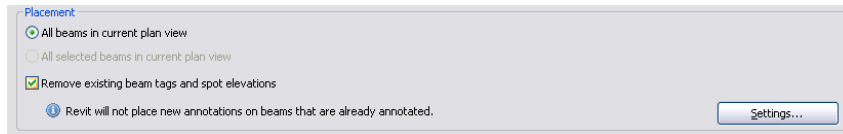
<None>: Locates the tag in the middle of the beam by default.

Beam Annotations Tool

The Beam Annotations tool allows you to place multiple beam tags, annotations, and spot elevations on selected beams or all beams in the current view. It is only available when working in a structural plan or ceiling plan view. Structural Framing Tags that are set to Rotate with Component must be loaded for the dialog to launch.

To access the Beams Annotations tool, click Annotate tab ➤ Tag panel ➤ Beam Annotations.

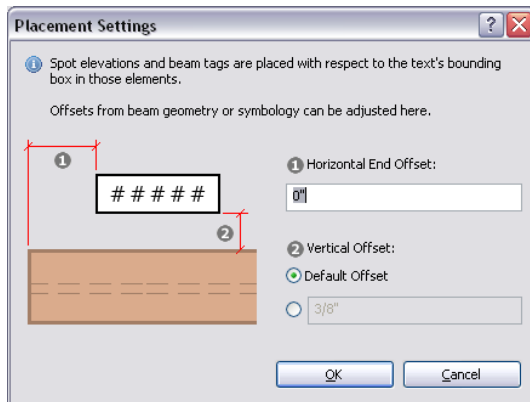
Placement



The Placement section of the Beam Annotations tool allows you to specify which beams you intend to annotate (either all in view or just the beams selected). As noted on the Beam Annotations tool, Revit Architecture does not overwrite existing tags.

To place new annotations in place of others, select Remove existing beam tags and spot elevations. All tags and spot elevations will be removed from beams and replaced by those currently set in the beam annotations tool. When deselected, no annotations will be placed on the beams.

Placement Settings: Click the Settings button to open the Placement Settings dialog and adjust the offset of tags and spot elevations from beams.



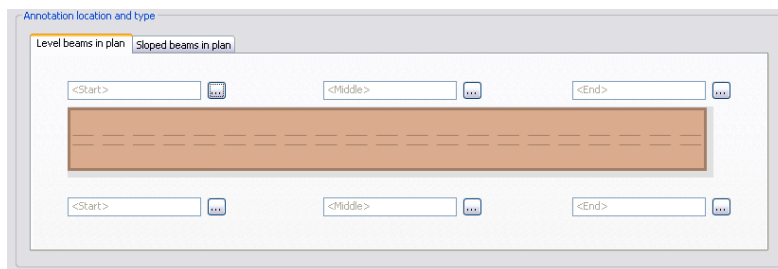
The Horizontal End Offset and Vertical Offset settings adjust the distance of tags and spot elevations from their attachment points (see [Structural Framing Tag Families](#) on page 853) by the entered measurement. This measurement is representative of the drawing scale and its default is 0" horizontally and 3/8" vertically.

Annotation Location and Type

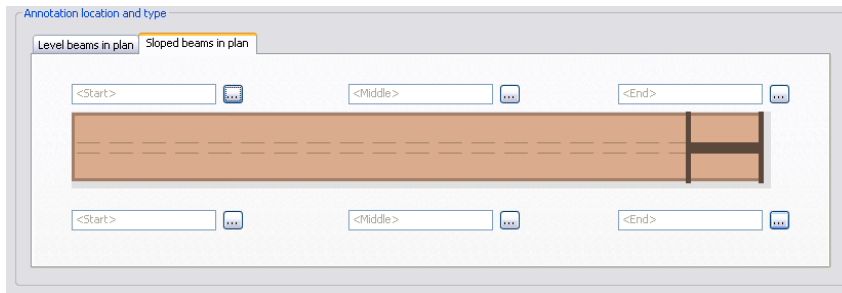
The lower section of the Beam Annotations tool defines the annotation types and locations specific to level and sloped beams.


Level/Sloped Beams Tabs: Both level beams and sloped beams use the same tagging options. The tabs allow you to make different annotations to either type of beam instance.

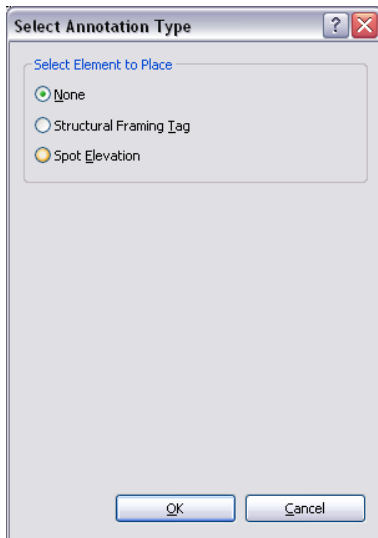
To make specific tags to level beams, make adjustments on the Level beams in plan tab.



To make specific tags to sloped beams, make adjustments on the Sloped beams in plan tab.



Annotation Location: At the center of the tabbed page is an image of a beam surrounded by six text fields. The fields represent the locations of the tags as they appear around the beam. The  buttons open the Select Annotation Type dialog which defines and edits the tag.



None: Tags do not track any particular point on the beam. Changes to the length of the beam do not cause the tag to move.

Structural Framing Tag: See [Structural Framing Tags](#) on page 855.

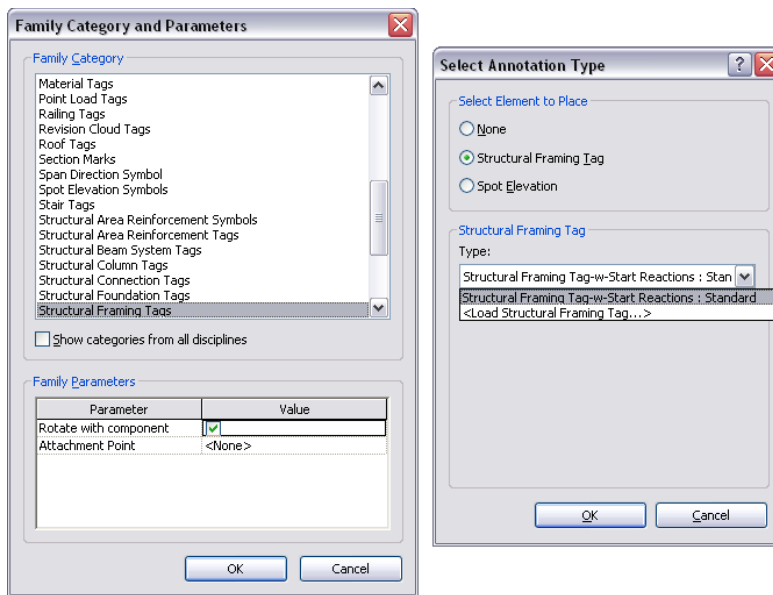
Spot Elevation: See [Spot Elevations](#) on page 856.

Structural Framing Tags

This selection enables a pull down menu of available structural family tags specific to the selected location along the beam. Specific family parameters determine which tags display. Qualifying framing tags must have the following parameters (see [Structural Framing Tag Families](#) on page 853) to be a viable annotations type:

- Rotate with Component is selected.
- The Attachment Point parameter is set to <None> or matches the position of the desired tag location in the Beam Annotations tool.

For example, structural framing tags which have defined Attachment Point parameters of End are only available to the beam location settings marked <End> in this tool.



Structural framing tags with attachment points of <None> are available to only the Middle location settings provided they rotate with component.

These specifications also apply to the <Load Structural Framing Tag> option, which opens the Load Family dialog (see [Loading Families](#) on page 427).

To appear in the Structural Framing Tag list, loaded families must follow these guidelines.

Spot Elevations

The Spot Elevations tool allows the placement of spot elevations when the type parameter Rotate with Component is selected. This is similar to tags in that they are filtered by this parameter.

Beam Elevation (Project) calculates elevation from the lowest level of the project.

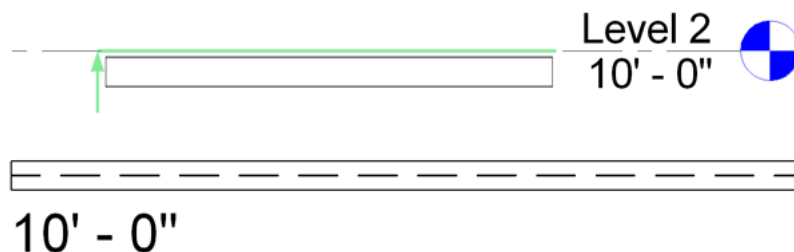
Create/modify types gives you the option of creating a custom spot elevation. When selected, the Family Type Properties dialog opens to edit the spot elevation tag.

Beam Elevation (Relative) enables the Relative Base drop-down list, which allows selection of the base relative level for elevation calculation.

NOTE Only one spot elevation type can be placed at a time. If you change the spot elevation type in any of the 12 locations (6 for the level and 6 for sloped), it will change all 12 spot elevation type settings in the Beam Annotations tool.

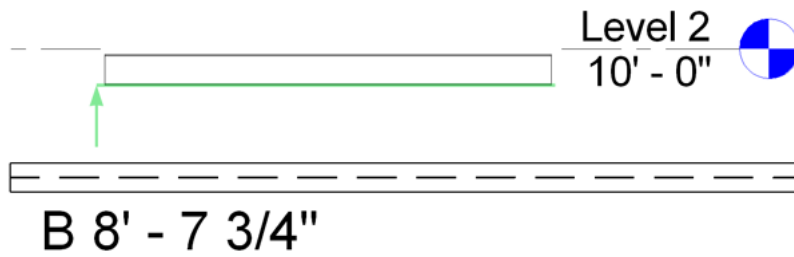
The Display Elevation drop-down list selects the location of elevation measurement on the beam.

Actual (Selected) Elevation

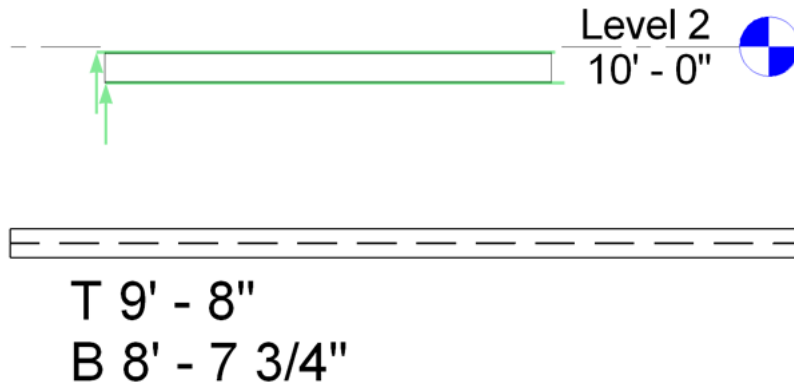


NOTE Actual (Selected) Elevation tags the elevation of the location line, not the beam geometry.

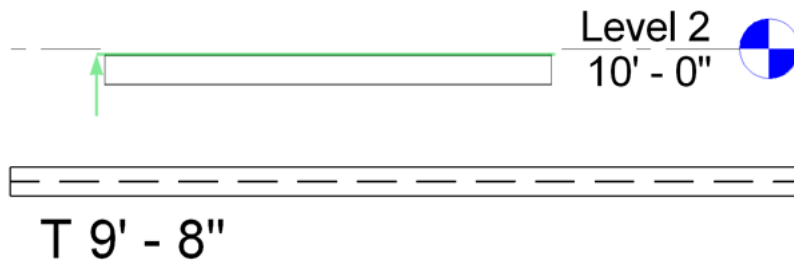
Bottom Elevation



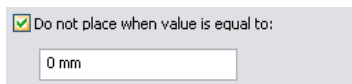
Top & Bottom Elevations



Top Elevation



The final option available in the Select Annotation Type dialog for spot elevations is a filter for defined elevations.



This option enables a filter that prevents spot elevations from being created if it equals the entered value. The default setting is 0 units as defined by the project.

Beam Properties

Several properties for beams, including work plane, materials, and angle, are accessible in the Instance Properties dialog.

Modifying Beam Properties

To modify beam properties

- 1 Select the beam, and click Modify Structural Framing tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 2 In the Instance Properties dialog, edit beam instance parameters. (See [Beam Instance Properties](#) on page 860.)
- 3 Click OK.
- 4 To edit beam type parameters, click Edit type. See [Beam Type Properties - Steel](#) on page 858 or [Beam Type Properties - Concrete](#) on page 859.

NOTE Changes made to type parameters affect all beams of this type in the project. Click Duplicate to create a beam type.

Beam Type Properties - Steel

Properties vary depending on the specified beam families during the installation process. The following type properties apply to the steel beam families that load during a typical installation:

Name	Description
Structural	
A	Section area.
W	Nominal weight.
Dimensions	
bf	Flange width.
d	Actual depth of section.
k	k distance.
k2	k2 distance. This is a read-only value.
tf	Flange thickness.
tw	Web thickness.
Identity Data	
Assembly Code	Unifomat assembly code selected from a hierarchical list.
Keynote	The beam keynote. Add or edit the value. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The manufacturer internal number.
Manufacturer	The shape manufacturer.

Name	Description
Type Comments	A field for entering general comments about the shape type. This information can be included in a schedule.
URL	A link to a web page that may contain type-specific information.
Description	Description of the beam. Enter a description.
Assembly description	Description of the assembly based on the assembly code selection. This is a read-only value.
Type Mark	A value that designates the particular beam; possibly the shop mark. This value must be unique for each element in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Cost	The pricing of the beam.
OmniClass Number	The number from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.
OmniClass title	The name from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.

Beam Type Properties - Concrete

Properties will vary depending on the beam families that are specified during the installation process. The following type properties apply to the concrete beam families that load during a typical installation:

Name	Description
Structural	
b	Beam width.
h	Beam depth.
Identity Data	
Assembly Code	Unifomat assembly code selected from a hierarchical list.
Keynote	The beam keynote. Add or edit the value. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The manufacturer internal number.
Manufacturer	The shape manufacturer.
Type Comments	A field for entering general comments about the shape type. This information can be included in a schedule.
URL	A link to a web page that may contain type-specific information.
Description	Description of the beam. Enter a description.

Name	Description
Assembly description	Description of the assembly based on the assembly code selection. This is a read-only value.
Type Mark	A value that designates the particular beam; possibly the shop mark. This value must be unique for each element in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Cost	The pricing of the beam.
OmniClass Number	The number from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.
OmniClass title	The name from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.

Beam Instance Properties

Properties will vary depending on the beam families that are specified during the installation process. The following instance properties apply to beam families that load during a typical installation:

Name	Description
Constraints	
Reference Level	The constraining level. This is a read-only value that is dependent on the work plane on which the beam was placed.
Work Plane	The current plane on which elements are placed. This is a read-only value.
Start Level Offset	The distance of the beam start point from the reference level. Values entered here are reset when the member is pinned. Read-only when pinned.
End Level Offset	The distance of the beam endpoint from the reference level. Values entered here are reset when the member is pinned. Read-only when pinned.
z-Direction Justification	Either center, top, bottom, or other. Selecting the option other enables an additional parameter, z-Direction offset value .
z-Direction Offset Value	The numeric value that offsets the geometry.
Lateral Justification	The location of the physical geometry (in plan) with respect to the location line. Either Side 1, Side 2 and Center. Read-only when pinned.
Orientation	The beam orientation to the current plane on which elements are placed. This is a read-only value.
Cross-Section Rotation	Parameter that controls rotating beams and braces. The angle of rotation is measured from the beam's work plane and the direction of the center reference plane.
Construction	

Name	Description
Start Extension	Applies to steel beams only. The dimension between the edge of the start end of the beam and the element to which it is connected.
End Extension	Applies to steel beams only. The dimension between the edge of the finish end of the beam and the element to which it is connected.
Materials and Finishes	
Beam Material	The structural material. See Material Physical Type Parameters on page 489.
Structural	
Stick Symbol Location	Applies to steel beams only.
Moment Connection Start	Applies to steel beams only. A moment frame, or cantilever symbol at the start end of a beam.
Moment Connection End	Applies to steel beams only. A moment frame, or cantilever symbol at the finish end of a beam.
Cut Length	The physical length of the beam. This is a read-only value.
Structural Usage	Specifies the usage. Either Girder, Horizontal bracing, Joist, Other, or Purlin.
Rebar Cover - Top Face	Applies to concrete beams only. The rebar cover distance from the beam top face.
Rebar Cover - Bottom Face	Applies to concrete beams only. The rebar cover distance from the beam bottom face.
Rebar Cover - Other Faces	Applies to concrete beams only. The rebar cover distance from the beam to adjacent element faces.
Estimated Reinforcement Volume	Specifies the estimated reinforcement volume of the selected element. This is a read-only parameter that only displays when rebar has been placed.
Camber Size	Applies to steel beams only. The beam camber.
Number of Studs	Applies to steel beams only. The number of studs per beam.
Dimensions	
Length	The length between beam handles. See Beam Handles on page 850. This is the analytical length of the beam. This is a read-only value.
Volume	The volume of the selected beam. This is a read-only value.
Identity Data	
Comments	User comments.
Mark	A label created for the beam. Possible use: shop mark. This value must be unique for each element in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the

Name	Description
	warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Phasing	
Phase Created	Indicates in which phase the beam component was created. See Project Phasing on page 1331.
Phase Demolished	Indicates in which phase the beam component was demolished. See Project Phasing on page 1331.
Structural Analysis	
Start Release	Start release conditions. Either Fixed, Pinned, Bending Moment, or User Defined. User Defined allows you to enable/disable each of the start release conditions.
Start Fx	Translational release at the start end of the beam along the x-axis.
Start Fy	Translational release at the start end of the beam along the y-axis.
Start Fz	Translational release at the start end of the beam along the z-axis.
Start Mx	Rotational release at the start end of the beam along the x-axis.
Start My	Rotational release at the start end of the beam along the y-axis.
Start Mz	Rotational release at the start end of the beam along the z-axis.
End Release	End release conditions. Either Fixed, Pinned, Bending Moment, or User Defined. User Defined allows you to enable/disable each of the end release conditions.
End Fx	Translational release at the end of the beam along the x-axis.
End Fy	Translational release at the end of the beam along the y-axis.
End Fz	Translational release at the end of the beam along the z-axis.
End Mx	Rotational release at the end of the beam along the x-axis.
End My	Rotational release at the end of the beam along the y-axis.
End Mz	Rotational release at the end of the beam along the z-axis.
Analyze as	Used by external analysis applications to determine whether beam conditions contribute to lateral analysis.
Analytical Model	
Vertical Projection	Extends the beam analytical model to the level specified, in the Z direction.
Auto-detect Horizontal Projection	Specifies the placement of the analytical model in the center of the beam.

Name	Description
Other	
Start Extension Calculation	Applies to steel beams only. Specifies family parameters; defines maximum distance of start extension parameter. This is a read-only value.
End Extension Calculation	Applies to steel beams only. Specifies family parameters; defines maximum distance of end extension parameter. This is a read-only value.

Joins and Cutback on Framing Elements and Columns

This section details the concepts and the procedures to adjust how framing elements join and cut back from one another in Revit Architecture. While most elements adhere to these approaches, they may behave differently depending on their unique instance and settings. These differences are detailed here and in the sections dedicated to framing-specific elements.

Related topics

- [Structural Columns](#) on page 820
- [Beams](#) on page 840
- [Braces](#) on page 893

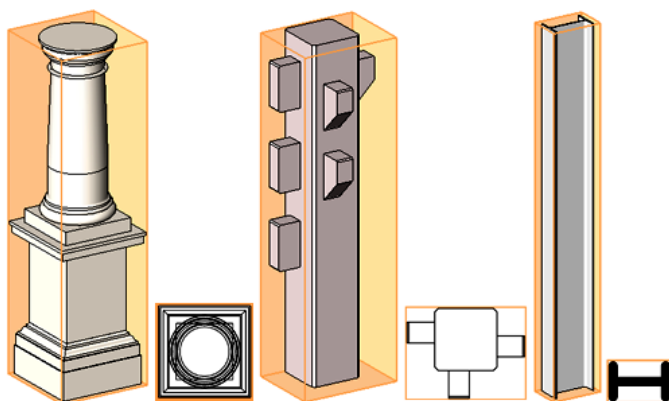
Bounding Boxes

Before describing how structural framing elements join, attach, and cut back from one another, it is important to understand how component families are perceived in a Revit Structure project. Each element instance is enclosed in a bounding box.

Overview

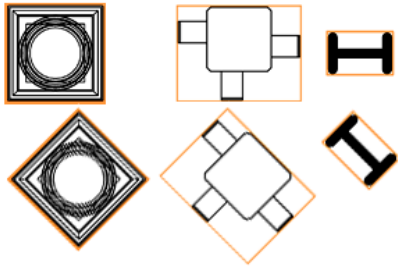
The bounding box is an invisible 3D rectangular space that contains all model elements, annotation elements, and datum elements defined in a family-based element. Datum extents are the exception. For example, a horizontal reference plane will only affect a top or bottom of the bounding box, not either of its sides. The bounding box is oriented with respect to the family definition.

Bounding boxes of columns represented in orange



The top, bottom, and sides of the bounding box rotates accordingly to maintain its relationship with the element as it rotates.

Bounding boxes rotating with elements

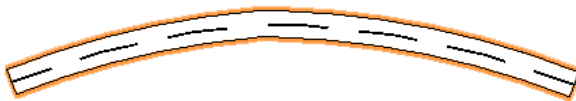


General purposes of the bounding box

- If a family does not have a family origin explicitly defined, the origin will default to the center of the bounding box. This origin affects placement of instances and their behavior when the instance type or family is changed. For detailed information about family origins, see [The Families Guide](#) on page 418.
- The bounding box helps define the joining and cutback of structural framing elements.

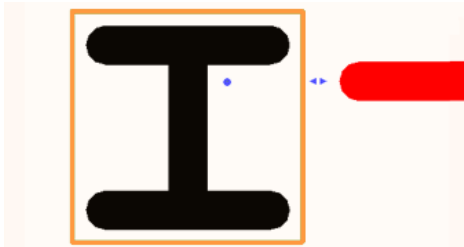
Curved Beams

Curved beams present a unique instance of the bounding box. The bounding box bends to meet the needs of the beam. This provides accurate joining and cutback with the beam.

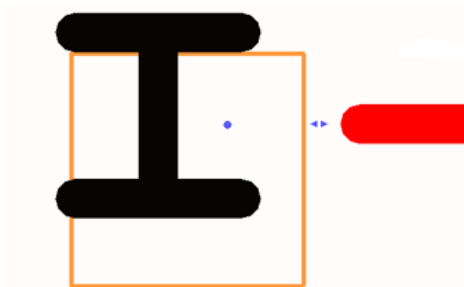


Beam to Column Joins

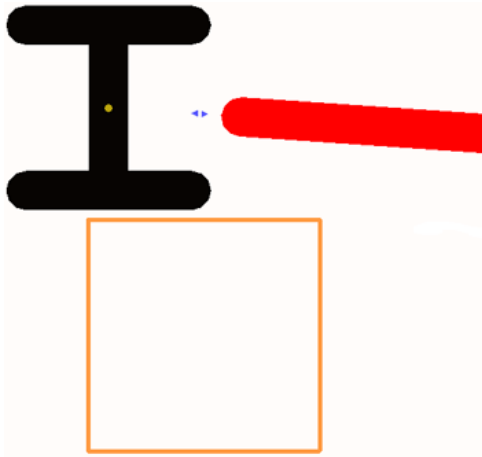
The following illustration shows an example of a beam that is not centered on a column. The beam handle of the beam in the illustration remains within a bounding box. Remember, the bounding box is not visible.



If the column is moved slightly, but not completely out of its existing bounding box, the beam handle remains in position, unaffected by column movement.



However, if the column is moved out of its bounding box, the beam handles snap to the center of the column. When placed, the column will maintain a bounding box.

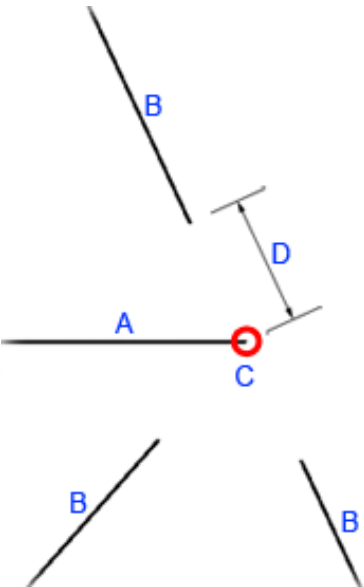
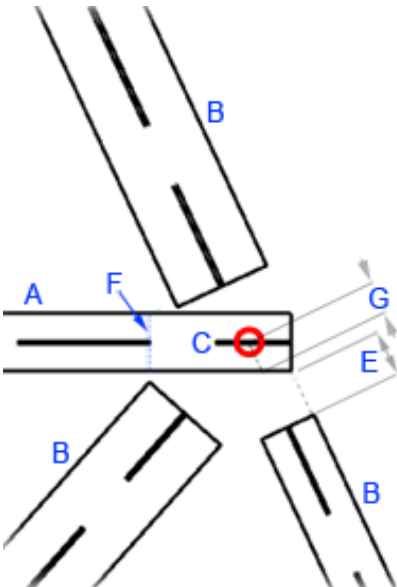


Cutback

Beam cutback is the visible representative gap in beam geometry at the connection point in join relationships. Fabricated materials require spatial and placement considerations for which they will be cut to fit. This gap is evident when comparing the conceptual coarse (symbolic) view to the medium/fine view of non-concrete beams.

Revit Architecture adjusts the setback and cutback for non-concrete beams based on default cutback settings. Concrete beams take precedence in mixed material joins, forcing non-concrete beams to set back and cut back.

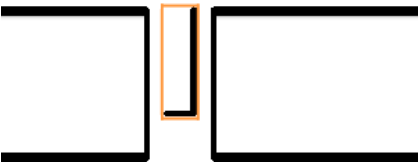
The shortest beam in a join extends to the furthest boundary of all joined beams. All other beams cut back. See [Beam to Beam Cutback](#) on page 867.

Coarse level of detail (symbolic)	Medium/Fine level of detail (physical geometry)
	
KEY	
A. Beam into which others are framed	E. Cutback
B. Cutback beam	F. Beam end if cutback
C. Common endpoint in join	G. Setback
D. Cutback	

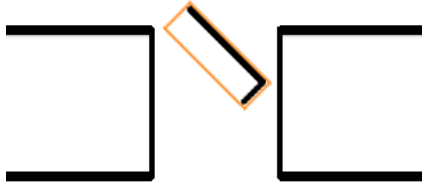
Bounding Box Considerations

Cutback is affected by the bounding box of an element. Notice how the beams framed into the L-beam adjust based on its rotation.

An L-beam framed into by 2 beams



The same L-beam rotated 45 degrees



The extents of the bounding box force the framing lengths of the joined beams accordingly.

Modifying Beam Instance (Medium/Fine Level of Detail) Cutback

Set default cutback settings for beam instances with the Instance Properties dialog.

- 1 Select a beam instance (or instances).
- 2 Click Modify Structural Framing tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 3 Under the Construction heading, locate the Start Extension and End Extension parameters. Adjust as needed.

These parameters adjust the cutback of beam instances used in medium/fine level of detail views. Positive dimensions entered here extend the beam, effectively reducing the cutback. Negative values increase the cutback. Adjustments do not affect symbolic representation. See [Changing Beam Geometry Using Shape Handles](#) on page 851 to manually configure cutback.

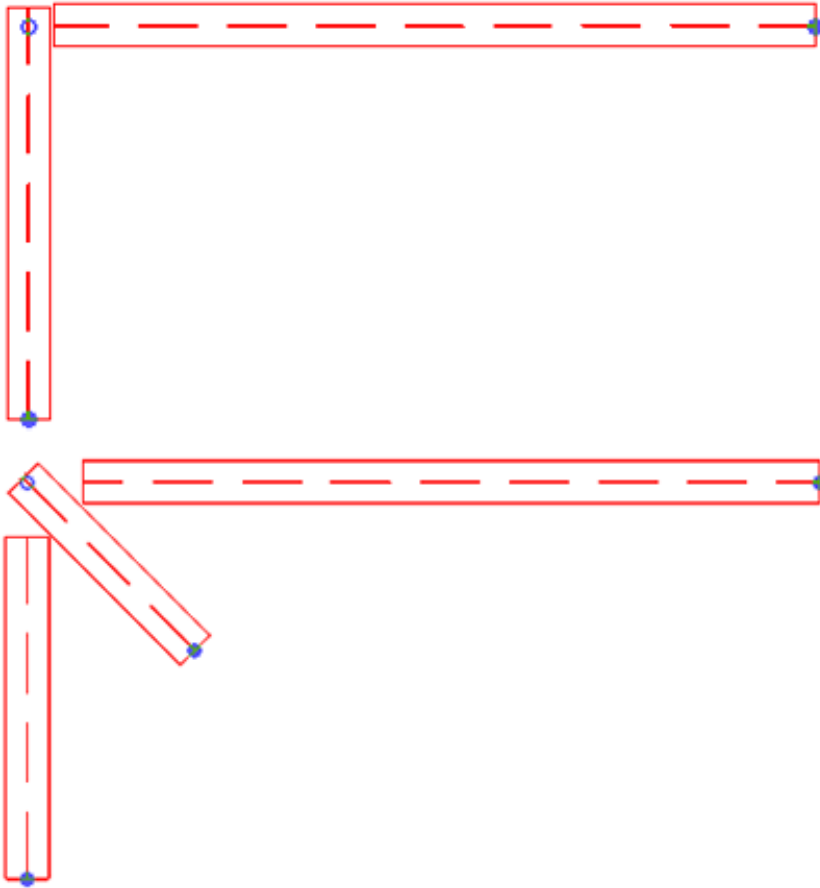
Beam to Beam Cutback

Setback and cutback apply when connecting beams. Beams connect at their endpoints, and multiple beams can connect to one endpoint.

An end join connection is achieved when 2 or more endpoints snap together or when the endpoint of a beam is an origin point when you draw another beam. Structural beams drawn with the Chain option also connect by their endpoints. See [Sketching Beams with the Chain Option](#) on page 847.



When 2 beams are end-joined at an angle, the shortest beam will not cut back, forcing the longer beams to cut back. The setback of the shortest beam also adjusts to meet the perceived endpoint of the longer beam. If further beams connect to the join, they will cut back from the shortest beam. If the new beam is shorter, the join reconfigures so that the longer beams frame into the shortest beam. You can edit this visual representation of a cutback with the Beam Join Editor.



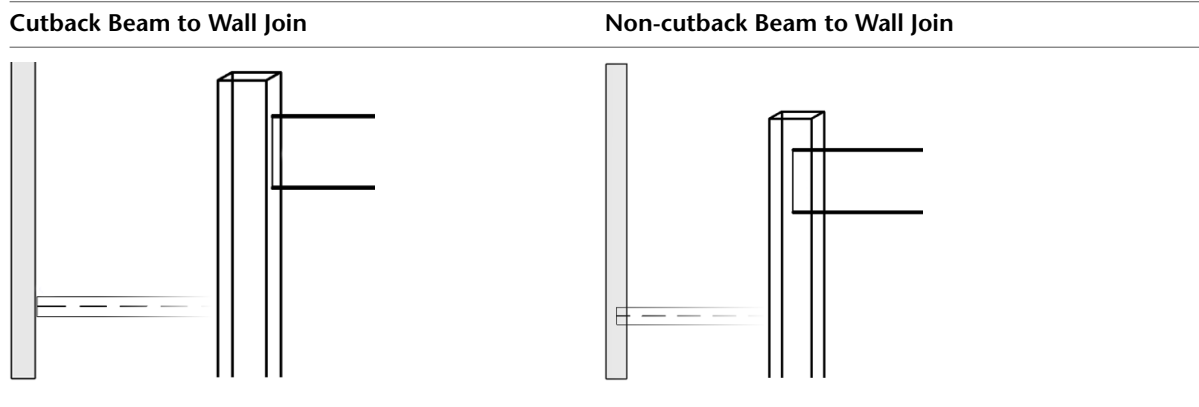
Beam to Column Cutback

Setback and cutback apply when connecting beams to structural columns. The beams are independent of one another, are only associated with the common column, and will cut back from the column accordingly. The column, including its bounding box, must have overlapping geometry with the beams of the join for the beams to cut back.

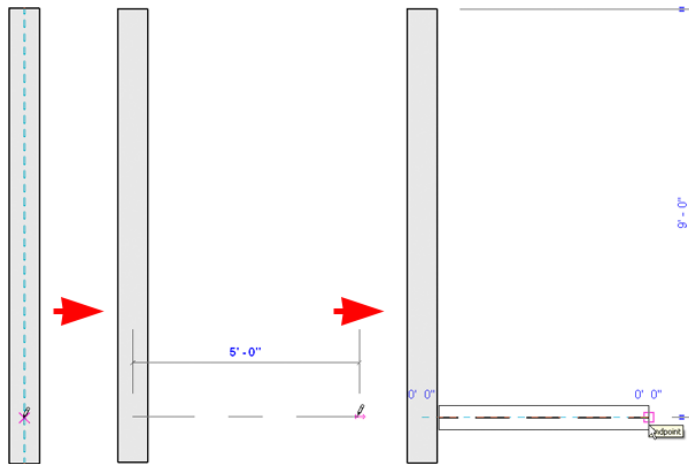
Beams joined to columns always adjust for setback and cutback, yet vertical columns cannot manually be adjusted with the Beam/Column Join Editor.

Beam to Wall Cutback

Setback and cutback apply when connecting beams to structural walls. The beams are independent of one another, are only associated with the common wall, and will cut back from the wall accordingly. Recessing the beam into a beam pocket is possible by removing the cutback with the Beam Join Editor.



Joining a beam to a wall is achieved by drawing a beam and attaching one of its endpoints to the center of the total wall thickness.



Column Cutback

Columns can be set back and cut back using the Beam/Column Editor. With the exception of the following rules, columns act as beams in the default setback and cutback settings.

- Currently, columns cut back from beams but not from one another. Beams will frame into a column when joined at the column top.
- Mitering between beams and columns is not currently implemented.
- When multiple cutback beams share a join with a column, they will frame into the column. However, if the column is cut back, the shortest beam will extend and be framed into by others in the join.
- When a beam is framed into by a column, the symbolic line will extend one cutback distance beyond its endpoint.

Related topics

- [Beam to Column Joins](#) on page 864
- [Beam to Column Cutback](#) on page 868

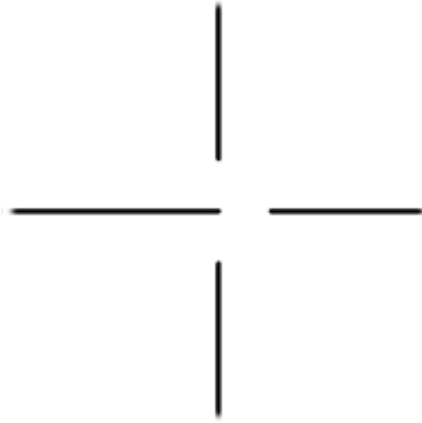
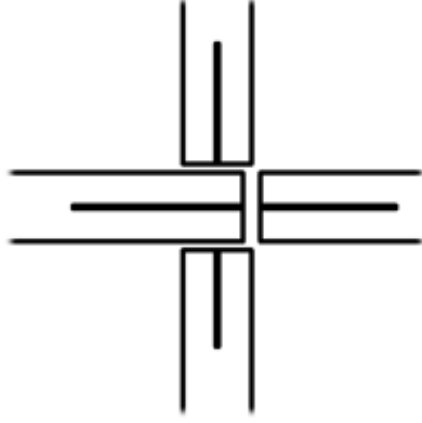
Beam Joins

There are 2 types of beam end joins: square-off and miter. The Beam Join Editor adjusts both by removing or applying the visible cutback as it displays in your project.

Square-off Joins

In square-off joins, the ends of beams and braces maintain a plane perpendicular to the centerline of the element. The beam into which others frame does not cut back, while its connecting beams cut back as warranted. This beam will cut back from a neighboring beam. When cut back, a beam will adjust in a way that prevents it from being closer to any other beam participating in the join by a distance equalling the cutback.

The following examples detail both coarse and medium/fine levels of detail in a project.

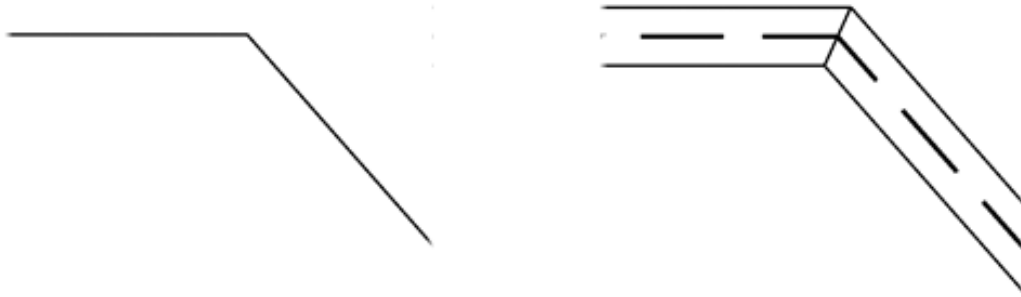
Coarse level of detail (symbolic)	Medium/Fine level of detail (physical geometry)
	

Miter Joins

Unlike square-off joins, miter joins do not cut back, allowing geometry to create a flush connection between 2 beams.

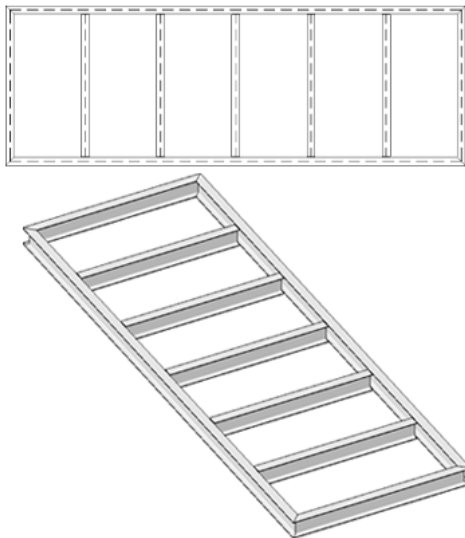
Coarse level of detail (symbolic)

Medium/Fine level of detail (physical geometry)

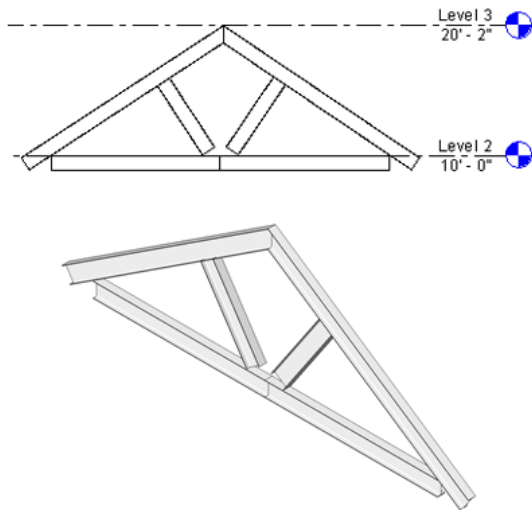


The 2 beams must be co-planar to create a miter join. They must also be of the same family type. Any other beams that share the join will cut back accordingly.

Beams in a co-planar join share the same plane and have unadjusted cross-sectional rotation parameters.



Beams that share the same vertical plane must have the same cross-sectional rotation to have a miter join. The vertical plane is a plane perpendicular to the work plane. A miter join will be created by default for beams that are created within the same vertical plane. This is the case for trusses.

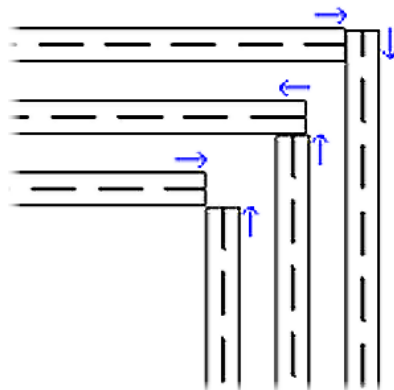


Adjusting Cutback

- 1 Open a project to a plan or 3D view.
- 2 Click Modify tab ► Edit Geometry panel ► Beam/Column Joins.
The editing mode activates, showing cutback arrow controls at the end join of beams (and columns if applicable, see [Column Cutback](#) on page 869).
- 3 On the Options Bar, filter the visible join controls based on Steel, Wood, Precast Concrete, and Other materials if necessary.
- 4 Click the cutback arrow controls to change the cutback in the direction the arrow is pointing.




- If a beam is cut back, the arrow points toward the join.
- If a beam is not cut back, the arrow points away from the join.



NOTE Adjusting cutback with the Beam Join Editor will not reset or change default extension settings in Element Properties, Symbolic Cutback Distance settings, or shape handle beam geometry adjustments.

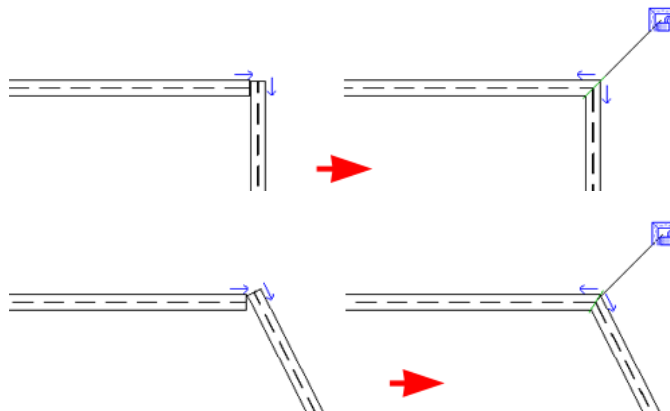
In this mode, beams without common end joins display in halftone. (Only shared end joins display arrow controls.) If a perceived end join displays in halftone, exit the Beam Join Editor and correct the endpoints. One way to determine whether beams are end-joined is to select each beam with the Modify tool. If their common endpoint appears, they are end-joined.

- 5 On the Quick Access toolbar, click  (Modify) when complete.

Creating a Miter Join

Miter joins are created by removing the cutback from 2 end-joined beams.

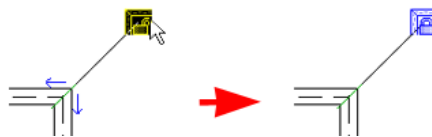
- 1 Open a project to a plan or 3D view.
- 2 Click Modify tab ► Edit Geometry panel ► Beam/Column Joins.
The editing mode activates, showing cutback arrow controls at the end join of beams.
- 3 On the Options Bar, filter the visible join controls based on Steel, Wood, Precast Concrete, and Other materials if necessary.
- 4 Click the appropriate arrow controls to remove the cutback from both beams.



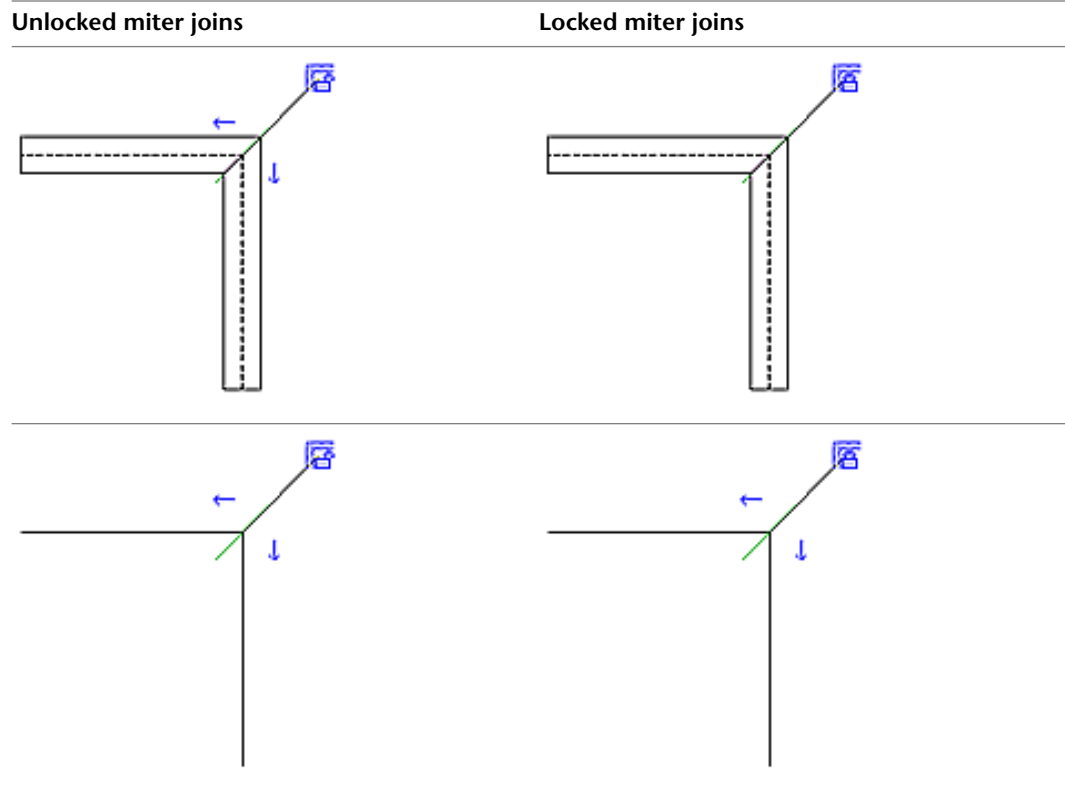
NOTE Remember that a miter join is only available to co-planar beams of the same family and type without cross-sectional rotation. See [Miter Joins](#) on page 871.


The green line marks the plane of the miter join. Any other beams cut back to adjust from the miter join.

- 5 Optionally, click the Miter Lock to lock the geometry in Medium/Fine levels of detail, so you can adjust the symbolic representation.



When locked, the Beam Join Editor arrows do not display in Medium/Fine views but do display in Coarse view.



6 On the Quick Access toolbar, click  (Modify).

Beam Systems

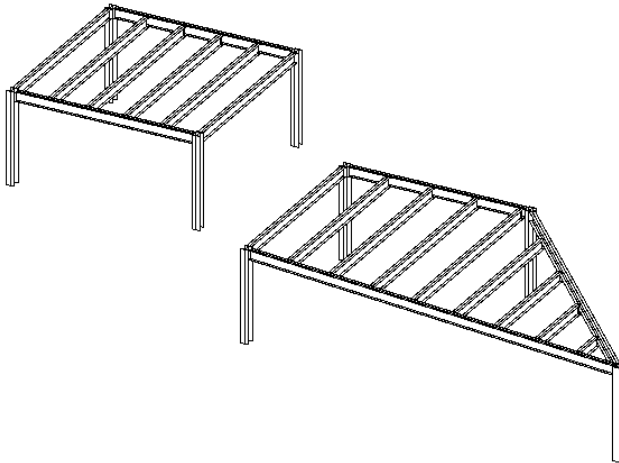
Structural beam systems create a single structural framing element that contains a series of individual beams placed in parallel. The beam system provides a quick method for framing an area of a structure that requires additional support. There are 2 ways to create a beam system, using either the one-click method or by sketching:

- The one-click beam system method is active by default. See [Creating a One-Click Beam System](#) on page 875.
- You can also sketch beam systems into a model. See [Creating a Structural Beam System](#) on page 876.

The Option Bar provides the beam system parameters for both creation methods, such as beam type, justification, and layout requirements. For more information, see [Beam System Layout Rules and Patterns](#) on page 884.

Beam system parameters adapt to changes in the design. If a column is relocated, the beam system parameters adapt to the changes automatically.

Example of a structural beam system and parametric adaptation after column is relocated



Creating a One-Click Beam System

You can create beam systems quickly, with one mouse click, as long as the following conditions are met:

- The one-click beam system can only be added in plan or ceiling view with a horizontal sketch plane. If the view or the default sketch plane is not a level and you click Beam System, you are redirected to the Create Beam System Boundary tab.
- There must be a closed loop of supporting elements (walls or beams) already drawn, or the program will automatically redirect you to the Create Beam System Boundary tab. For more information, see [Beam System Layout Rules and Patterns](#) on page 884.

WARNING Curved walls and beams can be used to create a loop, but cannot be the direction defining members in the Beam System.

To create a beam system, using one click

- 1 Click Home tab ► Build panel ► Beam drop-down ► Beam System.
- 2 On the Options Bar, select a beam type.

NOTE If you would like to sketch the beam system by hand, click the Sketch button located on the Options Bar to open the Create Beam System Boundary tab.

- 3 On the Options Bar, define the beam system spacing requirements with the Layout Rule.
- 4 If the beam system will be sloped or uneven in relation to the level, select the 3D option. However, if you want the walls of the structure in your project to define the slope of the 3D beam system, select Walls Define Slope.
- 5 Move your cursor to the structural members where you would like to add the beam system and click to add it.

One-click beam system creation



NOTE The beam system will align its direction parallel to the nearest structural member you selected.

In the example shown above, you should not

- Add a beam system that spans multiple quadrants. The intersecting beams would not cut the beam system, therefore, any intersections between girders and joists in such a beam system would not display.
- Copy and paste the beam system from quadrant to quadrant if their area, shape, and number of supports differ significantly.

For information about Beam System Properties, see [Beam System Type Properties](#) on page 892.

Creating a Structural Beam System

You can create a structural beam system either by picking the structural supporting elements, such as beams and structural walls, or by sketching the border. After specifying the beam system boundaries, you can specify the beam direction and beam system properties, such as spacing, justification, and beam type. For more information, see [Beam System Layout Rules and Patterns](#) on page 884.

To create a structural beam system

- 1 Click Home tab ► Build panel ► Beam drop-down ► Beam System.
- 2 Click Place Beam System tab ► Sketch panel ► Create Sketch.
- 3 Define the beam system boundary. For more information, see [Defining the Boundary of a Structural Beam System](#) on page 876.
- 4 Specify beam direction. For more information, see [Specifying Beam Direction in a Beam System](#) on page 883.
- 5 Specify beam system properties. For more information, see [Modifying Beam System Properties](#) on page 891.
- 6 Click Create Beam System Boundary tab ► Beam System panel ► Finish Beam System.

Defining the Boundary of a Structural Beam System

To define the boundary of a structural beam system, you can pick the structural supporting elements that exist on the edge of the proposed beam system, or you can use the drawing tools to sketch the lines. Of the

2 methods, you should try to use the Pick Supports tool whenever possible. When you pick the supports, the beam system is automatically locked to those elements. Any changes to the location of the supporting elements are automatically applied to the beam system.

Creating a beam system by picking supports



Creating a beam system by sketching lines



You can define the beam system boundary in either a plan or 3D view. If you work in a 3D view, you should specify the work plane before picking the supports. For more information, see [Setting the Work Plane](#) on page 317.

TIP Although you can sketch a beam system in a 3D view, it is recommended that you create the beam system in a plan view to achieve greater accuracy and to ensure that the lines are on a parallel plane.

After the beam system boundary is defined, the beams are placed inside the specified area according to the pattern specified in the beam system properties. For more information, see [Modifying Beam System Properties](#) on page 891.

Picking Supports as the Beam System Boundary

In either a plan or 3D view, you can pick structural beams and walls to define the boundary of the structural beam system.

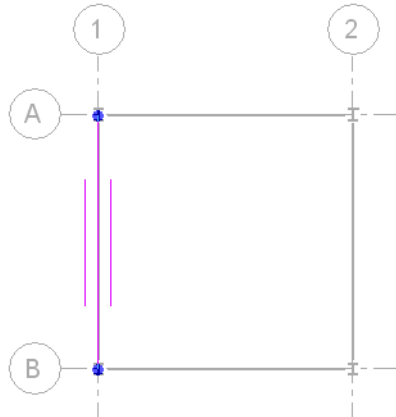
- 1 Click Home tab ► Build panel ► Beam drop-down ► Beam System.
- 2 Click Place Beam System tab ► Sketch panel ► Create Sketch.
- 3 Click Create Beam System Boundaries tab ► Draw panel ► Pick Supports.

TIP When picking supports, the first support you pick specifies the beam direction. The beams within the beam system will be parallel to this beam. You can modify this at any time. See [Modifying the Beam System](#).

4 Pick the first support member.

A sketch line with 2 drag handles displays over the picked support. Two shorter parallel lines display on each side of the line, indicating the beam system direction.

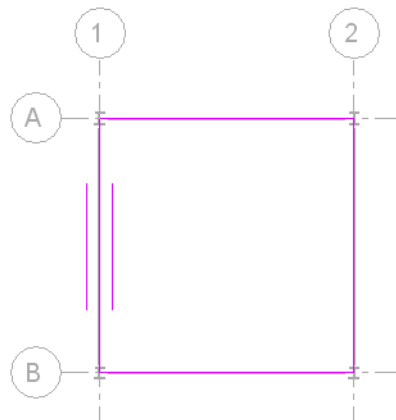
Beam system with first support member picked



5 Pick the remaining lines that define the beam system boundary.

NOTE The lines must result in a closed loop. Use the editing tools (Trim, Extend, and so on) on the Options Bar as necessary to create a closed loop of sketch lines. For more information, see [Editing Elements](#) on page 339.

Beam system with entire boundary selected



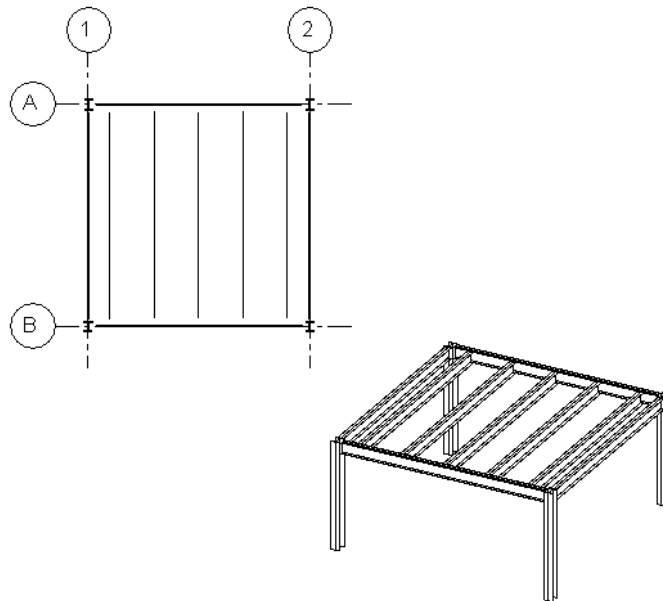
After specifying the beam system boundary, you can

- Modify the Beam direction if necessary. For more information, see [Specifying Beam Direction in a Beam System](#) on page 883.
- Modify beam system properties if necessary. See [Modifying Beam System Properties](#) on page 891.

- Use either the Pick Support or Lines tool to sketch an opening in the beam system. For more information, see [Cutting an Opening in a Beam System](#) on page 881.

6 Click Create Beam System Boundary tab ► Beam System panel ► Finish Beam System.

Floor plan and 3D view of completed structural beam system.

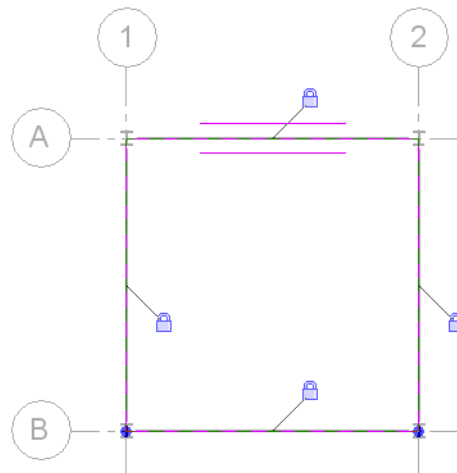


Sketching a Beam System Boundary

You can use the sketching tools to define the perimeter of a beam system. You can also use these tools to modify a beam system boundary, created using the Pick Supports method.

- 1 Click Home tab ► Build panel ► Beam drop-down ► Beam System.
- 2 Click Place Beam System tab ► Sketch panel ► Create Sketch.
- 3 Click Create Beam System Boundaries tab ► Draw panel ► Line to sketch, or click Create Beam System Boundaries tab ► Draw panel ► Pick Line to select existing lines.
- 4 Draw or pick the lines that define the beam system boundary.

Sketched beam system boundary with lines locked to supports



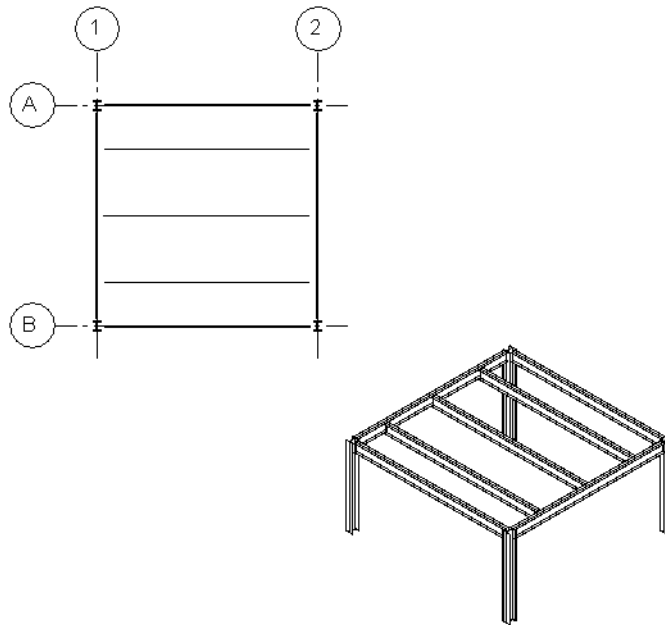
RELATED For more information, see [Sketching](#) on page 303.

After specifying the beam system boundary, you can

- Modify the Beam direction if necessary. For more information, see [Specifying Beam Direction in a Beam System](#) on page 883.
- Modify the beam system.
- Use either the Pick Support or Lines tool to sketch an opening in the beam system. For more information, see [Cutting an Opening in a Beam System](#) on page 881.

5 Click Create Beam System Boundary tab ► Beam System panel ► Finish Beam System.

Floor plan and 3D view of completed structural beam system

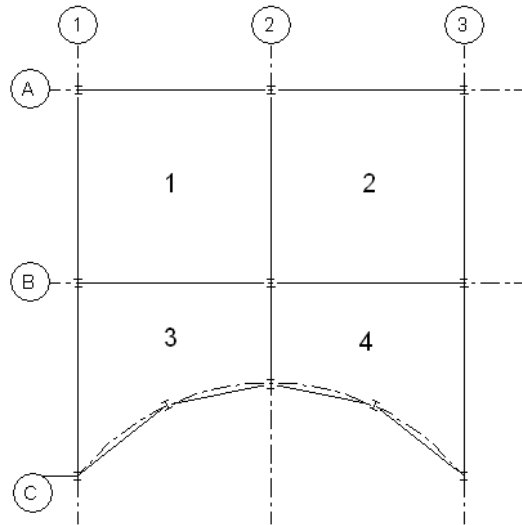


Creating Beam Systems for Non-Identical Boundaries

When creating a beam system, if both areas are not identical in shape and supports, then the pasted beam system area may not attach to supports as expected. In such a case, you may need to modify the beam system.

In the plan view illustrated below, notice that there are 4 distinct quadrants. Quadrants 1 and 2 are identical in area and support structure. Quadrants 3 and 4 are more complex.

Structural design with 4 quadrants



In the example shown above, you could

- Add a separate beam system to each quadrant. This is the best action to take because you can ensure that the beam system boundaries are locked to the supporting members by using the Pick Supports tool.
- Add a beam system to Quadrant 1 and copy it to Quadrant 2. You can do this since the area and support structure is identical. However, make sure the pasted copy attaches to all supports. You may need to modify the pasted beam system.
- Add a beam system to Quadrants 1 and 3 and mirror it to Quadrants 2 and 4 by selecting Grid 2 as the mirror axis. This process has the same limitations as copying and pasting. You may need to modify the system and re-pick the supports to ensure that the system is locked to a supporting member.

In the example shown above, you should not

- Add a beam system that spans multiple quadrants. The intersecting beams 2 and B would not cut the beam system; therefore, any intersections between girders and joists in such a beam system would not display.
- Copy and paste the beam system from Quadrant 1 to Quadrant 3. The area, shape, and number of their supports differ significantly.

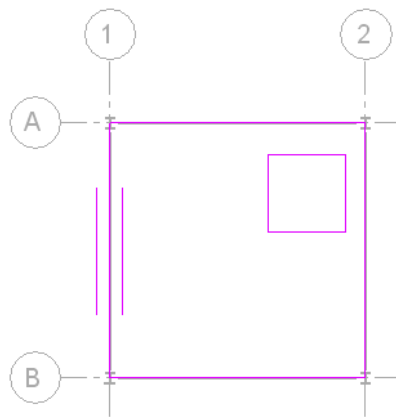
Cutting an Opening in a Beam System

You can cut an opening in a structural beam system by sketching a loop of lines inside the beam system boundary.

To cut an opening in a beam system

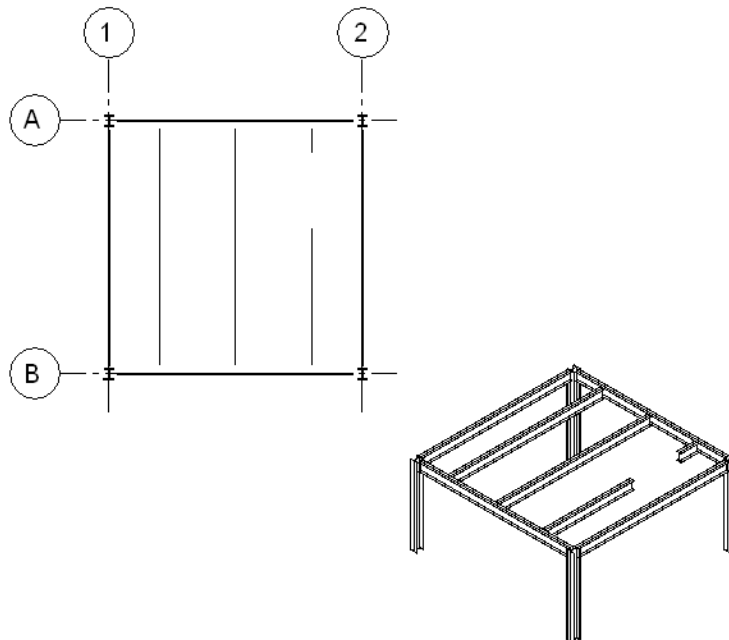
- 1 Select the beam system, and click Modify Structural Beam System tab ► Edit panel ► Edit Boundary.
- 2 Click Modify Structural Beam Systems > Edit Boundary tab ► Draw panel ► Line. Define the boundary of the opening.
- 3 Using the additional sketching tools available on the Draw panel and Options Bar, sketch a complete loop within the beam system boundary.

Beam system boundary with sketched opening



- 4 Click Modify Structural Beam Systems > Edit Boundary tab ► Beam System panel ► Finish Beam System.

Beam system with opening



Specifying Beam Direction in a Beam System



When sketching a beam system boundary, you can specify the beam direction within the structural beam system. All beams within the beam system will be parallel to the boundary line you select.

NOTE Walls and beams curved in plan view cannot be used to define the direction of a beam system.



To specify beam direction:

- 1 Select the beam system, and click Modify Structural Beam System tab ► Edit panel ► Edit Boundary.
- 2 Click Modify Structural Beam Systems > Edit Boundary tab ► Draw panel ► Beam Direction.

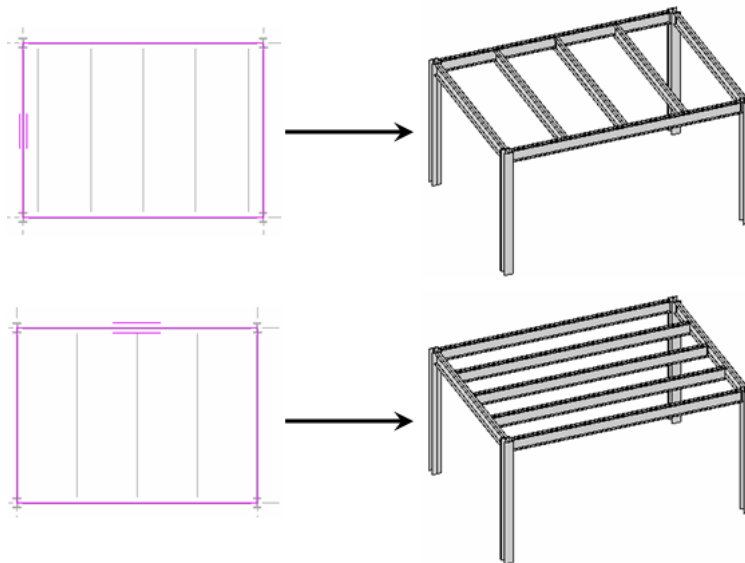
NOTE You only have access to this tool while either sketching or modifying a beam system boundary.

- 3 Click Modify Structural Beam Systems > Edit Boundary ► Draw panel ►  (Line) or  (Pick Lines).

If you select:

-  (Line), sketch a line, or pick a model line, to define beam direction that is independent of the sketched boundary lines. This line has no other function than to define the direction of the beams in a beam system and therefore cannot be used to close a loop.
-  (Pick Lines), select the sketch line to which you want all beams to be parallel.

The following image shows the selected sketch line and the resulting beam direction.



NOTE Drawing a direction sketch line or using the Pick Lines tool to pick another sketch line to define direction deletes any previously existing direction sketch line.

Beam System Layout Rules and Patterns

You can specify the beam system layout properties: number of beams, justification, beam type, spacing, layout rule, and slope. You can specify these values either when you create the beam system or modify them afterwards.

Specify the beam system layout rule

- 1 Right-click the beam system and select Element Properties.
- 2 In the Instance Properties dialog, under Pattern, select a value for Layout Rule:
 - **Fixed Distance** allows you to specify the distance between centerlines of beams within the beam system. The number of beams in the beam system is calculated based on your selections.
 - **Fixed Number** allows you to specify the number of beams within the beam system. The beams are evenly spaced and centered within the beam system.
 - **Maximum Spacing** allows you to specify the maximum distance between centerlines of beams. The quantity of beams required for the beam system is calculated automatically and centered within the beam system.
 - **Clear Spacing** is similar to the Fixed Distance value, but measures spacing between the exteriors of the beams instead of between their centerlines. When you adjust the size of an individual beam in a beam system with the clear spacing layout rule value, adjacent beams move to maintain the distance between them.

Specify number of beams

- 3 Enter a value for the number of beams that you want in the beam system.
This option is active only when you select the Fixed Number layout rule.

Specify spacing

- 4 Enter a value representing the distance between each beam.
This option is active only when you select the Fixed Distance, Maximum Spacing, or Clear Spacing layout rule value.

Specify justification

- 5 Select the Justification Type. This value determines the placement of the first beam in the system. Each subsequent beam is spaced a fixed distance from that point.
This option is active only when you select either the Fixed Distance or Clear Spacing layout rule value. In a plan view, select either:
 - **Beginning** places the first beam at the top or to the left of the beam system.
 - **End** places the first beam at the bottom or the right of the beam system.
 - **Center** places the first beam in the center of the beam system and spaces beams at a fixed distance on each side.

Specify 3D Snapping

- 6 Select the 3D check box if you want the beam system to slope. 3D Snapping enables the beam system to snap to points that are not within the work plane of the view such as columns in different elevations. See [3D Snapping](#) on page 848.

Specify beam type

- 7 Select a value for the type of beam used in the beam system.

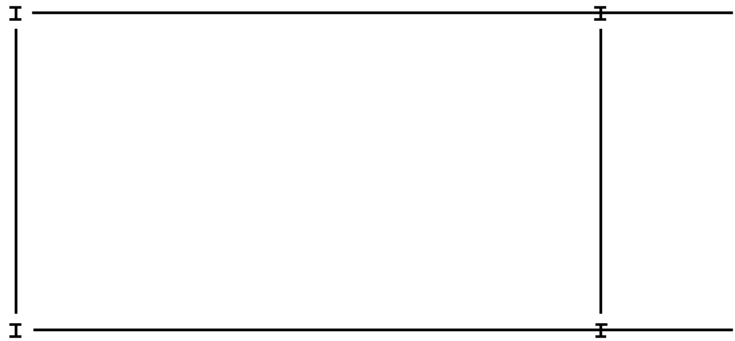
NOTE This is the same list available in the Modify Structural Beam Systems tab ► Element panel ► Type Selector drop-down. If the beam you require is not listed in the beam system creation tool, load the beam into the project before specifying the beam type within the beam system.

Creating a Cantilevered Beam System



You can use the beam system family to create various beam systems for bays of varying geometry, including arced, polygonal, and cantilevered. The following example provides a method for creating a cantilevered beam system.

Begin with a bay that is similar to the one shown in the following illustration of a partial plan view:

Partial Plan View



1 Click Home tab ► Build panel ► Beam drop-down ► Beam System.

2 Click Create Beam System Boundary tab ► Draw panel ►  (Pick Supports) to select the beam system boundary or  (Pick Lines) to sketch the beam system boundary.

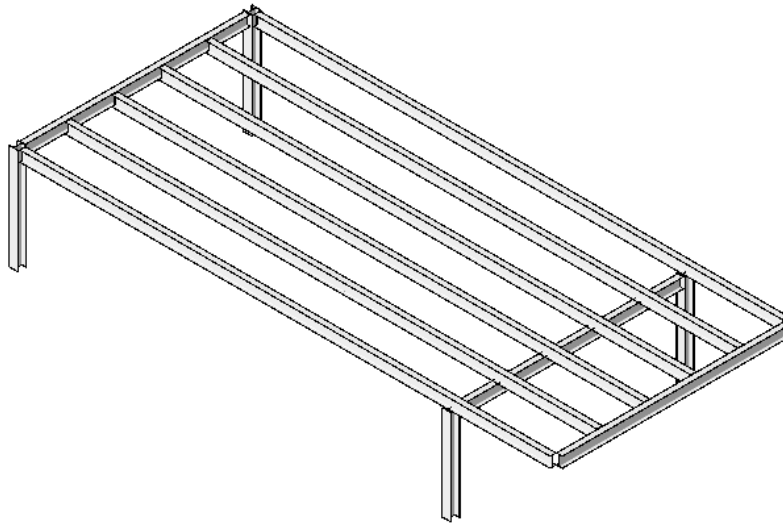
Pick supports



3 When the boundary has been created, click Create Beam System Boundary tab ► Beam System panel ► Finish Beam System.

The cantilevered beam system displays.

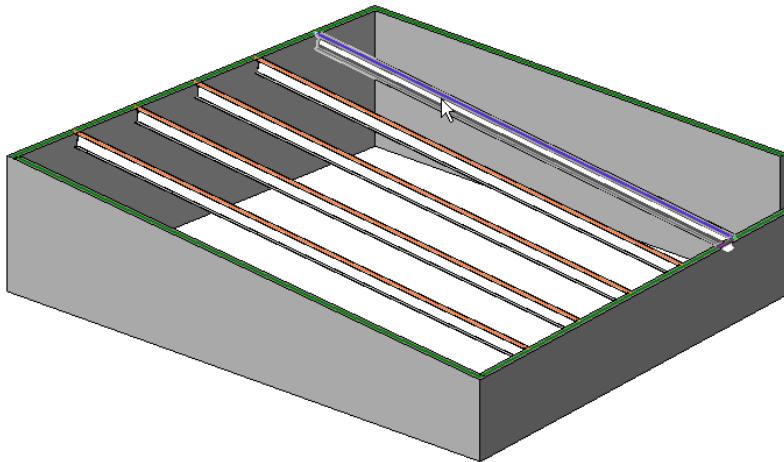
Finished cantilevered beam system



Creating a 3D Beam System

You can create non-planar beam systems in which the elevation of a beam is defined by its sketch lines.

3D beam system



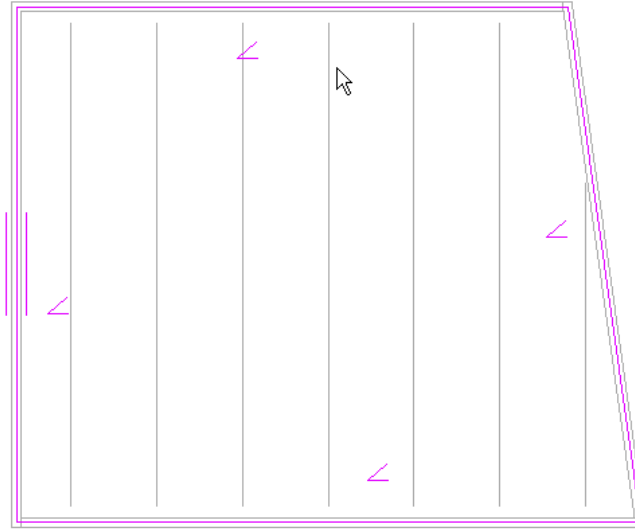
Note that sketched beam lines

- Can only define slope when they are created using the Pick Supports tool.
- That have a beam as their support always define slope.
- That have a wall as their support have a Defines slope property that you can edit. The default value is true.

The elevation of the end of a beam in a beam system is determined as follows:

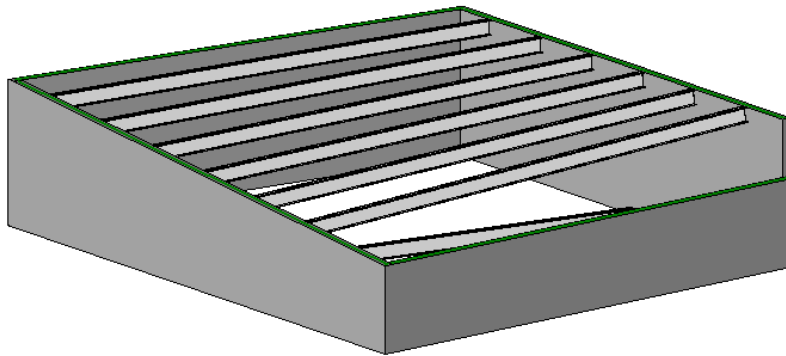
- If the end of the beam connects to a sketch line that defines slope, the beam is connected to the top of the associated support.

Define slope



- If the sketch line does not define slope, then the end of the beam is elevated to a plane defined by the endpoints of the 2 nearest sketch lines that do define slope.

Beam system elevated by nearest sketch lines



- If there are no lines in the sketch that define slope, the beam system behaves like a 2D beam system.

To add a 3D beam system

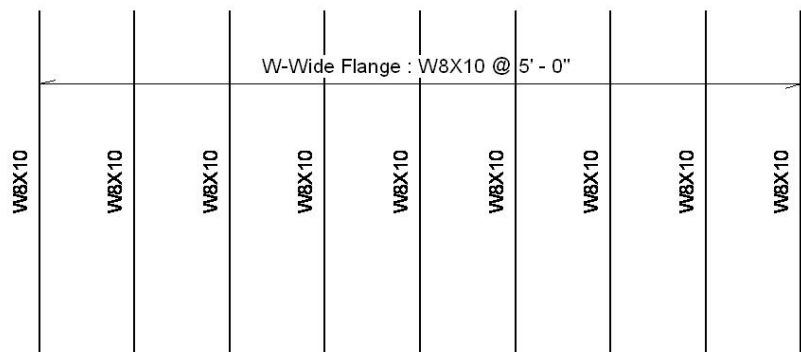
- 1 Click Home tab ► Build panel ► Beam drop-down ► Beam System.
- 2 Click Create Beam System Boundary tab ► Element panel ► Beam System Properties.
- 3 In the Instance Properties dialog, select the 3D instance parameter.
- 4 Click OK.

Tagging Beam Systems

You can tag the beam system and place the tags perpendicular to the beam system.

To tag a beam system

- 1 Load a beam system tag into the project.
There is a default beam system tag family called Structural Beam System Tag.rfa that installs with Revit Architecture. The family is typically located in the following location: Imperial or Metric Library\Annotations\Structural\Structural Beam System Tag.rfa.
- 2 Click Annotate tab ► Symbol panel ► Beam.
- 3 Click Place Beam System Tag tab ► Element panel, and select the desired beam system tag type from the Type Selector drop-down.
- 4 To place the tag automatically, select Auto place on the Options Bar.
- 5 Place the cursor on a beam system in the view to highlight it.
- 6 After highlighting the beam system, click to place the tag.
If you selected Auto place, the tag is placed at the center of the beam system.
If you did not select Auto place, move the cursor to the desired location on the beam system, and click to place it.

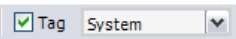


NOTE The Structural Beam System Tag.rfa family includes a label that changes the beam spacing in the beam system. Click on the dimension value to change the beam spacing.

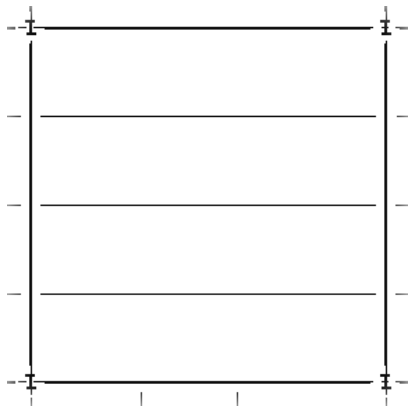
To modify the position of the beam system tag, select the tag, and drag it.

Tagging Beam Systems on Placement

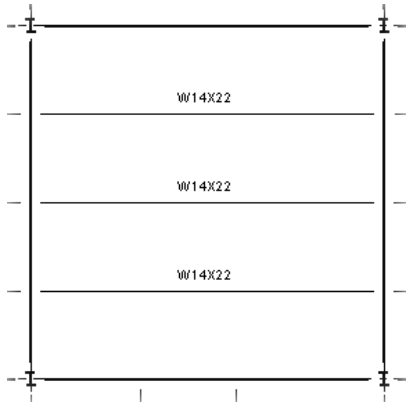
When placing beam systems within an existing grid bay, you can concurrently place tags in 3 ways from the Option bar.



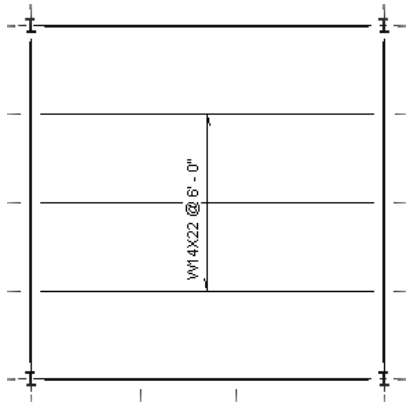
- Select one of the 3 following options to tag beam systems on placement.
- No Tags.** Clear the tag check box to disable tagging on placement.



Framing Tags. Select the Tag check box. Select Framing from the tag drop-down list to display tags on individual beams within the beam system.



System Tags. Select the Tag check box. Select System from the tag drop-down list to display a single tag at the midpoint of the beam system.



Resetting Structural Beam Systems

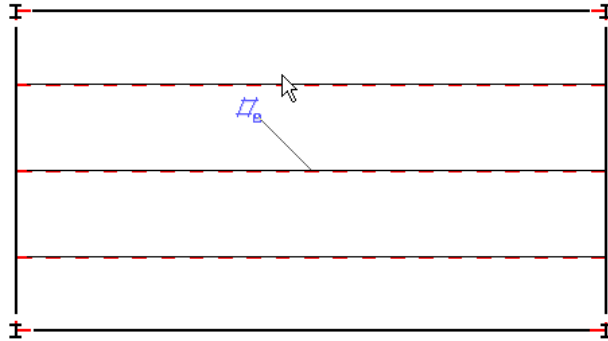
The Reset Structural Beam System tool recreates a beam system using the original beam system parameters. This tool can be used to undo changes to properties of individual beams in the system. After the beam system is reset, all beams in the system will have uniform parameters and be in the default locations. Specifically, the tool has the following reset effects:

- Beams that have been moved are returned to their original locations.

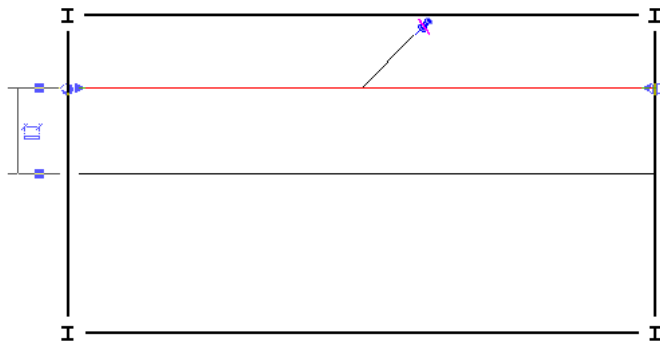
- Beams that have been deleted from the system are restored.
- Parameters that have been changed on individual beams (such as Beam Type, Offset, Angle) are reset.

Note that if the sketch of a beam system is modified, the beams of a system will remain attached to their original supports until the beam system is reset.

Original beam system



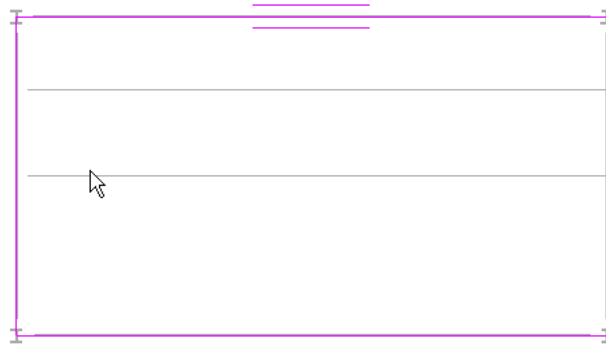
Beam system with changes



Using the Reset Structural Beam System tool

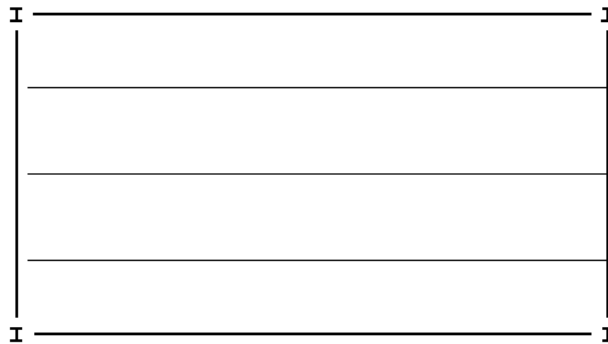
- 1 In the drawing area, click on the beam system you want to reset.
- 2 Click Modify Structural Beam Systems tab ► Edit panel ► Edit Boundary.
- 3 Click Modify Structural Beam Systems > Edit Boundary tab ► Adjust panel ► Reset System.

Reset structural beam system



- 4 Click Modify Structural Beam Systems > Edit Boundary tab ► Beam System panel ► Finish Beam System.

Beam system reset



Modifying a Beam System

To edit a beam system

- 1 In the drawing area, click on the beam system you want to reset.
- 2 Click Modify Structural Beam Systems tab ► Edit panel ► Edit Boundary.
- 3 Make any necessary changes with the available sketch tools and click Modify Structural Beam Systems > Edit Boundary tab ► Beam System panel ► Finish Beam System.

Modifying Beam System Properties

You can modify many of the properties for beam systems.

To modify beam system properties

- 1 If you are currently sketching, click Modify Structural Beam Systems > Edit Boundary tab ► Element panel ► Beam System Properties.
If you are in a project view, right-click the beam system, and select Element Properties.

2 In the Instance Properties dialog, edit beam system instance parameters.

3 Click Edit Type and edit beam system type parameters.

NOTE Changes made to type parameters affect all beam systems of this type in the project. You can click Duplicate to create a new beam system type.

Beam System Type Properties

Name	Description
Identity Data	
Keynote	The beam keynote. Add or edit the value. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The manufacturer internal number.
Manufacturer	The shape manufacturer.
Type Comments	A field for entering general comments about the shape type. This information can be included in a schedule.
URL	A link to a web page that may contain type-specific information.
Description	Description of the beam. Enter a description.
Assembly description	Description of the assembly based on the assembly code selection. This is a read-only value.
Type Mark	A value that designates the particular beam; possibly the shop mark. This value must be unique for each element in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Cost	The pricing of the beam.
Keynote	The beam keynote. Add or edit the value. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.

Beam System Instance Properties

Name	Description
Constraints	
3D	Creates a non-planar beam system in which the elevation of a beam is defined by its sketch lines. See Creating a 3D Beam System on page 886.
Elevation	The vertical offset of beam system beams from the beam system work plane.

Name	Description
Work Plane	This is a read-only value that is dependent on the work plane where the element was placed.
Pattern	
Layout Rule	Rules for beam spacing. See Beam System Layout Rules and Patterns on page 884.
Fixed Spacing	The space between beams. This parameter is only accessible for certain values of the Layout Rule parameter. See Beam System Layout Rules and Patterns on page 884.
Centerline Spacing	The distance between beam centerlines. This is a read-only parameter.
Justification	Specifies the starting location (beginning, end, or center) of the beam system in relation to the selected boundary.
Beam Type	The structural framing type to be used for creating beams in a beam system.
Identity Data	
Tag new members in view	Specifies the view in which to display the beam system tag.
Comments	User comments.
Mark	A label created for the beam system. This value must be unique for each element in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Phasing	
Phase Created	Indicates in which phase the beam system was created. See Project Phasing on page 1331.
Phase Demolished	Indicates in which phase the beam system was demolished. See Project Phasing on page 1331.

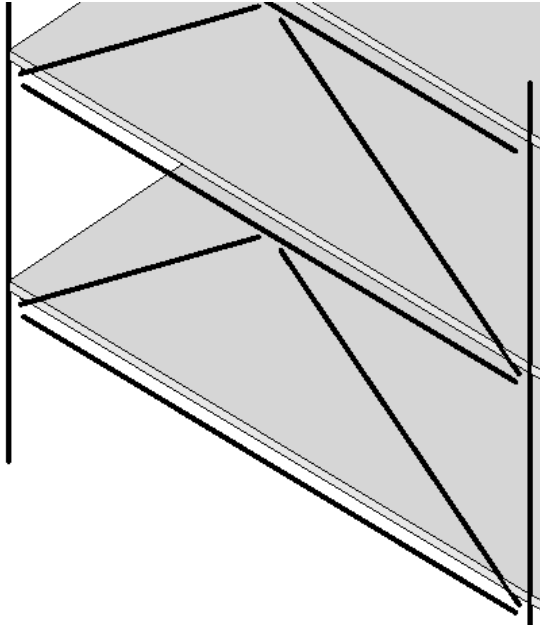
Braces

Braces are diagonal members connected to beams and columns. Like beams, you create braces by snapping the pointer to another structural element, clicking a start point, snapping to another structural element, and clicking an endpoint. For example, braces can appear between a structural column and a structural beam.

You can add braces in either a plan view or a framing elevation view. Braces attach themselves to beams and columns and adjust parametrically to changes in the building design. When attached to a beam, you can specify the type of attachment, distance, or ratio. In addition, you can set which end of the referenced element you want relative to the distance or ratio value; if the end is attached to a column or wall, you can set the level and offset for the height of the point.

You can copy, move, mirror, array, and rotate braces out of the vertical plane in which they were created. You can accomplish this in plan and 3D views.

Typical brace



Loading Structural Braces

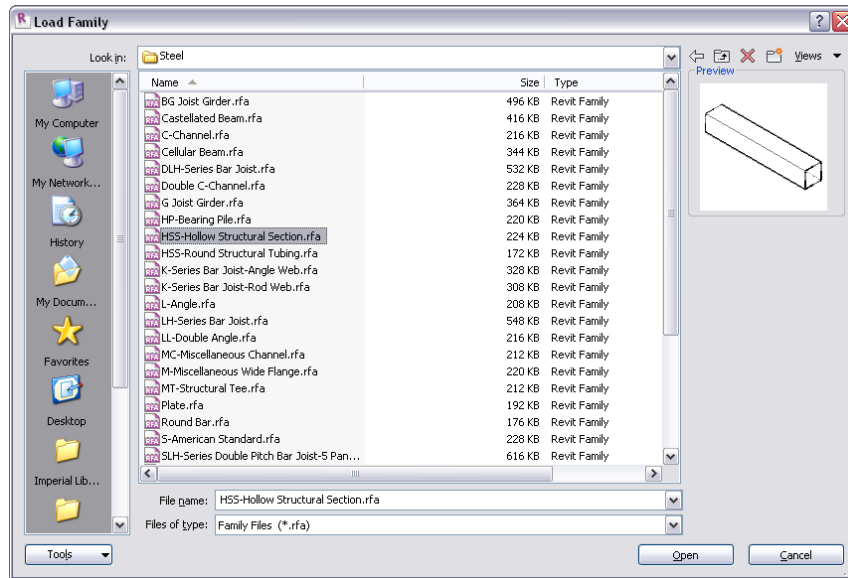
You can load structural braces in several ways:

To load brace families

- 1 Click Home tab ► Structure panel ► Brace.
- 2 Click Place Brace tab ► Detail panel ► Load Family.
- 3 In the Open dialog, navigate to either the imperial or metric library, and open the Structural/Framing folder.
- 4 Select a brace type folder: either Steel, Light Gauge Steel, Concrete, or Wood, and click Open.

NOTE When you open a framing family, you can select multiple brace sizes. In the Specify Types dialog that displays after you click Open, press and hold the Ctrl key when selecting brace sizes. If necessary, you can filter the Catalog by clicking the arrow at the column heading.

Family dialog box



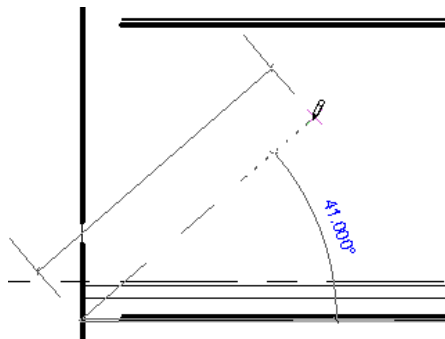
Adding Structural Braces

You can add braces in either a plan view or in a framing elevation view.

To add a brace in a framing elevation view

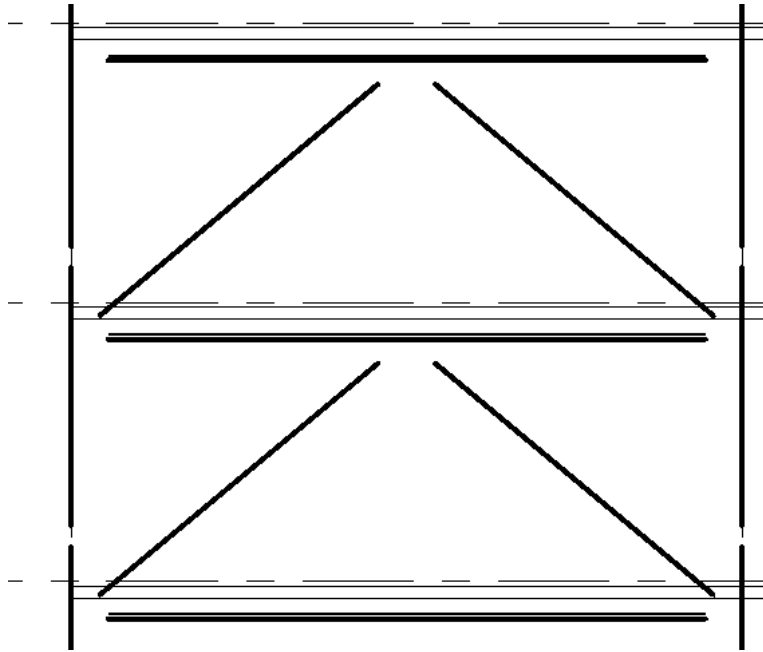
- 1 Open a framing elevation view.
- 2 If necessary, load additional braces from the Structural/Framing folder under the Library folder of the Revit Architecture program group. For more information, see [Loading Structural Braces](#) on page 894.
- 3 Click Home tab ► Structure panel ► Brace.
- 4 Click Place Brace tab ► Element panel, and select the appropriate brace from the Type Selector drop-down.
- 5 To edit the properties of the brace before adding the brace to your model, click Place Brace tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 6 In the drawing area, highlight the snapping point where you want to begin the brace, such as on a structural column. Click to place a start point.

Snap to begin brace



- 7 Move the pointer in a diagonal direction to sketch the brace and place the cursor near another structural element to snap it. Click to place the endpoint.

Sample braces in a framing elevation view



To add a brace in a plan view

- 1 Open a plan view.
- 2 Click Home tab ► Structure panel ► Brace.
- 3 On the Options Bar, specify both the Start Level and offset distance and the End Level and offset distance.
- 4 Click the start point and the endpoint of the brace in the project.

Modifying Braces

Controlling Brace Attachments

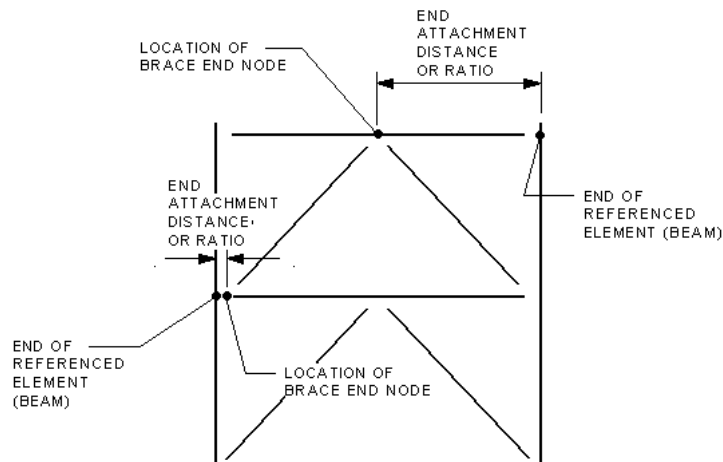
After adding a brace element, you can modify the brace properties to control how the brace maintains position along a beam. Each brace endpoint can be maintained positionally with a beam by either a distance or a length ratio from the beam endpoints. If you modify the position or length of the attached beam, the brace adapts to the change, depending on the brace settings you select.

Brace Property Terminology

- Start Attachment Type
- Start Attachment Distance or Ratio
- End of Referenced Element
- End Attachment Type
- End Attachment Distance or Ratio

■ End of Reference Element

Brace attachment properties



To modify brace properties

- 1 Select a brace.
- 2 Click Place Brace tab ► Element panel ► Element Properties drop-down ► Instance Properties.

To specify attachment parameters

- 3 In the Instance Properties dialog, under Structural, select one of the following Start Attachment Type options.
 - **Distance:** If the brace start point is placed on a beam, this value specifies the distance between the nearest end of the beam and the brace start point.
 - **Ratio:** If the brace start point is placed on a beam, this value specifies the percentage along the beam where the start point is placed. For example, 0.5 would place the start point half way between each end of the attached beam.

After selecting either option, enter a value for Start Attachment Ratio Property. Also, if the brace start point is placed on a column, this option is not available.

To specify the end of referenced element

- 4 Select a value for End of Referenced Element Property. This specifies at which end of the Referenced Element (the beam), the Distance or Ratio is measured from.

NOTE If the brace end is attached to a column or a wall, you can set the level and offset to specify the height of the point.

- 5 In the Instance Properties dialog, under Other, select the End Attachment Type.
 - **Distance:** If the brace endpoint is placed on a beam, this value specifies the distance between the nearest end of the beam and the brace endpoint.
 - **Ratio:** If the brace endpoint is placed on a beam, this value specifies the percentage along the beam where the endpoint is placed. For example, 0.5 would place the endpoint half way between each end of the attached beam.

After selecting either option, enter a value for Start Attachment Ratio Property. Also, if the brace start point is placed on a column, this option is not available.

Brace Properties

You can modify many properties for braces, such as structural, dimensional, and identity data. Brace instance properties depend on whether the brace is attached to a beam or to a column.

To modify brace properties

- 1 Select the brace and click Modify Structural Framing tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 2 In the Instance Properties dialog, edit brace instance parameters.
- 3 Click Edit Type to edit brace type parameters.

NOTE Changes made to type parameters affect all braces of this type in the project. You can click Duplicate to create a new brace type.

Steel Brace Type Properties

The following table lists the beam type properties for a typical steel brace:

Name	Description
Structural	
A	The section area.
Shape	Defines the shape of the selected type. Applies to HSS family type only.
W	The nominal weight.
Dimensions	
Ht	The flange height. Applies to HSS family type only.
b	The flange width. Applies to HSS family type only.
kr	The kr distance. Applies to HSS family type only.
t	The flange thickness. Applies to HSS family type only.
bf	The flange width.
d	The actual depth of section.
k	The k distance.
k2	The k2 distance. This is a read-only value.
tf	The flange thickness.
tw	The web thickness.

Name	Description
Identity Data	
Assembly Code	The uniformat assembly code selected from a hierarchical list.
Keynote	The keynote for the brace. See Keynotes on page 1117.
Model	The manufacturer internal number.
Manufacturer	The brace manufacturer.
Type Comments	A field for entering general comments about the brace type. This information can be included in a schedule.
URL	A link to a web page that may contain type-specific information.
Description	An optional description of the brace.
Assembly description	Description of the assembly based on the assembly code selection. This is a read-only value.
Type Mark	A value that specifies the particular brace; possibly the shop mark. This value must be unique for each brace in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Cost	The pricing of the brace.
OmniClass Number	The number from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.
OmniClass title	The name from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.

Steel Brace Instance Properties (When Attached to a Beam)

The following table lists the brace instance properties for a typical steel brace when attached to a beam.

Name	Description
Constraints	
Reference Level	The constraining level.
Construction	
Start Extension	The dimension between the physical edge of the start end of the brace and the element to which it is connected.
End Extension	The dimension between the physical edge of the finish end of the brace and the element to which it is connected.
Materials and Finishes	

Name	Description
Brace Material	Specifies the user-defined structural material. See Material Physical Type Parameters on page 489.
Structural	
Angle	The rotation about the longitudinal axis of the brace.
Moment Connection Start	The moment frame, or cantilever symbol at the start end of brace, if applicable.
Moment Connection End	The moment frame, or cantilever symbol at the finish end of brace, if applicable.
Cut Length	The physical length (not the analytical length). This is a read-only value.
Structural Usage	Specifies Vertical Bracing, Kicker brace, or Other.
Start Attachment Level Reference	Distance or Ratio (percentage relative to beam length); type of separation of brace start end to a designated beam end. Applies to the brace end attached to the beam.
Start Attachment Elevation	Distance from, or Ratio (percentage) of separation of brace start end to a designated beam end. Applies to the brace end attached to the beam.
End Attachment Type	Distance of separation of brace finish end to a designated beam end. Applies to the brace end attached to the beam.
End Attachment Ratio	Ratio (percentage) of separation of brace finish end to a designated beam end. Applies to the brace end attached to the beam.
End of Referenced Element	Designated end (start or finish) of Referenced Element (beam) to which start end of brace is attached. Applies to the brace end attached to the beam.
Dimensions	
Length	The distance between the component endpoints that define the element's location. This is a read-only value.
Volume	The volume of the selected brace element. This is a read-only value.
Identity Data	
Comments	A field for entering comments about the brace.
Mark	A label created for the brace. Possible use: shop mark. This value must be unique for each brace in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Phasing	
Phase Created	Indicates in which phase the brace component was created. See Project Phasing on page 1331.
Phase Demolished	Indicates in which phase the brace component was demolished. See Project Phasing on page 1331.

Name	Description
Structural Analysis	
Start Release	Specifies the start release condition: either Fixed, Pinned, Bending Moment, or User Defined. User Defined allows you to enable/disable each of the start release conditions.
Start Fx	The translational release at the start end of the brace along the local x-axis.
Start Fy	The translational release at the start end of the brace along the local y-axis.
Start Fz	The translational release at the start end of the brace along the local z-axis.
Start Mx	The rotational release at the start end of the brace along the local x-axis.
Start My	The rotational release at the start end of the brace along the local y-axis.
Start Mz	The rotational release at the start end of the brace along the local z-axis.
End Release	Fixed, Pinned, Bending Moment or User Defined. User Defined allows you to enable/disable each of the end release conditions.
End Fx	The translational release at the end of the brace along the local x-axis.
End Fy	The translational release at the end of the brace along the local y-axis.
End Fz	The translational release at the end of the brace along the local z-axis.
End Mx	The rotational release at the end of the brace along the local x-axis.
End My	The rotational release at the end of the brace along the local y-axis.
End Mz	The rotational release at the end of the brace along the local z-axis.
Analyze As	Determines whether brace conditions contribute to lateral analysis. Available for use by external analysis applications.
Other	
Start Extension Calculation	Defines the maximum distance of start extension parameter. Set in family parameters.
End Extension Calculation	Defines the maximum distance of end extension parameter. Set in family parameters.

Brace Instance Properties

The following table lists the default instance properties for a typical brace when not attached to a beam.

Name	Description
Constraints	
Reference Level	The constraining level.
Construction	

Name	Description
Start Extension	The dimension between the edge of the start end of the brace and the element to which it is connected.
End Extension	The dimension between the edge of the finish end of the brace and the element to which it is connected.
Materials and Finishes	
Brace Material	The user defined structural material. See Material Physical Type Parameters on page 489.
Structural	
Angle	The rotation about the longitudinal axis of the brace.
Moment Connection Start	The moment frame or cantilever symbol at the start end of brace, if applicable.
Moment Connection End	The moment frame or cantilever symbol at the finish end of brace, if applicable.
Cut Length	The physical length. This is a read-only value.
Structural Usage	Specifies structural usage: either Vertical Bracing, Kicker brace, or Other.
Start Attachment Level Reference	The constraining level of the start end of the brace.
Start Attachment Elevation	The elevation of the start end referenced from the start attachment level reference.
End Attachment Level Reference	The constraining level of the finish end of the brace.
End Attachment Elevation	The elevation of the finish end referenced from the end attachment level reference.
Rebar Cover - Top Face	Applies to concrete beams only. The rebar cover distance from the column top face.
Rebar Cover - Bottom Face	Applies to concrete beams only. The rebar cover distance from the column bottom face.
Rebar Cover - Other Faces	Applies to concrete beams only. The rebar cover distance from the column to adjacent element faces.
Estimated Reinforcement Volume	Specifies the estimated reinforcement volume of the selected element. This is a read-only parameter that only displays when rebar has been placed.
Dimensions	
Length	The length of the brace location line. This is a read-only value.
Volume	The volume of the selected brace element. This is a read-only value.
Identity Data	
Comments	User comments.

Name	Description
Mark	A label created for the brace. Possible use: shop mark. This value must be unique for each brace in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Phasing	
Phase Created	Indicates in which phase the brace component was created. See Project Phasing on page 1331.
Phase Demolished	Indicates in which phase the brace component was demolished. See Project Phasing on page 1331.
Structural Analysis	
Start Release	Specifies the start release condition: either Fixed, Pinned, Bending Moment, or User Defined. User Defined allows you to enable/disable each of the start release conditions.
Start Fx	The translational release at the start end of the brace along the local x-axis.
Start Fy	The translational release at the start end of the brace along the local y-axis.
Start Fz	The translational release at the start end of the brace along the local z-axis.
Start Mx	The rotational release at the start end of the brace along the local x-axis.
Start My	The rotational release at the start end of the brace along the local y-axis.
Start Mz	The rotational release at the start end of the brace along the local z-axis.
End Release	Specifies the end release condition: either Fixed, Pinned, Bending Moment or User Defined. User Defined allows you to enable/disable each of the end release conditions.
End Fx	The translational release at the end of the brace along the local x-axis.
End Fy	The translational release at the end of the brace along the local y-axis.
End Fz	The translational release at the end of the brace along the local z-axis.
End Mx	The rotational release at the end of the brace along the local x-axis.
End My	The rotational release at the end of the brace along the local y-axis.
End Mz	The rotational release at the end of the brace along the local z-axis.
Analyze As	Used by external analysis applications to determine whether brace conditions contribute to lateral analysis.
Other	

Name	Description
Start Extension Calculation	Defines maximum distance of start extension parameter. Set in family parameters.
End Extension Calculation	Defines maximum distance of end extension parameter. Set in family parameters.

Openings in a Structural Beam, Brace, or Structural Column

You can cut openings through different structural elements such as beams, braces, or structural columns, using the Opening by Face tool. For more information, see [Openings](#) on page 725. The following behavior applies to all structural elements:

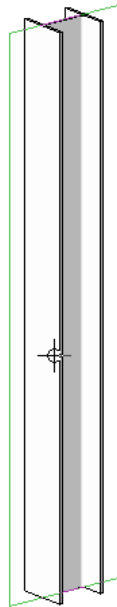
- A beam opening is applied to a face that is vertical or horizontal through the major or minor axis (typically vertical or horizontal) of the beam.
- A beam opening cuts through the entire element (for example, it cannot cut only one flange of a wide-flange beam).
- Two perpendicular planes for openings are provided by each beam, brace, or column. These planes align with the major and minor axis of the member.

NOTE Curved beams are not valid hosts for beam openings.

To cut an opening in a structural beam, brace, or structural column

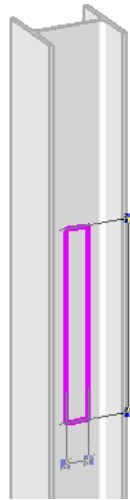
- 1 Click Modify tab ► Opening panel ► By Face.
- 2 Select the desired plane of the member to which you want to add an opening.

Selecting the plane
of the column



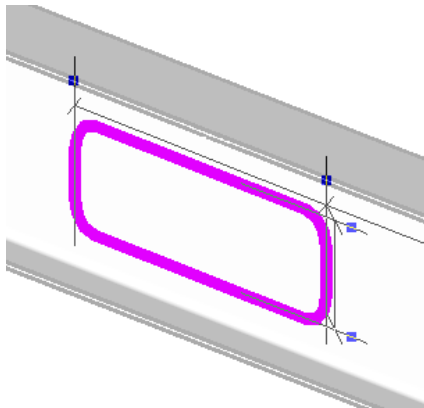
3 Using the Create Open Boundary tab sketching tools, sketch the opening on the beam, brace, or column.

Sketching the opening



When you sketch an opening for a structural beam, brace, or structural column using the rectangle option, you can specify a radius, which allows you to sketch rectangles with fillets. This helps to avoid sharp corners on the opening that can concentrate stresses.

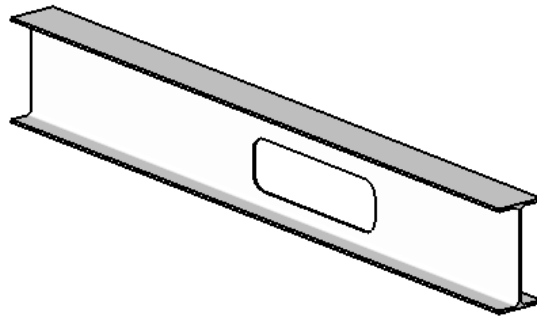
Beam opening with radius



For more information, see [Sketching](#) on page 303.

4 Click Finish Sketch.

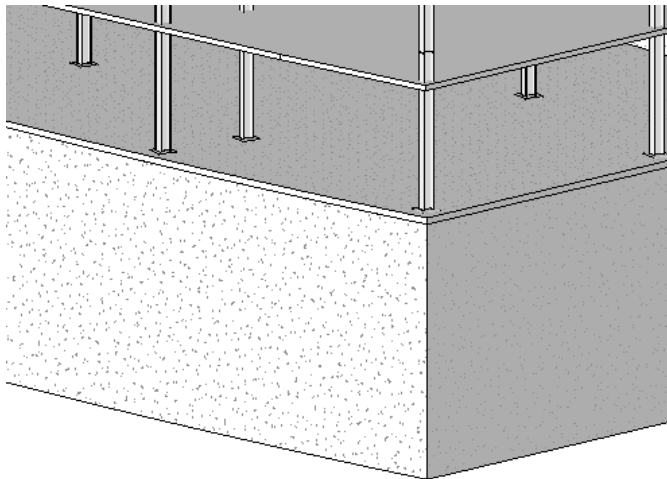
Finished sketch



Structural Walls

The Structural Wall family type in Revit Architecture has the following possible structural usage options: non-bearing, bearing, shear, and structural combined.

Typical structural wall



You create a wall by sketching the centerline of the wall in either a plan view or a 3D view. Revit Architecture creates thickness, height, and other wall parameters based on the properties that are specified in the Wall Family Type. When created, the elevation of the top of the wall is the current level, and the elevation of the bottom of wall derives from the Base Offset value.

A structural wall differs from non-structural walls by its Structural Usage instance parameter. When adding a structural wall, by default Revit Architecture sets the wall instance parameter, Structural Usage, to Bearing. You can change this parameter at any time by modifying the instance parameters of the Wall Family Type. The Structural Usage options are used for the following:

Shear	Used for rigid planar surfaces that inherently resist lateral thrusts of shear
Bearing	Walls that support a vertical load in addition to their own weight
Non Bearing	Walls that support no vertical load except that of their own weight and used to define and divide spaces

Creating a Structural Wall

- 1 Click Home tab ► Build panel ► Wall drop-down ► Structural Wall.
- 2 Click Place Structural Wall tab ► Element panel, and select the family type of the wall from the Type Selector drop-down.
- 3 Optionally, change the instance properties of the wall to be placed if desired by clicking Place Structural Wall tab ► Element panel ► Element Properties drop-down ► Instance Properties. See [Modifying Type Properties](#) on page 121.

Modify the Type Parameters of the wall to be placed by clicking the Edit Type button in the Instance Properties dialog. See [Structural Wall Properties](#) on page 912.

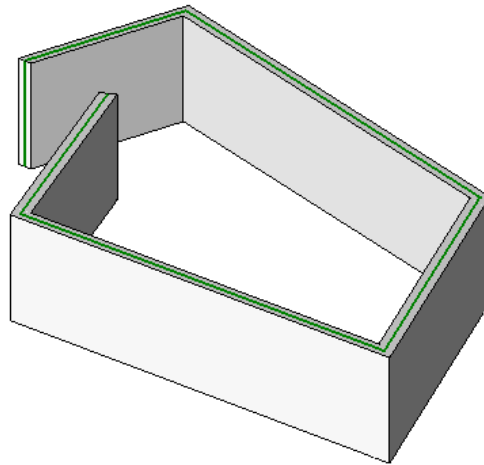
- 4 The Height/Depth area of the Options Bar is shown in the following illustration.



You may pre-select the height (top) or depth (base) of a structural wall from the Options Bar. Select either Height or Depth from the list box, then use the Constraint list to the right of Height/Depth selection to set the constraint of the top or base of the wall either by Level or as Unconnected. If you select Unconnected, specify the height or depth by entering the value to the right of the constraint list. The Unconnected Height/Depth measurement is relative to the current Level.

- 5 On the Options Bar, select Chain if you intend to create a series of walls.

Creating a structural wall chain



Sketch the wall

- 6 Sketch the shape of the wall. If the walls do not appear after you draw them, you may need to lower the view depth or create a foundation level to use as an underlay for the current level. See [View Range](#) on page 247 and [View Properties](#) on page 259.
- 7 Optionally, edit structural walls. See [Modifying Walls](#) on page 672 and [Splitting Walls and Lines](#) on page 408.
- 8 Optionally, create arc walls. See [Adding Arc Walls](#) on page 637.

Related topics

- [Modifying Structural Walls](#) on page 908
- [Defining Structural Wall Shapes or Openings](#) on page 908
- [Structural Walls](#) on page 906

Modifying Structural Walls

You can modify the appearance of structural walls through their properties either before or after you place the wall.

Modifying Structural Walls

You modify wall properties, in the Instance Properties dialog. To open the dialog, do one of the following:

- Select the wall, and then click Modify Wall tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- Right-click the wall and click Element Properties. The shortcut menu also contains several options for manipulating the wall, such as changing the zoom scale.

Changing Structural Wall Types

Select a wall in the drawing area, and then select a family type in the Modify Wall tab ► Element panel ► Type Selector drop-down.

Interior and Exterior Structural Wall Properties

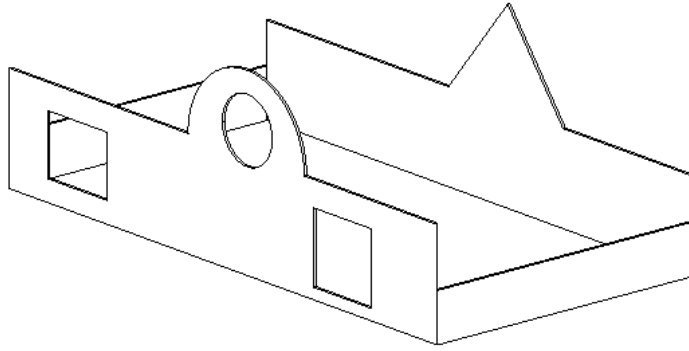
The properties of a wall vary, depending on whether it is an interior or an exterior wall. In addition, when you modify type properties, all walls of that type are modified. When you modify instance properties, the properties of a single instance of a wall are modified.

NOTE When you modify parameters, the type names do not update. For example, if you change the width of an exterior wall from 200 mm to 250 mm, its name retains a reference to the original width.

Defining Structural Wall Shapes or Openings

When you sketch a wall by picking 2 points, Revit Architecture draws a rectangular wall by default. You can modify the shape of the wall or add openings to it by editing its elevation profile. To edit a wall's elevation profile, the view must be parallel and can be either a section or elevation view. You cannot edit the elevation profile of an arc wall.

Design with non-rectangular walls and cut openings



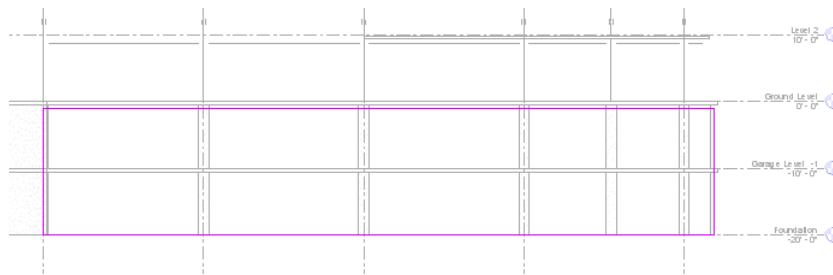
Modifying Structural Wall Elevation Profiles

1 In the drawing area, select a wall.

2 Click Modify Walls tab ► Modify Wall panel ► Edit Profile.

If you select a wall in a plan view, the Go To View dialog displays. Select an elevation view, and click Open View.

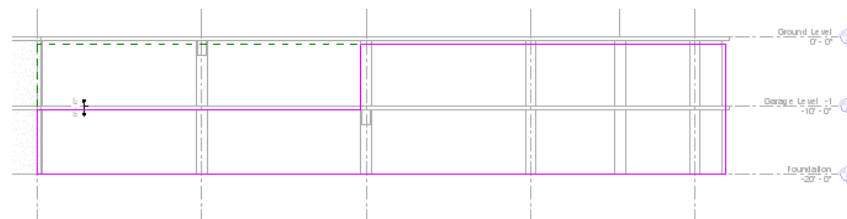
Wall displayed as model lines



3 Edit the wall as desired:

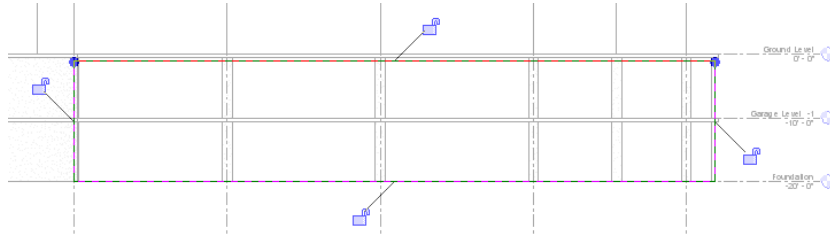
- Delete the lines and then sketch a completely different shape.
- Split the existing lines and add arcs.
- Draw openings or holes.

Wall modified



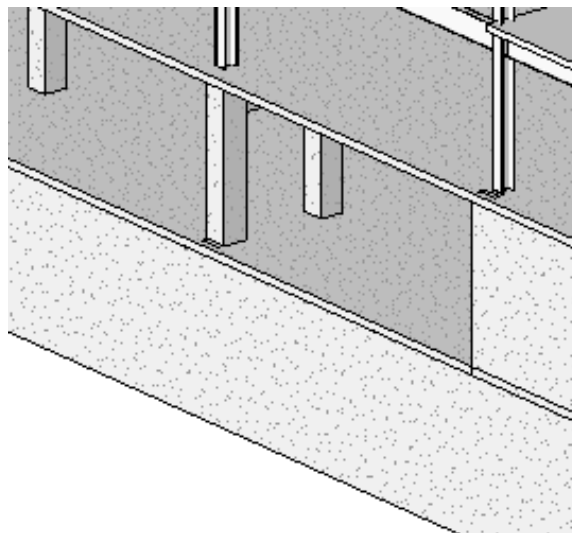
TIP As you edit the rectangle, datum planes appear to indicate the original shape and size of the wall. If the lines you sketch snap to the datum planes, the endpoints of the lines automatically align to the planes, unless you explicitly unlock them. If you unlock the sketched lines, you can modify them independently of the datum planes. If you exit sketch mode while the sketched lines are still aligned, as you move a datum handle, the sketched lines move with it.

Sketch lines unlocked



4 Click **Modify Walls > Edit Profile tab > Wall panel > Finish Wall**.

Modified wall displayed in 3D

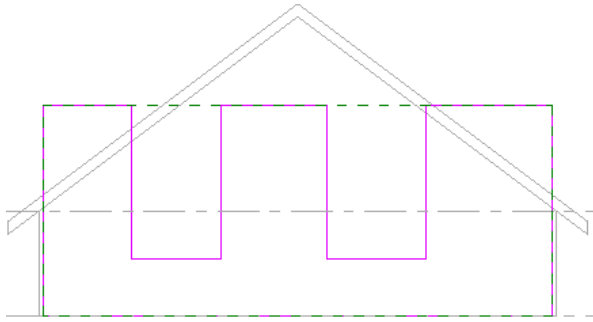


NOTE To revert an edited wall to its original shape, select the wall and click **Modify Walls tab > Modify wall panel > Reset Profile**.

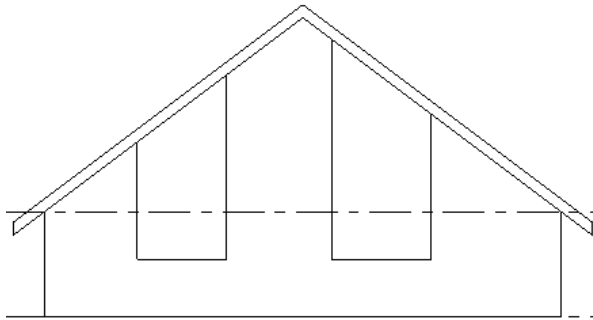
Tips for Defining Structural Wall Shapes or Openings

- When you define a wall shape on a wall that is not horizontal or vertical in a plan view, you should draw a section parallel to the wall before sketching in the elevation. The **Go To View** dialog displays. Revit Architecture suggests the section view as the optimal view for editing the sketch.
- When you edit the elevation profile of a wall attached to another element, the wall temporarily reverts to its original shape and height. For example, the profile of a wall attached to a roof assumes its unconnected height prior to being attached to the roof. As a result, you may find the wall is not at the right height to edit the elevation profile. To change the unconnected height, click **Modify Walls > Edit Profile tab > Draw panel > Properties**.
As you edit the elevation profile, keep in mind that after you finish the sketch, the wall top or bottom attaches only where horizontal lines are coincident with the reference planes in the sketch.

The sample sketched profile. Note the top sketch lines are coincident with reference planes.



The finished wall attached to roof. Non-coincident horizontal lines from the sketch did not attach.

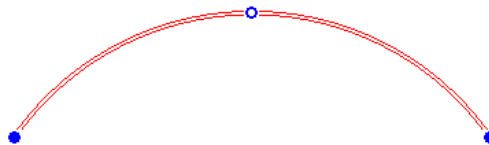


Arc Walls

Resizing Arc Walls

You can resize arc walls using middle and end controls.

- 1 Select an arc wall.

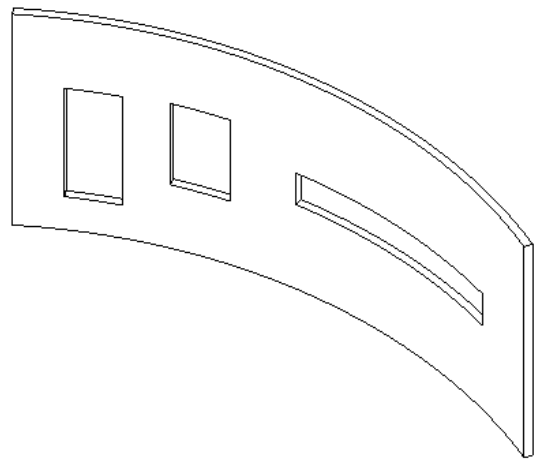


- 2 Drag the end controls to change the arc length.
- 3 To change the arc radius while keeping it concentric, select Keep Concentric on the Options Bar.
Leave this option deselected to retain existing end conditions, such as endpoint location or tangency to a straight wall.
- 4 Drag the middle control.

Cutting Arc Walls

You can cut square or rectangular openings into an arc wall by editing the elevation of the wall. See [Defining Wall Shapes or Openings](#) on page 662.

- 1 In either a 3D or elevation view, select an arc wall.
- 2 Click Modify Walls tab ► Modify Wall panel ► Create Opening.
The Rectangles tool becomes active.
- 3 Sketch rectangular openings in the arc wall.



- 4 When you finish, click  (Modify) on the Quick Access toolbar.

As you sketch the openings, permanent dimensions appear. If the wall has a top constraint set to a level, dimensions appear from both the top and base constraints. If the wall has a top constraint that is explicit, dimensions appear from the base constraint only.

Structural Wall Properties

You can modify many properties for structural walls, as shown in the following 2 sections:

Structural Wall Type Properties

Name	Description
Construction	
Structure	Specifies a wall layer. Select the Edit button to add, change, or delete a wall layer.
Wrapping at Inserts	Specifies the layer wrapping of walls at inserts. See Layer Wrapping on page 815.
Wrapping at Ends	Specifies the layer wrapping of wall end caps. See Setting Layer Wrapping on page 816.
Width	Specifies the width of the wall.
Wall Function	Specifies the function of the wall which identifies specific properties: either Interior, Exterior, Foundation, Retaining, Soffit, or Core-shaft.

Name	Description
Additional Top/Exterior Offset	Specifies an additional offset from the top/exterior rebar cover. This allows placing multiple rebar elements together in different area reinforcement layers.
Additional Bottom/Interior Offset	Specifies an additional offset from the bottom/interior rebar cover. This allows placing multiple rebar elements together in different area reinforcement layers.
Additional Offset	Specifies an additional offset from the rebar cover. This allows placing multiple rebar elements together in different path reinforcement layers.
Graphics	
Coarse Scale Fill Pattern	Specifies a fill pattern for a wall in a coarse-scale view. See View Properties on page 259.
Coarse Scale Fill Color	Specifies a color for the fill pattern for a wall in a coarse-scale view.
Identity Data	
Keynote	Specifies or modifies the structural wall keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The manufacturer internal number.
Manufacturer	The wall manufacturer.
Type Comments	A field for entering general comments about the wall type. This information can be included in a schedule.
URL	A link to a web page that may contain type-specific information.
Description	A description of the wall.
Assembly Description	A description of the assembly based on the assembly code selection. This is a read-only value.
Assembly Code	A unformat assembly code selected from a hierarchical list.
Type Mark	A value that designates the particular wall. This value must be unique for each element in a project. Revit Architecture warns you when the number is already used, but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Fire Rating	The fire rating of the wall.
Cost	The pricing of the wall.

Structural Wall Instance Properties

Name	Description
Constraints	

Name	Description
Location Line	Specifies the position of the wall with respect to the line sketched in the project elevation. For more information, see Adding Interior and Exterior Walls on page 634. The wall location line remains the same for that wall, even if the type changes.
Base Constraint	Specifies the level from which the wall base is referenced.
Base Offset	Specifies the offset of the base of the wall from its base constraint.
Base is Attached	Indicates whether the base of the wall is attached to another component, such as a structural floor. This is a read-only value.
Base Extension Distance	Indicates the distance you have moved the base of the layers in a wall. See Compound Structure on page 813. This parameter is enabled when the layers of a wall are set to extendable.
Top Constraint	The name of the level to which the wall top is set.
Unconnected Height	If top constraint is unconnected, you may set an unconnected height of the wall. This value is read-only if there is a top constraint.
Top Offset	Specifies the offset of the top of the wall from its top constraint; enabled only when the top constraint is set to a level.
Top is Attached	Indicates whether the top of the wall is attached to another component, such as a structural floor. This is a read-only value.
Top Extension Distance	Indicates the distance you have moved the top of the layers in a wall. See Compound Structure on page 813. This parameter is enabled when the layers of a wall are set to extendable.
Room Bounding	Indicates whether the wall is part of a room boundary. This parameter is enabled after you place the wall.
Related to Mass	This is a read-only value.
Structural	
Rebar Cover - Exterior Face	Specifies the rebar cover distance from the wall exterior face.
Rebar Cover - Interior Face	Specifies the rebar cover distance from the wall interior face.
Rebar Cover - Other Face	Specifies the rebar cover distance from the face of adjacent element.
Estimated Reinforcement Volume	Specifies the estimated reinforcement volume of the selected element. This is a read-only parameter that only displays when rebar has been placed.
Structural Usage	The structural use of the wall.
Dimensions	
Length	Indicates the length of the wall. This is a read-only value.
Area	Indicates the area of the wall. This is a read-only value.

Name	Description
Volume	Indicates the volume of the wall. This is a read-only value.
Identity Data	
Comments	A field for entering comments about the wall.
Mark	A label created for the wall. This value must be unique for each element in a project. Revit Architecture warns you when the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Phasing	
Phase Created	Indicates in which phase the wall component was created. See Project Phasing on page 1331.
Phase Demolished	Indicates in which phase the wall component was demolished. See Project Phasing on page 1331.
Analytical Model	
Enable Analytical Model	Changes the visibility of the wall analytical model.
Horizontal Projection	The horizontal plane of the wall used for analysis and design.
Top Vertical Projection	The top vertical plane of the wall used for analysis and design.
Bottom Vertical Projection	The bottom vertical plane of the wall used for analysis and design.

Wall Foundations

Wall foundations are members of the structural foundation category. You can place these foundations along structural walls, in either a plan or 3D view.

Wall foundations are constrained to the wall that they support. They move with the wall when you move the wall.

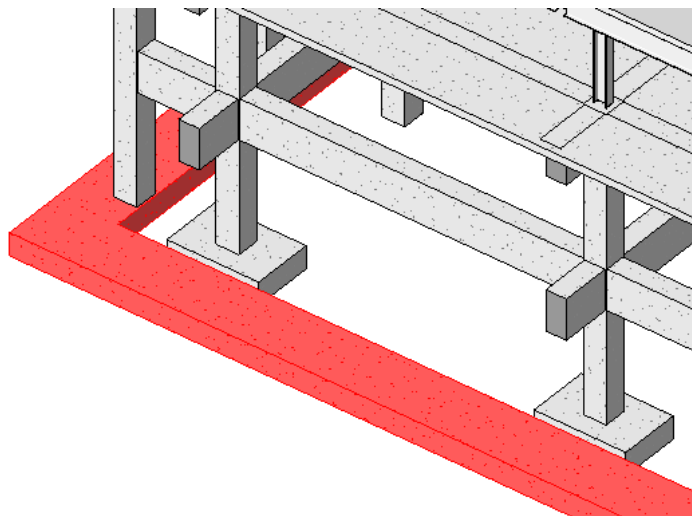
You join wall foundations using the Join tool.

See also:

- [Isolated Foundations](#) on page 925
- [Foundation Slabs](#) on page 940

Creating a Wall Foundation

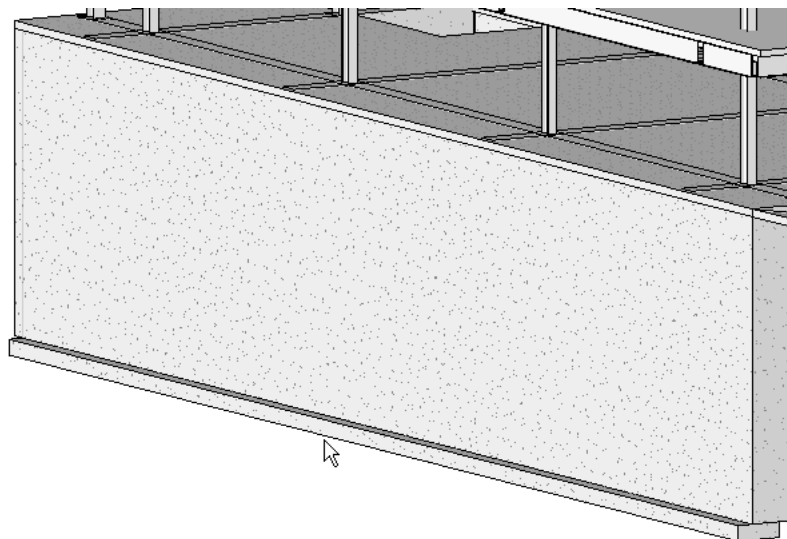
Foundations snap to walls.



Before placing the foundations, open a view that already contains structural walls.

- 1 Click Home tab ► Structural panel ► Foundation drop-down ► Wall Foundation.
- 2 Select the desired walls in the view.

Select the wall



- 3 Optionally, use Join Geometry to join wall foundations with isolated foundations or with other wall foundations. For more information about the Join Geometry tool, see [Joining Geometry](#) on page 406.
- 4 Optionally, select a foundation, and access its type properties.
You can specify Structural Usage (either Retaining or Bearing). If you select Retaining, you can specify values for Toe Length, Heel Length, and Foundation Thickness. Toe and heel length define the width of the foundation. For more information, see [Wall Foundation Properties](#) on page 920.

Structural usage - retaining

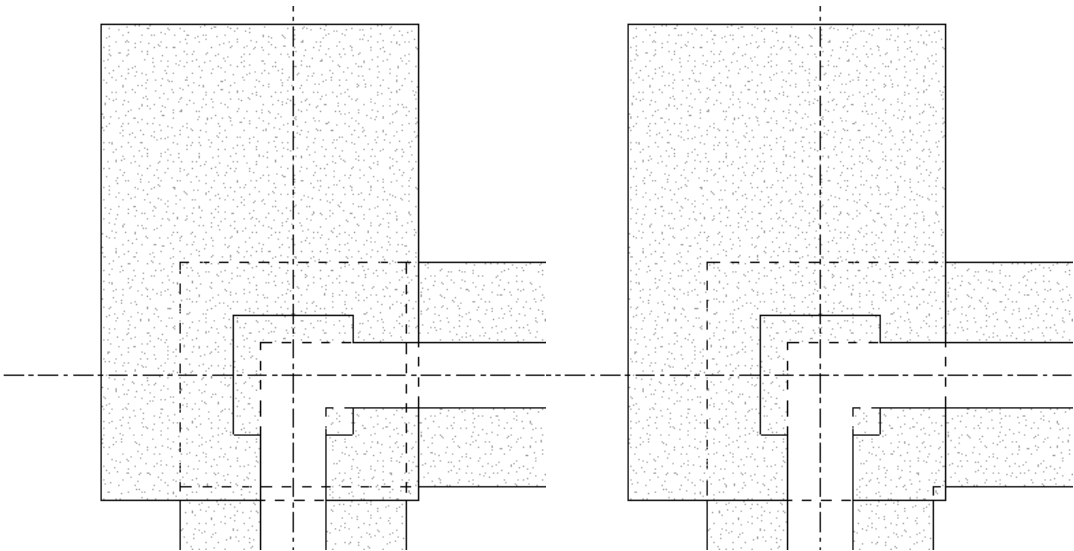
Structural	
Structural Usage	Retaining
Dimensions	
Toe Length	1' 0"
Heel Length	1' 0"
Foundation Thickness	1' 0"
Default End Extension Length	0' 0"
Do Not Break At Inserts	<input type="checkbox"/>

If you select Bearing, you can specify values for Width and Foundation Thickness.

Structural usage - bearing

Structural	
Structural Usage	Bearing
Dimensions	
Width	3' 0"
Foundation Thickness	1' 0"
Default End Extension Length	0' 0"
Do Not Break At Inserts	<input type="checkbox"/>

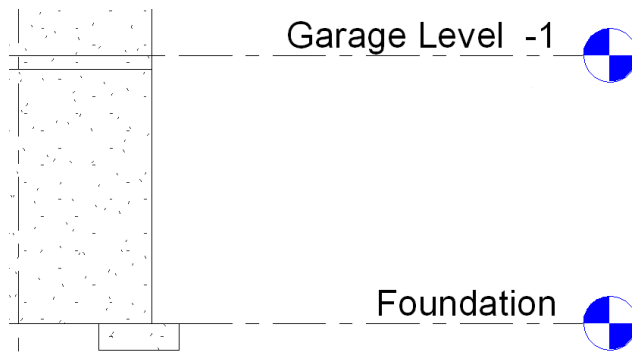
Wall foundations prior to use of join geometry Wall foundations after use of join geometry



The Bottom Elevation of structural foundations (footings) is reported in a read-only instance parameter called Elevation at Bottom. You can then display this value in a view by tagging the foundation with the Structural Foundation Tag with Elevation tag. It is available from the family library, under Structural/Annotations.

NOTE The wall foundation is created at the bottom of the selected wall. If the created wall foundation is beyond the view range of the active view, you will be prompted with a warning. To see the foundation, you have to either extend the view range for the current view, or open a view that shows the wall foundation.

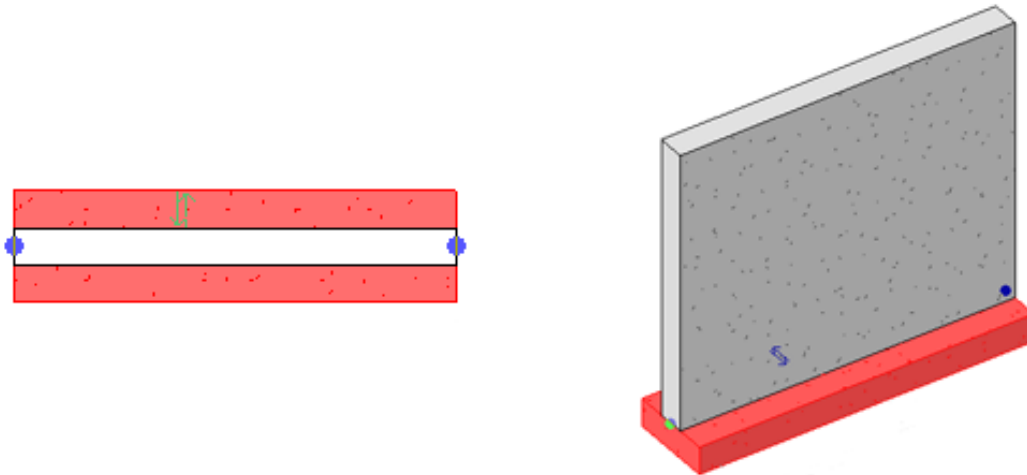
Elevation view of a wall foundation



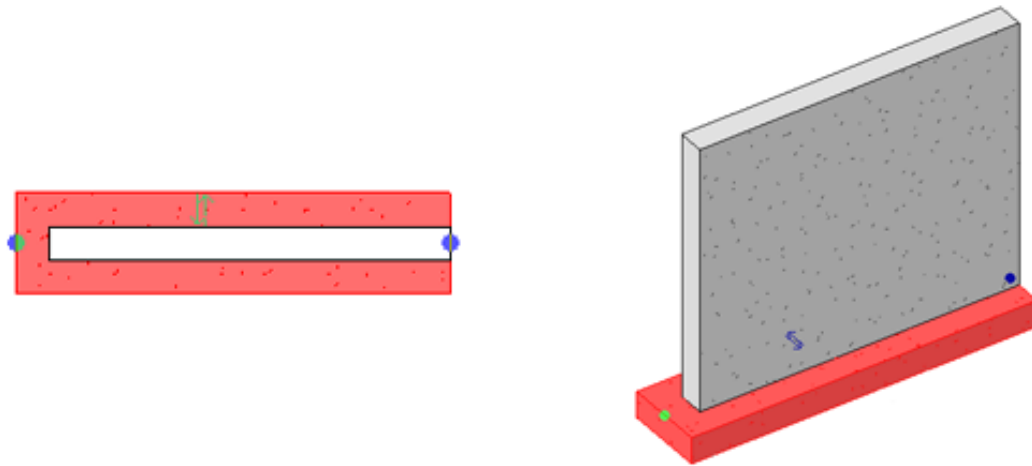
Modifying Wall Foundations

You can edit the lengths of wall foundations with end controls. They display as small filled circles that indicate where the end of the selected wall foundation is attached. End controls will snap to other visible references.

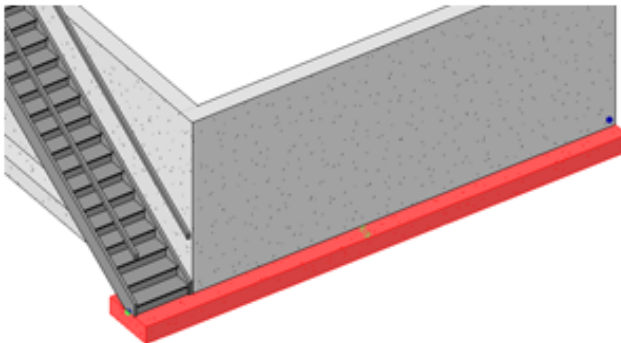
You can also use the end controls to resize the footing beyond its wall when necessary. Select the wall foundation to be resized and the end controls will appear.



Drag either end of the foundation as needed. The wall foundation will not scale in length. Only the end being dragged will extend.



Extending a footing to accommodate a run of stairs.



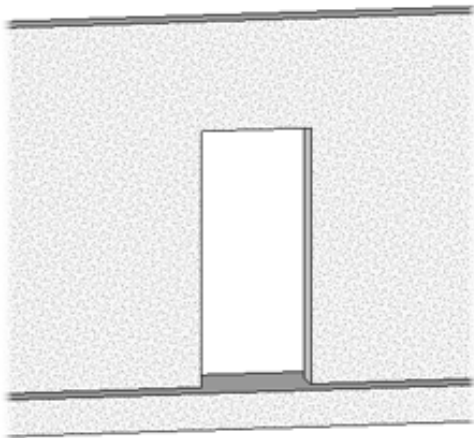
Default End Extensions

You can set the default extension length of wall foundations in your project. This is set in the Wall Foundation Type Properties. See [Wall Foundation Type Properties - Retaining](#) on page 921 and [Wall Foundation Type Properties - Bearing](#) on page 922.

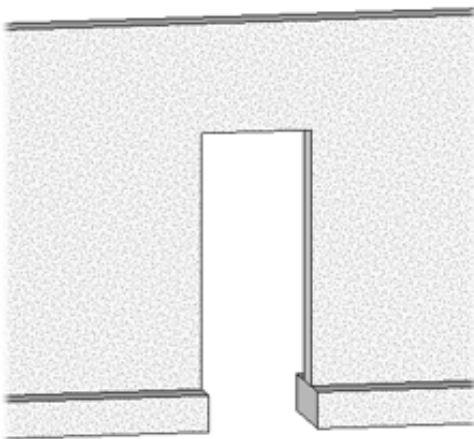
Under the Dimensions section, enter a value in the Default End Extension Length parameter. Any unjoined wall foundation end will extend this distance beyond its host wall. The value will be set for the entire project.

Doors and Windows

When a doorway or window is created in a wall, the wall foundation remains continuous beneath the opening.



You can disable this in the Wall Foundation Type Properties. See [Wall Foundation Type Properties - Retaining](#) on page 921 and [Wall Foundation Type Properties - Bearing](#) on page 922. Under the Dimensions section, clear Do Not Break at Inserts. The value will be set for the entire project.



Wall Foundation Properties

There are 2 types of wall foundations for structural use: bearing and retaining. You can modify the properties for both types, including heel length, toe length, foundation thickness, and width.

Modifying Wall Foundation Properties

- 1 Select the wall foundation, and click Modify Structural Foundations tab ► Element Properties panel ► Element Properties drop-down ► Instance Properties.

2 In the Instance Properties dialog, edit wall foundation instance parameters.

3 Click Edit Type to edit wall foundation type parameters.

NOTE Changes made to type parameters affect all wall foundations of this type in the project. You can click Duplicate to create a new wall foundation type.

Wall Foundation Type Properties - Retaining


Name	Description
Materials and Finishes	
Material	Specifies the concrete to be used.
Structural	
Structural Usage	Specifies the wall usage type: either Retaining or Bearing. For information about the Bearing type, see Wall Foundation Type Properties - Bearing on page 922.
Dimensions	
Toe Length	Specifies the length from the edge of a wall to the outside face of the foundation.
Heel Length	Specifies the length from edge of a wall to the inside face of the foundation.
Foundation Thickness	Specifies the foundation thickness.
Default End Extension Length	Specifies the distance the foundation will extend beyond the end of the wall.
Do Not Break At Inserts	Selecting this parameter forces the foundation to be continuous.
Identity Data	
Model	The manufacturer internal number.
Manufacturer	The foundation manufacturer.
Type Comments	A field for placing general comments about the foundation type. This information can be included in a schedule.
URL	A link to a web page that may contain type-specific information.
Description	Enter an optional description of the wall foundation.
Assembly description	Describes the assembly, based on the assembly code selection. This is a read-only parameter.
Assembly Code	The uniformat assembly code selected from a hierarchical list.
Type Mark	A value that designates the particular foundation. This value must be unique for each element in a project. Revit Architecture warns you when the number value is already used, but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.

Name	Description
Cost	The pricing of the foundation.


Wall Foundation Type Properties - Bearing

Name	Description
Materials and Finishes	
Material	Specifies the concrete to be used.
Structural	
Structural Usage	Specifies the wall usage type: either Retaining or Bearing. For information on Retaining type, see Wall Foundation Type Properties - Retaining on page 921.
Dimensions	
Width	Specifies the overall width of the bearing wall foundation.
Foundation Thickness	Specifies the foundation thickness.
Default End Extension Length	Specifies the distance the foundation will extend beyond the end of the wall.
Do Not Break At Inserts	Selecting this parameter forces the foundation to be continuous and not break when openings are applied to its host wall.
Identity Data	
Model	The manufacturer internal number.
Manufacturer	The foundation manufacturer.
Type Comments	A field for entering general comments about the foundation type. This information can be included in a schedule.
URL	A link to a web page that may contain type-specific information.
Description	Enter an optional description of the wall foundation.
Assembly description	Describes the assembly based on the assembly code selection. This is a read-only parameter.
Assembly Code	A unformat assembly code selected from a hierarchical list.
Type Mark	A value to designate the particular foundation. This value must be unique for each element in a project. Revit Architecture warns you when the number value is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Cost	The pricing of the foundation.

Wall Foundation Instance Properties - Retaining

Name	Description
Structural	
Rebar Cover - Top Face	Specifies the rebar cover distance from the wall top face.
Rebar Cover - Bottom Face	Specifies the rebar cover distance from the wall bottom face.
Rebar Cover - Other Faces	Specifies the rebar cover distance from the wall to adjacent element faces.
Estimated Reinforcement Volume	Specifies the estimated reinforcement volume of the selected element. This is a read-only parameter that only displays when rebar has been placed.
Dimensions	
Length	Indicates the overall length. This is a read-only parameter.
Width	Indicates the overall width. This is a read-only parameter.
Volume	Indicates the volume of the foundation. This is a read-only parameter.
Elevation at Bottom	<p>Indicates the elevation used for tagging the Bottom of Foundation. This parameter is affected by the family parameter Cap (see Family Category and Parameters on page 433). The following image shows the difference between the Cap parameter enabled (in red) and disabled (in green).</p>  <p>The Elevation at Bottom measurement is taken from this setting. This is a read-only parameter.</p>
Identity Data	
Comments	A field for placing general comments about the foundation type.
Mark	A label created for the foundation. This value must be unique for each element in a project. Revit Architecture warns you when the number value is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Phasing	
Phase Created	Indicates in which phase the foundation component was created. See Project Phasing on page 1331.
Phase Demolished	Indicates in which phase the foundation component was demolished. See Project Phasing on page 1331.
Structural Analysis	
Analyze As	Indicates the property type for structural analysis. Select either Foundation or Not for Analysis.

Wall Foundation Instance Properties - Bearing

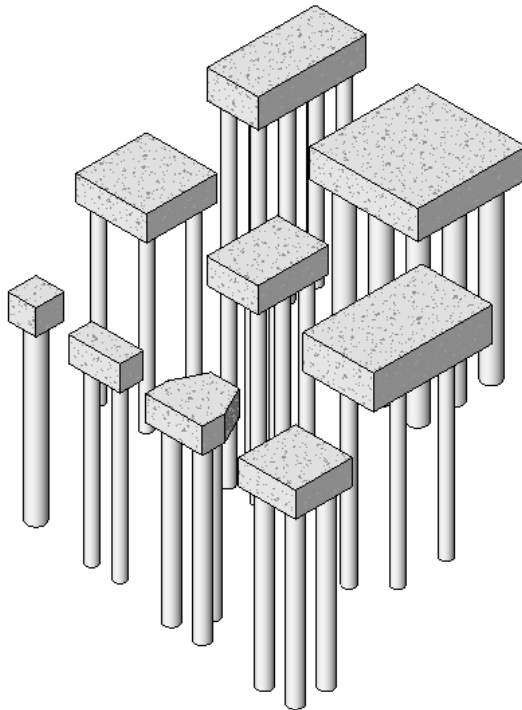
Name	Description
Constraints	
Eccentricity	Specifies the offset from the wall center line to the bearing foundation center line.
Structural	
Rebar Cover - Top Face	Specifies the rebar cover distance from the wall foundation top face.
Rebar Cover - Bottom Face	Specifies the rebar cover distance from the wall foundation bottom face.
Rebar Cover - Other Faces	Specifies the rebar cover distance from the wall foundation to adjacent element faces.
Estimated Reinforcement Volume	Specifies the estimated reinforcement volume of the selected element. This is a read-only parameter that only displays when rebar has been placed.
Dimensions	
Length	Indicates the overall length. This is a read-only parameter.
Width	Indicates the overall width. This is a read-only parameter.
Volume	Indicates the volume of the foundation. This is a read-only parameter.
Elevation at Bottom	<p>Indicates the elevation used for tagging the Bottom of Foundation. This parameter is affected by the family parameter Cap (see Family Category and Parameters on page 433). The following image shows the difference between the Cap parameter enabled (in red) and disabled (in green).</p>  <p>The Elevation at Bottom measurement is taken from this setting. This is a read-only parameter.</p>
Identity Data	
Comments	A field for placing general comments about the foundation type.
Mark	A label created for the foundation. This value must be unique for each element in a project. Revit Architecture warns you when the number value is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Phasing	
Phase Created	Indicates in which phase the foundation component was created. See Project Phasing on page 1331.
Phase Demolished	Indicates in which phase the foundation component was demolished. See Project Phasing on page 1331.

Name	Description
Structural Analysis	
Analyze As	Indicates the property type for structural analysis. Select either Foundation or Not for Analysis.

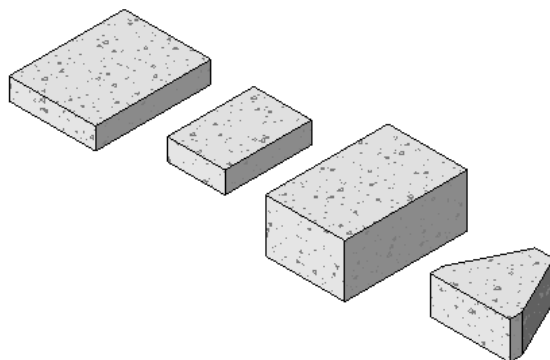
Isolated Foundations

Isolated foundations are standalone families that are part of the structural foundation category. Several types of isolated foundations can be loaded from the family library, including pile caps with multiple piles, rectangular piles, and single piles.

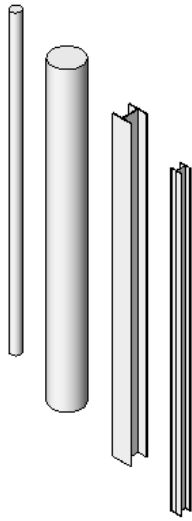
Pile caps with multiple piles



Rectangular and triangular pile caps



HP shaped and pipe piles



Adding Isolated Foundations

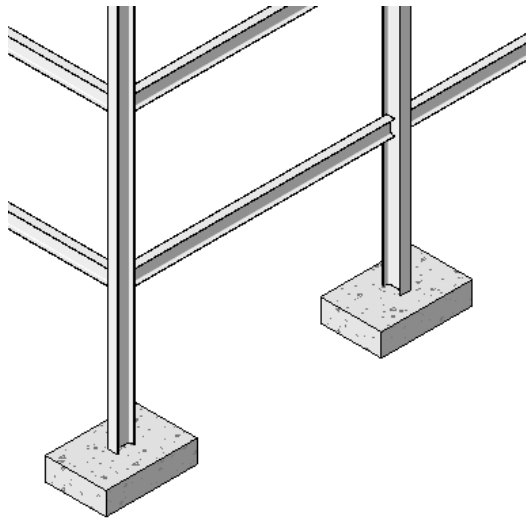
1 Click Home tab ► Structure panel ► Foundation drop-down ► Isolated Foundation.

You can load isolated foundation families by clicking Place Isolated Foundation tab ► Model panel ► Load Family.

2 Click Place Isolated Foundation tab ► Element panel, and select an isolated foundation type from the Type Selector drop-down.

3 Place the isolated foundation in either a plan or 3D view.

Rectangular isolated foundation



The Bottom Elevation of structural foundations (footings) is reported in a read-only instance parameter called Elevation at Bottom. You can then display this value in a view by tagging the

foundation with the Structural Foundation Tag with Elevation tag. It is available from the family library, under Structural/Annotations. For more information, see [Applying a Tag](#) on page 1125.

Isolated Foundation Properties

You can use several standard types of isolated foundations: either Rectangular Footings, Concrete Pile-Caps, or Steel Pipe Piles.

Modifying Isolated Foundation Properties

You can edit isolated foundation properties, such as those indicating structure, dimension, and identity.

To edit isolated foundation properties

- 1 Select the isolated foundation, and click Modify Structural Foundations tab ► Element Properties panel ► Element Properties drop-down ► Instance Properties.
- 2 In the Instance Properties dialog, edit isolated foundation instance parameters.
- 3 Click Edit Type to edit isolated foundation type parameters.

NOTE Changes made to type parameters affect all isolated foundations of this type in the project. You can click Duplicate to create a new isolated foundation type.


Isolated Foundation Type Properties

Name	Description
Dimensions	
Width	Specifies the width of the isolated foundation type. Applies to the Pile Cap Pile family type.
Length	Specifies the length of the isolated foundation type. Applies to the Pile Cap Pile family type.
Thickness	Specifies the foundation thickness. Applies to the Pile Cap Pile family type.
Identity Data	
Assembly Code	A unformat assembly code selected from a hierarchical list.
Keynote	Add or edit the isolated foundation keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The manufacturer internal number.
Manufacturer	The foundation manufacturer.
Type Comments	A field for placing general comments about the foundation type. This information can be included in a schedule.
URL	A link to a web page that may contain type-specific information.

Name	Description
Description	Enter an optional description of the wall foundation.
Assembly Description	Describes the assembly based on the assembly code selection. This is a read-only parameter.
Type Mark	A value that designates the specific foundation. This value must be unique for each element in a project. Revit Architecture warns you when the number value is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Cost	The pricing of the foundation.
OmniClass Number	The number from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.
OmniClass title	The name from Table 23 of the OmniClass Construction Classification System that best categorizes the family type.

Isolated Foundation Instance Properties

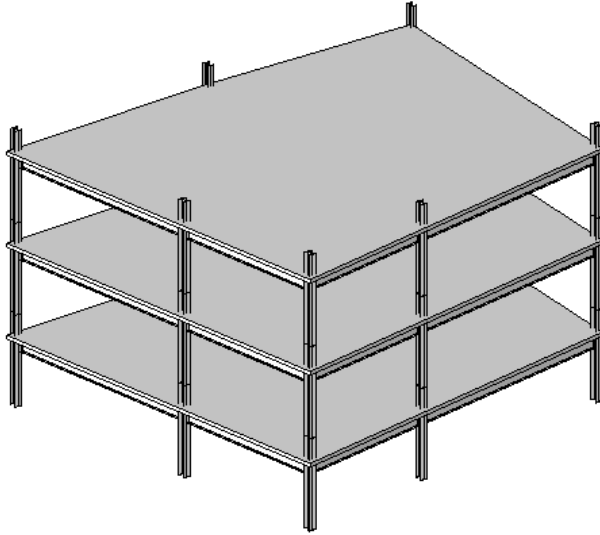
Name	Description
Constraints	
Level	The level to which the slab is constrained.
Host	The level to which the host of the isolated slab is constrained.
Offset	Specifies the elevation of the top of the isolated foundation relative to its level.
Moves With Grids	Changes the column constraint to grid.
Materials and Finishes	
Material	Specifies the material of the isolated foundation.
Structural	
Rebar Cover - Top Face	Specifies the distance of the rebar cover from the element top face.
Rebar Cover - Bottom Face	Specifies the distance of the rebar cover from the element bottom face.
Rebar Cover - Other Faces	Specifies the distance of the rebar cover from the element to adjacent element faces.
Estimated Reinforcement Volume	Specifies the estimated reinforcement volume of the selected element. This is a read-only parameter that only displays when rebar has been placed.
Dimensions	
Elevation at Bottom	Indicates the elevation used for tagging the Bottom of Foundation.

Name	Description
	<p>This parameter is affected by the family parameter Cap (see Family Category and Parameters on page 433). The following image shows the difference between the Cap parameter enabled (in red) and disabled (in green).</p>  <p>The Elevation at Bottom measurement is taken from this setting. This is a read-only parameter.</p>
Identity Data	
Comments	A field for entering comments about the wall.
Mark	A label created for the element. This value must be unique for each element in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Phasing	
Phase Created	Indicates in which phase the component was created. See Project Phasing on page 1331.
Phase Demolished	Indicates in which phase the component was demolished. See Project Phasing on page 1331.
Structural Analysis	
Analyze As	Indicates the property type for structural analysis. Select either Foundation or Not for Analysis.

Structural Floor

You can add a structural floor to the building model. It uses a similar interface and functionality as creating floors. This functionality includes creating and editing slab edges, thickened slabs, drop panels, or ramps, as well as user selection and user creation of structural floor types.

Typical structural floors



- To add a structural floor, see [Floors](#) on page 709.
- To create or edit ramps, see [Sloped Floors](#) on page 710.
- To create or edit slab edges, thickened slabs, or drop panels, see [Slab Edges](#) on page 712 and [Ramps](#) on page 742.
- To modify structural floors, see [Modifying Structural Floors](#) on page 937.

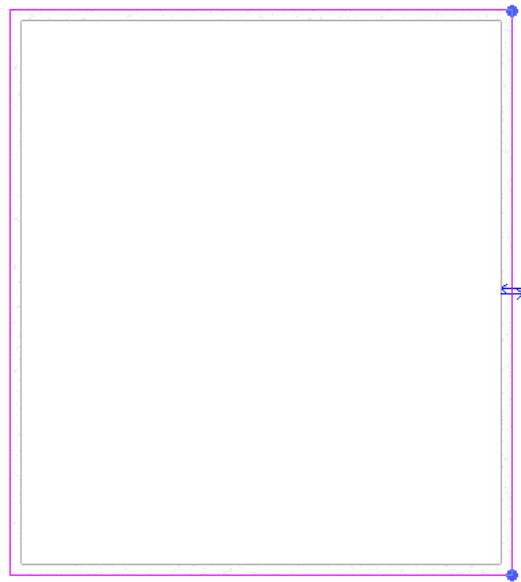
Adding a Structural Floor or Deck


You create structural floors and decks by sketching them. You can sketch lines for the slab edges either by picking walls or by using the Line tool. Typically you will sketch a floor in a plan view, although you can sketch it in a 3D view, provided the work plane of the 3D view is set to the work plane in which you want to place the structural floor. The top of the structural floor is offset relative to the level at which it is placed. For information about Height Offset from Level, and other Structural Floor parameters, see [Structural Floor Properties](#) on page 938.

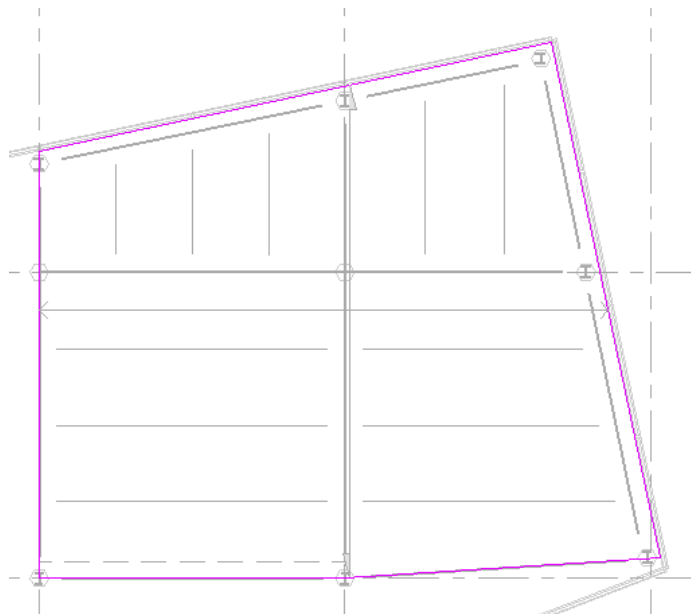
For information about structural floors and hidden lines, see [Display of Hidden Lines of Structural Concrete Components](#) on page 244.

To add a structural floor

- 1 Click Home tab ► Build panel ► Floor drop-down ► Structural Floor.
- 2 Click Create Floor Boundary tab ► Element panel ► Floor Properties.
- 3 In the Instance Properties dialog for type, specify the structural floor type, and click OK.



- 4 Click Create Floor Boundary tab ► Draw panel ► Boundary Line and then click  (Pick Walls) to select the walls in your model.
- 5 Click Extend into wall on the Options Bar if you want the offset to be measured from the wall's core.
- 6 Specify an offset for slab edges in the Offset text box on the Options Bar.



NOTE Instead of picking walls you can sketch a structural floor. Use the sketch tools on the Create Floor Boundary tab ► Draw panel to form the boundary of the structural floor. The sketch must form a closed loop or boundary condition. See [Sketching](#) on page 303.

- 7 Click Create Floor Boundary tab ► Floor panel ► Finish Floor.

NOTE To add openings to a structural floor, see [Cutting Openings in Structural Floors](#) on page 934.

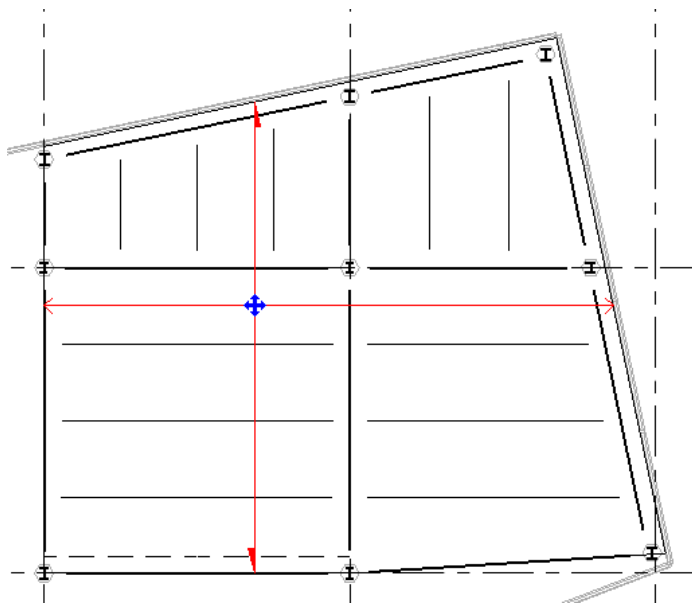
Related topics

- [Span Direction](#) on page 932
- [Modifying Structural Floors](#) on page 937
- [Structural Floor](#) on page 929

Span Direction

When you place a structural floor, a span direction component is placed in plan view along with the structural floor. The span direction component is used to change the orientation of the steel deck in the plan. Deck span direction is designated by the direction of the filled half-arrows.

Direction of span



To rotate a span direction symbol

- 1 Select the span direction component.
- 2 Click **Modify Span Direction Symbol** tab ► **Modify** panel ► **Rotate**.
- 3 Click a start angle for the rotation of the span direction.
- 4 Click an end angle to complete the angle of rotation.

To align the span direction to a structural floor, beam, or grid line

- 1 Select the span direction component.
- 2 Click **Modify Span Direction Symbol** tab ► **Align Symbol** panel ► **Align Perpendicular**.
- 3 Select a structural floor, beam, or grid line to which the span direction will be perpendicular.

The deck is rotated by the angle value that you apply to the span direction component.

NOTE You may also add a span direction component to a structural floor that does not have one. Click Annotate tab ► Symbol panel ► Span Direction and select the structural floor. You can also create new span direction types for decks and for one-way structural floors. For information about creating family types, see [The Families Guide](#) on page 418.

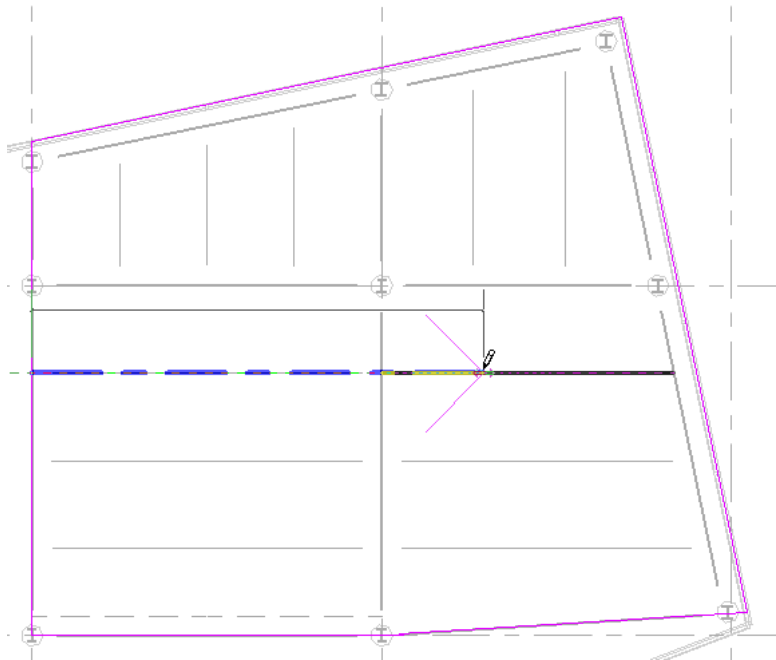
Sloped Structural Floors

Revit Architecture provides 3 independent ways to create a sloped structural floor:

Method 1

While sketching a structural floor, click Create Floor Boundary tab ► Draw panel ► Slope Arrow to draw a slope arrow that defines the slope of the structural floor.

Structural Floor sketch with slope arrow



Select the slope arrow, and click Create Floor Boundary tab ► Draw panel ► Properties. Do one of the following methods:

To create a slope by setting height at tail

- 1 For Specify, select Height at Tail.
- 2 Specify a value for Height Offset at Tail.
This value determines how high above the level the slope arrow begins.
- 3 Optionally, specify a level for Level at Tail to start the slope arrow at a certain level.
For example, the floor sketch is on level 1. You could start the slope arrow on level 2.
- 4 Specify a value for Height Offset at Head.
This value determines how high above the level the slope arrow ends.
- 5 Optionally, specify a level for Level at Head to end the slope arrow above a certain level.
For example, the floor sketch is on level 1. You could end the slope arrow on level 2.

6 Click OK.

For more information about the slope arrow, including its properties, see [Slope Arrow](#) on page 685.

To create a slope by setting slope value

1 For Specify, select Slope.

2 Set the value of Rise/(Run) to set a slope value.

3 Optionally, specify a value for Height Offset at Tail.

This value determines how high above the level the slope arrow begins.

4 Optionally, specify a level for Level at Tail to start the slope arrow at a certain level.

For example, the floor sketch is on level 1. You could start the slope arrow on level 2.

5 Click OK.

Method 2

Select 2 parallel floor lines that you sketched and click Modify Floors > Edit Boundary ► Draw panel ► Properties. For Defines constant height property, select Yes for both lines. This enables the Offset from Base property. Then, select the lines individually and specify a value for the Offset from Base property for each of the lines.

Method 3

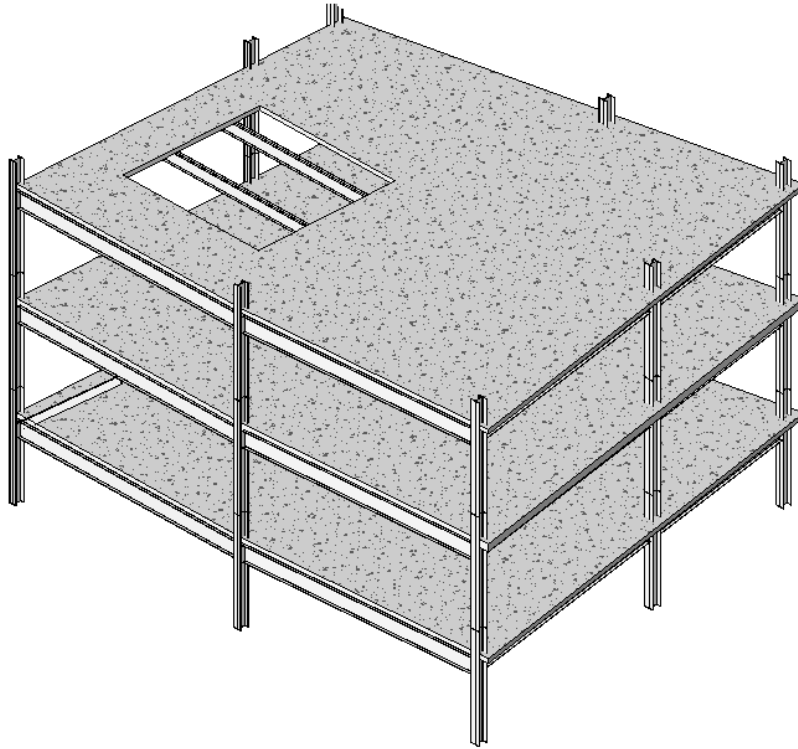
Select a single sketch line and click Modify Floors > Edit Boundary ► Draw panel ► Properties. For Defines constant height property, select Yes. Select the Defines Slope property, and specify a value for the slope angle (rise).

For a complete listing of parameters available for setting slopes, see [Roof Properties](#) on page 703.

Cutting Openings in Structural Floors

There must be an existing structural floor in the model.

Typical opening in a structural floor

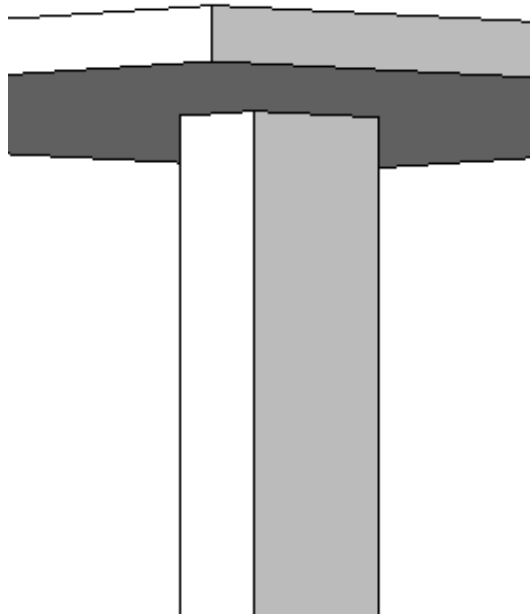


- 1 Click Modify tab ► Opening panel ► By Face.
- 2 Select a structural floor.
- 3 Using the sketch tools on the Create Opening Boundary tab ► Draw panel, sketch the structural floor opening.
- 4 Click Create Opening Boundary tab ► Opening by Face panel ► Finish Opening.

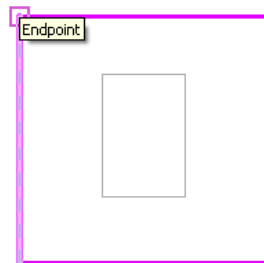
Drop Panels

You can add drop panels to reinforce a structural floor at column locations. This is achieved by sketching a second smaller structural floor.

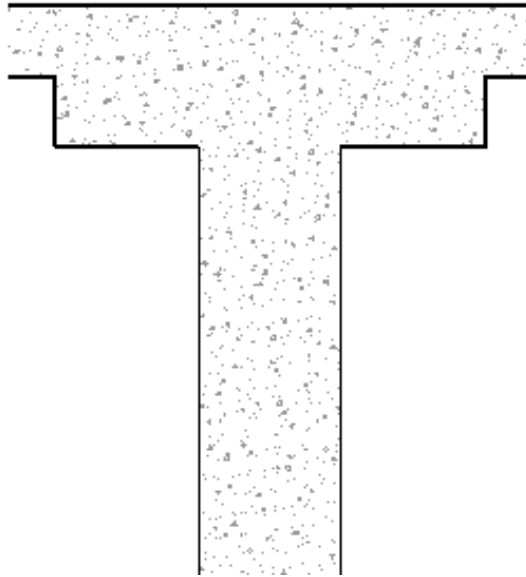
- 1 Open a plan view with a structural floor over a column.



- 2 Click Home tab ► Build panel ► Floor drop-down ► Structural Floor.
- 3 Click Create Floor Boundary tab ► Draw panel ► Boundary Line, and use the sketching tools to complete a sketch of the drop panel (see [Sketching](#) on page 303). The sketch must form a closed loop or boundary condition.

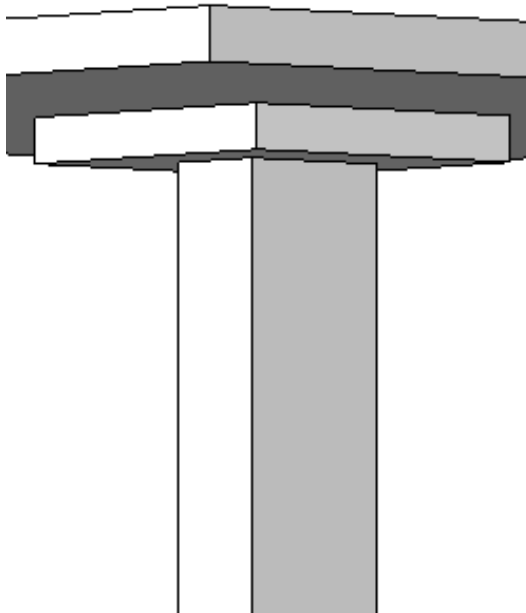


- 4 Click Create Floor Boundary tab ► Floor panel ► Finish Floor.
- 5 View the drop panel in an elevation or cross section view.
- 6 Select the new drop panel.
- 7 Right click the new drop panel and select Element Properties.
- 8 In the Instance Properties dialog, adjust the Constraint parameters of the drop panel so that it is at the correct elevation in your model.



9 Click OK.

10 Join the geometry of the elements if necessary. See [Joining Geometry](#) on page 406.



Modifying Structural Floors

You can modify structural floors either by editing structural floor properties or by directly changing structural floor geometry in the drawing area. To modify a structural floor before you add it, you must select the structural floor type in the type selector. When you activate the Structural Floor tool to place structural floors, you can select different types of structural floors in the Type Selector.

You specify structural floor properties in the Instance Properties dialog. You can open this dialog in several ways, such as to right-click the structural floor and click Element Properties. See [Structural Floor Properties](#) on page 938. Structural Floor properties include the structural floor thickness and elevation of the structural floor relative to the associated level.

Other available modifications include:

- Edit the sketch. See [Sketching](#) on page 303.
- Edit the shape and thickness. See [Shape Editing for Structural Floors, Roofs and Floors](#) on page 944.
- Apply rebar cover settings.
- Add reinforcement.
- Adjust span direction. See [Span Direction](#) on page 932.
- Add slab edges. See [Slab Edges](#) on page 712.
- Apply drop panels. See [Drop Panels](#) on page 935.

Structural Floor Properties

The following table shows parameter names, values, and descriptions for structural floors. You can modify values. See [Structural Floor](#) on page 929.

Structural Floor Type Properties

Name	Description
Construction	
Structure	User selects Edit button to add, change, or delete structural floor layers. See Compound Structure on page 813.
Default Thickness	Indicates the thickness of a structural floor type, which is determined by the cumulative thickness of its layers. See Shape Editing for Structural Floors, Roofs and Floors on page 944.
Additional Top/Exterior Offset	Specifies an additional offset from the top/exterior rebar cover. This allows placing multiple rebar elements together in different area reinforcement layers.
Additional Bottom/Interior Offset	Specifies an additional offset from the bottom/interior rebar cover. This allows placing multiple rebar elements together in different area reinforcement layers.
Additional Offset	Specifies an additional offset from the rebar cover. This allows placing multiple rebar elements together in different path reinforcement layers.
Graphics	
Coarse Scale Fill Pattern	Specifies a fill pattern for a structural floor in a coarse-scale view. See View Properties on page 259
Coarse Scale Fill Color	Applies a color to the fill pattern for a structural floor in a coarse-scale view.
Identity Data	

Name	Description
Keynote	Add or edit the floor keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The manufacturer internal number.
Manufacturer	The structural floor manufacturer.
Type Comments	A field for placing general comments about the structural floor type. This information can be included in a schedule.
URL	A link to a web page that may contain type-specific information.
Description	You may provide a description of the structural floor here.
Assembly description	Describes the assembly based on the assembly code selection. This is a read-only value.
Assembly Code	The unformat assembly code selected from a hierarchical list.
Type Mark	A value to designate the specific structural floor. This value must be unique for each element in a project. Revit Architecture warns you when the number value is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Cost	The pricing of the structural floor.

Structural Floor Instance Properties

Name	Description
Constraints	
Level	The level to which the structural floor is constrained.
Height Offset from Level	Specifies the elevation of the top of the structural floor relative to the Level parameter.
Related to Mass	This is a read-only value.
Structural	
Structural	Changes between the Structural and non-Structural floor.
Rebar Cover - Top Face	The rebar cover distance from the structural floor top face.
Rebar Cover - Bottom Face	The rebar cover distance from the structural floor bottom face.
Rebar Cover - Other Faces	The rebar cover distance from the structural floor to adjacent element faces.
Estimated Reinforcement Volume	Specifies the estimated reinforcement volume of the selected element. This is a read-only parameter that only displays when rebar has been placed.
Structural Floor Shape Edit	


Name	Description
Curved Edge Condition	Specifies the structural floor surface to either Conform to curve or Project to side. This parameter is only available to curved edge structural floors. See Using the Curved Edge Condition Tool on page 948.
Dimensions	
Slope Angle	Specifies the slope of the structural floor from the horizontal.
Perimeter	Indicates the structural floor perimeter. This is a read-only value.
Area	Indicates the area of the structural floor. This is a read-only value.
Volume	Indicates the volume of the structural floor. This is a read-only value.
Thickness	Specifies the default Structural Floor thickness. This is a read-only value, unless a shape edit has been applied and its type contains a variable layer. When the value is writable it can be used to set a uniform thickness of the structural floor. The entry can be blank if the thickness varies. See Shape Editing for Structural Floors, Roofs and Floors on page 944.
Identity Data	
Comments	A field for placing general comments about the structural floor.
Mark	A label created for the structural floor. Possible use: shop mark. This value must be unique for each element in a project. Revit Architecture warns you when the number value is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Phasing	
Phase Created	Indicates in which phase the structural floor component was created. See Project Phasing on page 1331.
Phase Demolished	Indicates in which phase the structural floor component was demolished. See Project Phasing on page 1331.
Structural Analysis	
Structural Usage	This is a read-only value.
Analytical Model	
Analytical Projection Plane	The plane of the structural floor used for analysis and design.

Foundation Slabs

The Foundation Slab type has 3 more foundation-specific values than a regular structural floor has. These additional values, which are instance parameters displayed in the Instance Properties dialog, are: Width, Length, and Elevation at Bottom. Using these values, an analysis tool can distinguish between a standard structural floor and a foundation slab.

Foundation slabs may be used to model structural floors on a grade, which do not require support from other structural elements. Foundation slabs may also be used to model complex foundation shapes that cannot be created using Isolated or Wall Foundation tools.

Adding Foundation Slabs

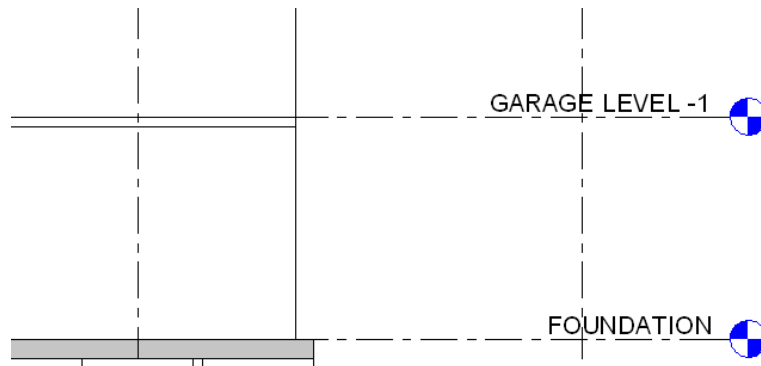
- 1 Click Home tab ► Structure panel ► Foundation drop-down ► Foundation Slab.
- 2 Click Create Floor Boundary tab ► Element panel ► Floor Properties.
- 3 In the Instance Properties dialog for type, specify the structural floor type, and click OK.
- 4 Click Create Floor Boundary tab ► Draw panel ► Boundary Line and then click  (Pick Walls) to select the walls in your model.
- 5 Click Extend into wall on the Options Bar if you want the offset to be measured from the wall's core.
- 6 Specify an offset for slab edges in the Offset text box on the Options Bar.

NOTE Instead of picking walls you can sketch a foundation slab. Use the sketch tools on the Create Floor Boundary tab ► Draw panel to form the boundary of the foundation slab. The sketch must form a closed loop or boundary condition. See [Sketching](#) on page 303.

- 7 Click Create Floor Boundary tab ► Floor panel ► Finish Floor.
- 8 Click the foundation, and select the desired Foundation family type on the Family drop-down list.

NOTE Foundation slabs are added below the level in which they are drawn. Therefore, if you add a foundation slab in Level 1, it is added below Level 1 and will not be visible in the Level 1 plan view. To see the foundation slab in a plan view, create a new level below Level 1, for example, Foundation Level. When you create a new level below Level 1, you will also be able to see the foundation slab as an underlay (displayed in halftone) in Level 1.

Foundation slab below foundation level



Related topics

- [Cutting Openings in Structural Floors](#) on page 934
- [Modifying Structural Floors](#) on page 937
- [Structural Floor](#) on page 929

Foundation Slab Properties


You can specify the Structural Usage parameter of a Foundation slab: either Foundation or Slab on Grade. If set to Foundation, the slab will provide support for other elements connected to it. If set to Slab on Grade, the slab will only support itself. The Foundation Slab Type also has an additional, read-only parameter, Elevation at Bottom. The Elevation at Bottom parameter is used for tagging the Bottom of the Foundation elevation. You can modify parameter names, values, and descriptions for Foundation Slabs.

See [Foundation Slabs](#) on page 940.

Foundation Slab Type Properties

Name	Description
Construction	
Structure	Select the Edit button to add, change, or delete slab layers.
Thickness	Slab thickness. This is a read-only parameter.
Graphics	
Coarse Scale Fill Pattern	Specifies a fill pattern for a slab in coarse-scale view. Click in the value box to open the Fill Patterns dialog. See View Properties on page 259.
Coarse Scale Fill Color	Applies a color to the fill pattern for a slab in a coarse-scale view.
Identity Data	
Keynote	Add or edit the slab keynote. Click in the value box to open the Keynotes dialog. See Keynotes on page 1117.
Model	The manufacturer internal number.
Manufacturer	The slab manufacturer.
Type Comments	A field for placing general comments about the slab type. This information can be included in a schedule.
URL	A link to a web page that may contain type specific information.
Description	Enter or edit the description of the slab.
Assembly Description	Describes the assembly based on the assembly code selection. This is a read-only parameter.
Assembly Code	A unformat assembly code selected from a hierarchical list.
Type Mark	A value that designates the specific slab. This value must be unique for each element in a project. Revit Architecture warns you when the number value is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Cost	The pricing of the slab.

Foundation Slab Instance Properties

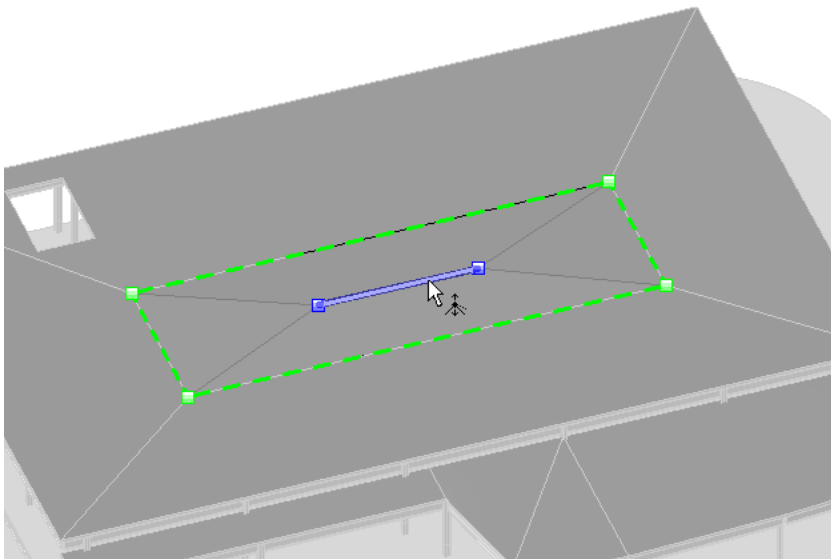
Name	Description
Constraints	
Level	Specifies the level that the slab is constrained to.
Height Offset From Level	Specifies the elevation of the top of the slab relative to the constrained level of the slab.
Related to Mass	This is a read-only value.
Structural	
Structural	If checked, Slab has an Analytical Model and is exported to analysis packages.
Rebar Cover - Top Face	The rebar cover distance from the foundation slab top face.
Rebar Cover - Bottom Face	The rebar cover distance from the foundation slab bottom face.
Rebar Cover - Other Faces	The rebar cover distance from the foundation slab to adjacent element faces.
Estimated Reinforcement Volume	Specifies the estimated reinforcement volume of the selected element. This is a read-only parameter that only displays when rebar has been placed.
Dimensions	
Slope	Specifies the slope of the slab from the horizontal plane.
Perimeter	Indicates the slab perimeter. This is a read-only parameter.
Area	Indicates the area of the slab. This is a read-only parameter.
Volume	Indicates the volume of the slab. This is a read-only parameter.
Width	Indicates the width of the slab, if rectangular. This is a read-only parameter.
Length	Indicates the length of the slab, if rectangular. This is a read-only parameter.
Elevation at Bottom	<p>Indicates the elevation used for tagging the Bottom of Foundation. This parameter is affected by the family parameter Cap (see Family Category and Parameters on page 433). The following image shows the difference between the Cap parameter enabled (in red) and disabled (in green).</p>  <p>The Elevation at Bottom measurement is taken from this setting. This is a read-only parameter.</p>
Identity Data	
Comments	A field for placing general comments about the slab.
Mark	A label created for the slab. Possible use: shop mark. This value must be unique for each element in a project. Revit Architecture warns you when the number

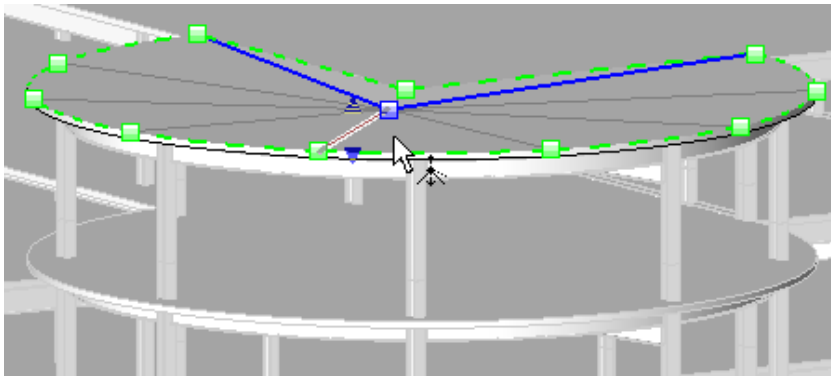
Name	Description
	value is already used but allows you to continue using it. You can see the warning using the Review Warnings tool. See Reviewing Warning Messages on page 1415.
Phasing	
Phase Created	Indicates in which phase the slab component was created. See Project Phasing on page 1331.
Phase Demolished	Indicates in which phase the slab component was demolished. See Project Phasing on page 1331.
Structural Analysis	
Structural Usage	If set to Foundation, the slab will provide support for other elements connected to it. If set to Slab on Grade, the slab will only support itself.
Analytical Model	
Analytical Projection Plane	The plane of the slab used for analysis and design.

Shape Editing for Structural Floors, Roofs and Floors

You can use shape editing tools to manipulate the surface of either an existing horizontal structural floor, roof, or floor, by defining high and low points for drainage. By specifying the elevation of these points, you split the surface into sub-regions that can slope independently.

Shape edit examples





Use shape editing tools to slope a constant thickness structural floor or the top surface of a structural floor with a variable thickness layer, to model the following:

- A constant thickness structural floor or roof supported by sloped non-planar framing.
- A variable thickness material used to slope the surface of a horizontal plane (for example, tapered insulation).

NOTE Structural floors and roofs that have been shape edited will not report a true thickness. The shape editing tools were designed to allow for moderate slopes and in such cases, variances in true thickness are trivial. However, more significant slopes will increase this variance. Revit Architecture will issue a warning when a slope significantly deviates from the expected thickness.

In order to enable shape editing tools, the following conditions must be met:

- Structural Floors must be flat and on a horizontal plane.
- A roof cannot attach to another roof, and the roof cannot be a curtain roof. If either of these conditions is not met, you cannot use the slab shape edit buttons.

NOTE If these conditions are violated later, by element editing, the slab shape edit will cause an error with a callback, allowing the user to reset the slab shape edit.

You can use the following shape edit tools on the Modify Floors tab ► Shape Editing panel

- Sub Elements
- Add Point
- Add Split Line
- Pick Supports
- Reset Shape

NOTE Editing the shape of a structural floor, roof, or floor with these tools does not affect the shape of its analytical model. A single analytical model face, based on the original top face, remains unchanged.

Important Considerations

Automatic Split Lines. In order to maintain the accuracy of the structural floor/roof geometry, split lines are sometimes created automatically. Automatically created split lines will be deleted when the condition that caused them to be created is no longer valid. For example, when 4 non-planar vertices become planar, or when you manually create a split line.

Warped Structural Floor/Roofs. A surface will warp when bounded by 4 non-planar boundary edges or user-created split lines. To avoid warping, add a split line between opposite vertices.

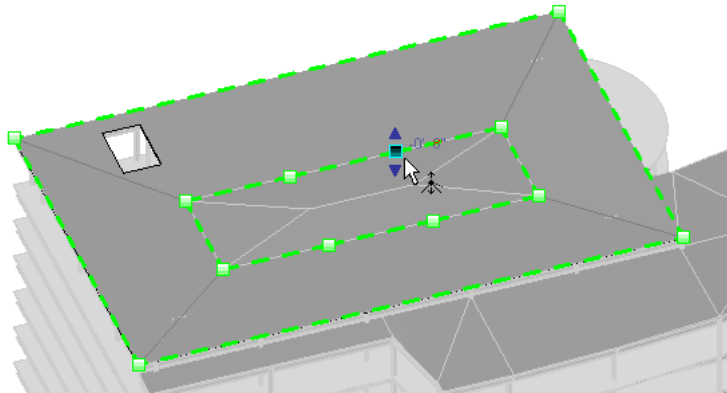
Using the Modify Sub Elements Tool

You can use the Modify Sub Elements tool to manipulate one or more of the points or edges on a selected structural floor, roof, or floor.

- 1 Select the structural floor, roof, or floor you want to modify.
- 2 Click Modify Floors tab ► Shape Editing panel ► Modify Sub Elements.

NOTE When you select the Modify Sub Elements tool, the Options Bar will display an Elevation edit box in which you can enter a common elevation value for all the selected sub elements. This value is the vertical offset between the vertices and the original top face of the structural floor.

- 3 Drag a point or edge to modify the location or elevation.



NOTE If you place the cursor over the structural floor, you can press *Tab* to pick specific sub elements. Standard selection methods also apply. See [Selecting Multiple Elements](#) on page 340.

- Dragging a blue arrow moves the point vertically.
 - Dragging a red square (shape handle) moves the point horizontally.
- 4 Click the text control to enter a precise height value for the selected point or edge.
The value of the height represents the offset from the original top face of the structural floor.

NOTE For an edge this means that the center is moved to the specified height, but the relative heights of the 2 ends are maintained.

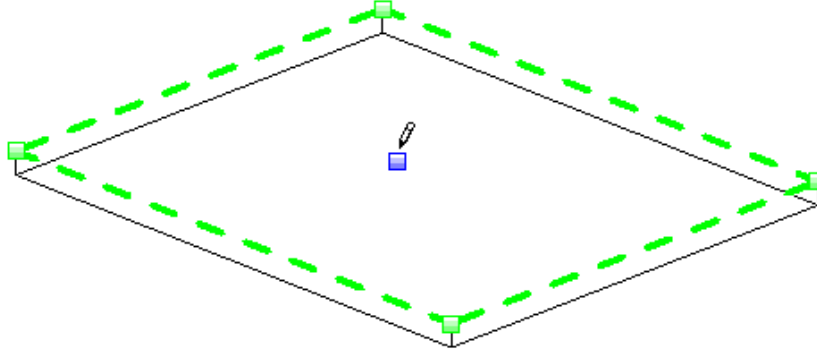
Using the Add Point Tool

You can use the Add Point tool to add singular points to the element geometry. The points are used by the shape modification tools to change the element geometry.

- 1 Select the structural floor, roof, or floor you want to modify.
- 2 Click Modify Floors tab ► Shape Editing panel ► Add Point.

NOTE The Elevation edit box displays on the Options Bar with a Relative check box next to it. If you select Relative, new points will be added at the specified value, relative to the surface on which they are added. So, with the default value of 0 the points will lie in the surface that they were created on. If you clear the check box, the value in the edit box represents the project elevation, and points will be added at this elevation.

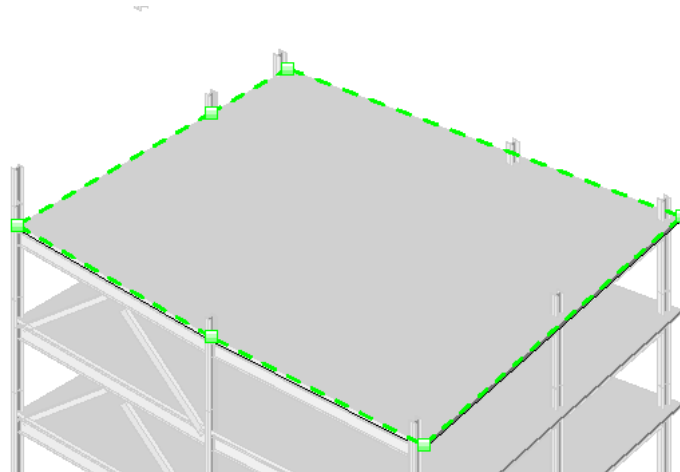
- 3 Click on the face or edges of the structural floor, roof, or floor to add points that define a slope.



Using the Add Split Line Tool

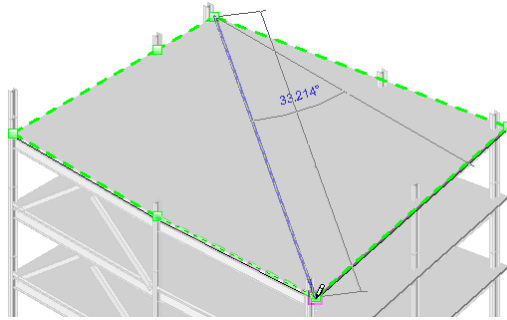
You can use the Add Split Line tool to add linear edges and to split the existing face of a structural floor into smaller sub-regions.

- 1 Select the structural floor you want to modify.

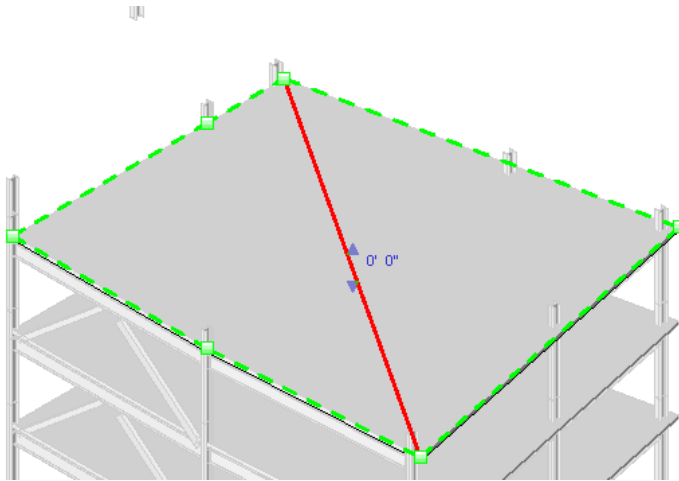


- 2 Click Modify Floors tab ► Shape Editing panel ► Add Split Line.
- 3 Select a vertex, edge, face or point anywhere on the structural floor to start the split line.

NOTE Start points and endpoints can be added anywhere on the face of the structural floor. If your cursor is over a vertex or edge, the editor will snap to 3D vertices and edges and present standard snap controls with temporary dimensions along the edges. If no vertex or edge is snapped to, then on selection, the line end will be projected to the closest point on the surface. No temporary dimensions will be created on the face.



- 4 Select another vertex, edge, face or point anywhere on the structural floor to end the split line. A new edge will be added to the face of the structural floor.



Using the Pick Supports Tool

You can use the Pick Supports tool to pick beams to define split lines and create constant bearing lines for the structural floor.

- 1 Select the structural floor, roof, or floor you want to modify.
- 2 Click Modify Floors tab ► Shape Editing panel ► Pick Supports.
- 3 Select an existing beam.

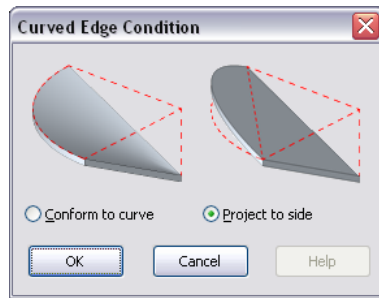
A new split edge is created using the endpoint elevations from the picked reference. The elevations are moved up from the bottom face to the top face of the structural floor or roof using the structural floor or roof thickness.

Using the Curved Edge Condition Tool

Structural Floors drawn with arc segments can be altered using structural floor shape editing tools. The Curved Edge Condition tool is an additional tool specific to curved edges. It sets them to project a flat surface to the edge or a curved surface that conforms to the arc edge of the structural floor.

- 1 Right click the shape edited curved edge structural floor you want to modify and select Element Properties.

- 2 In the Instance Properties dialog, click the Curved Edge Condition button located under Structural Floor Shape Edit. This opens the Curved Edge Condition Dialog.



- 3 Select either Conform to curve for a scalloped surface, or Project to side for a flat surface.
- 4 Click OK to apply the condition.
- 5 Click OK to close the Instance Properties dialog.

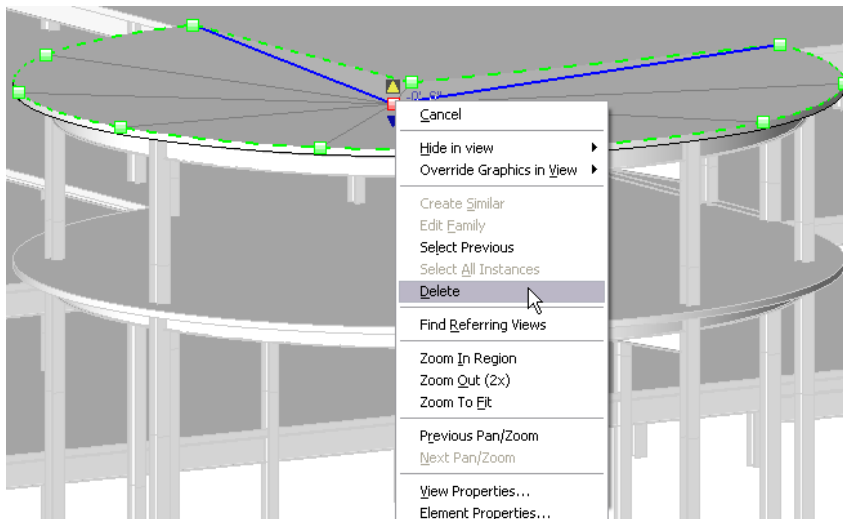
Using the Reset Shape Tool

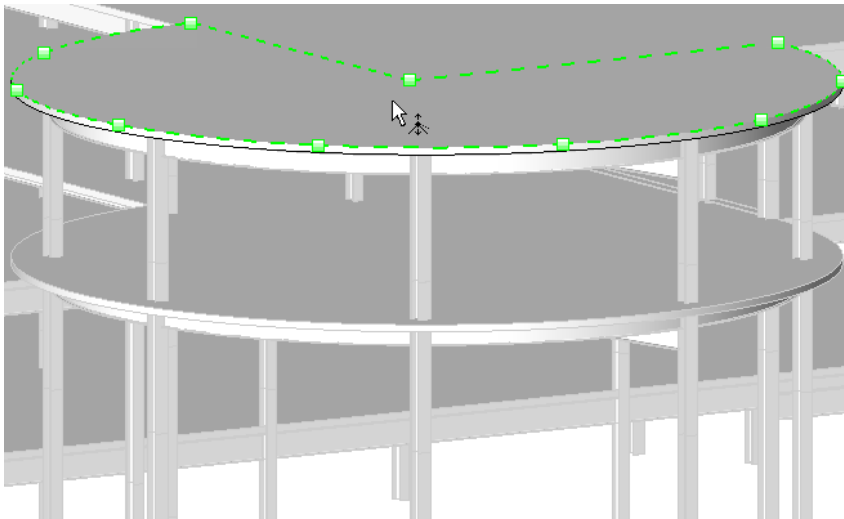
To remove structural floor shape modifications and reset the element geometry to its original state, click Click Modify Floors tab ► Shape Editing panel ► Reset Shape.

Deleting Shape Modifiers

To delete shape edit elements:

- 1 Select the modified structural floor.
- 2 Click Modify Floors tab ► Shape Editing panel ► Modify Sub Elements.
- 3 Click on the shape edit element to select it.
- 4 Either press *Delete* or right-click the element and select Delete.



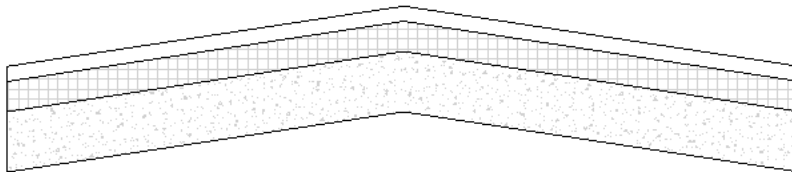


The shape edit element is removed and the structural floor adjusts its geometry accordingly.

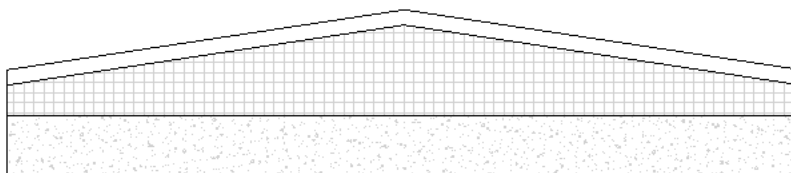
Variable Layer Thickness for Roofs and Structural Floors

The variable layer thickness parameter of roofs and structural floors affects the shape editing tools in the following ways:

- When there is no variable thickness layer, the whole roof or structural floor slopes and maintains constant thickness between parallel top and bottom faces.



- When there is a variable thickness layer, the top face of the roof or structural floor slopes, and the bottom stays in a horizontal plane, creating a variable thickness structural floor.



NOTE There is a Thickness property for structural floors. If the structural floor has a structural floor shape edit, and if the structural floor type contains a variable layer, then this parameter can be used to set the structural floor to a uniform thickness by entering a desired value.

To modify the variable thickness layer of a structural floor or roof

- 1 Right-click the structural floor or roof, and select Element Properties.
- 2 In the Instance Properties dialog, click Edit Type.

- 3 In the value box of the Structure property, click Edit.
- 4 In the Edit Assembly dialog, specify the material for layers and the thickness of those layers. The variable thickness parameter column will contain empty check boxes next to layers where variable thickness can be enabled. For more information about the Edit Assembly dialog, see [Compound Structure](#) on page 813.
- 5 Next to the desired layer of the roof or structural floor in the assembly, select the variable check box
- 6 Click OK until all of the dialogs are closed.
- 7 Click Modify Floors tab ► Shape Editing panel ► Modify Sub Elements and make the desired changes to your roof or structural floor. For more information, see [Using the Modify Sub Elements Tool](#) on page 946.

Structural Component Tags

Structural components can be annotated with tag components as needed. Some structural component instances are annotated by default when they are placed. For example, beam size is displayed when you add a beam to your model.

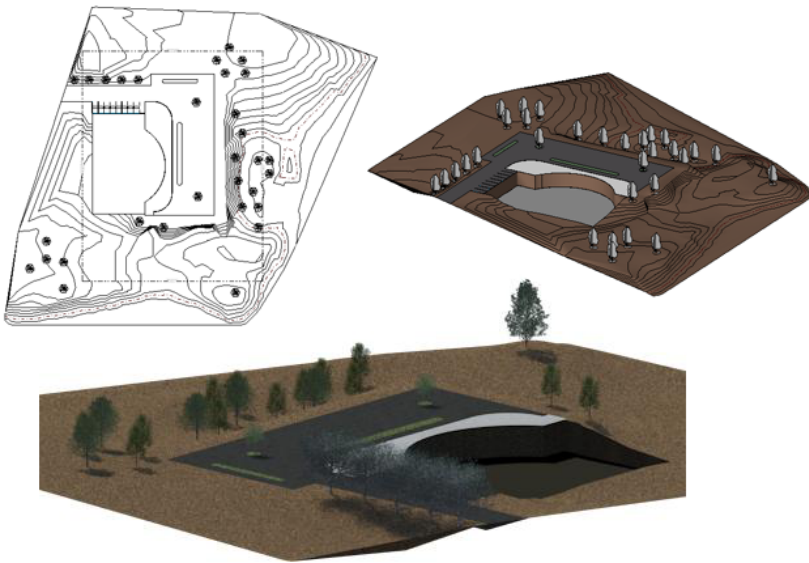
Structural framing tag families are available in the Annotations folder of the Library folder. You have a choice of loading a several different tags, depending upon the component. For information about loading a family, see [Loading Families](#) on page 427.

Columns and structural floors are not annotated by default in plan view. You can place their tags by using the Tag button. For example, to tag a column, click Annotate tab ► Tag panel ► Tag, and select a column in the plan view. The column size tag will be placed in your view. For more information about tags, see [Tags](#) on page 1123.

Site Design

15


Revit Architecture features several tools to help you lay out a site plan. You can start by sketching a toposurface, add property lines, a building pad, and parking and site components. You can then create a 3D view or render it for a more realistic presentation.



Site Settings

You can modify a project's global site settings at any time. You can define contour line intervals, add user-defined contour lines, and select the section cut material.

Defining Site Settings

1 Click Massing & Site tab ► Model Site panel ► .

2 To display contour lines in a site plan, do the following:

- Select At Intervals Of, and enter a value for contour line intervals. This value determines the elevation at which contour lines display.

- For Passing Through Elevation, enter a value to set the starting elevation for contour lines. By default, Passing Through Elevation is set to zero. If you set the contour interval to 10, for example, lines display at -20, -10, 0, 10, 20. If you set the Passing Through Elevation value to 5, lines display at -25, -15, -5, 5, 15, 25.

3 To add custom contour lines to a site plan, click Insert, and specify the following values:

- **Start.** Enter the elevation where additional contour lines begin to display.
- **Stop.** Enter the elevation at which additional contour lines no longer display. This value is enabled when you select Multiple Values for Range Type.
- **Increment.** Specify the increment for each additional contour line. This value is enabled when you select Multiple Values for Range Type.
- **Range Type.** For one additional contour line, select Single Value. For multiple contour lines, select Multiple Values.
- **Subcategory.** Specify the line style for the contour line. The default styles are Hidden Lines, Primary Contours, Secondary Contours, and Triangulation Edges. To create a custom line style, see [Object Styles](#) on page 493.

NOTE If you clear At Intervals of, custom contour lines still display.

4 Under Section Graphics, do the following:

- For Section cut material, select a material to use to display the site in a section view. Appropriate materials include Site-Earth, Site-Grass, and Site-Sand. See [Searching for a Material](#) on page 470.
- For Elevation of poche base, enter a value to control the depth of the cross-section of earth, for example, -30 feet or -25 meters. This value controls the poche depth for all topography elements in your project.

5 Under Property Data, do the following:

- Specify an option for Angle Display. If you select Degrees, property lines display in the Property Lines bearings table using the 360-degree bearing standard. Property line tags display using the same notation.
- Specify an option for Units. If you select Decimal degrees, the angles in the Property Lines bearings table display as decimals rather than as degrees, minutes, and seconds.

6 Click OK.

To see the results of your changes to the contour line settings, open a site plan view. To see the results of your changes to the section cut material, open a section view.

Related topics

- [Contour Line Labels](#) on page 971
- [Project Location and Orientation](#) on page 448
- [Site Settings Properties](#) on page 955

Site Settings Properties

Name	Description
Contour Line Display	Displays contour lines. If you clear the check box, custom contour lines still display in the drawing area.
At Intervals of	Sets the interval between contour lines.
Passing Through Elevation	Contour intervals are based on this value. For example, if you set the contour interval at 10, contour lines display at -20, -10, 0, 10, 20. If the Passing Through Elevation value is set to 5, lines display at -25, -15, -5, 5, 15, 25.
Additional Contours	
Start	Sets the elevation where additional contour lines begin.
Stop	Sets the elevation where additional contour lines no longer display.
Increment	Sets the interval for additional contour lines.
Range Type	Select Single Value to insert one additional contour line. Select Multiple Values to insert additional incremental contour lines.
Subcategory	Sets the type of contour lines to display. Select a value from the list. You can define custom contour line types using the Object Styles tool, in the Topography category.
Section Graphics	
Section cut material	Sets the material that displays in a section view.
Elevation of poche base	Controls the depth of the cross-section of earth (for example, –30 feet or –25 meters). This value controls the poche depth for all topography elements in your project.
Property Data	
Angle Display	Specifies the display of angular values on property line tags.
Units	Specifies the units to use when displaying bearing values in the Property Lines table.

Toposurfaces

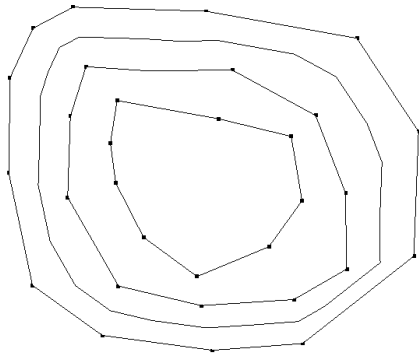
The Toposurface tool defines a topographical surface (a toposurface) using points. You can create toposurfaces in 3D views or site plans.

When viewing a toposurface, consider the following:

- **Visibility.** You can control the visibility of topographic points. There are 2 topographic point subcategories, Boundary and Interior. Revit Architecture classifies points automatically.
- **Triangulation edges.** Triangulation edges for toposurfaces are turned off by default. You can turn them on by selecting them from the Model Categories/Topography category in the Visibility/Graphics dialog.

See [Visibility and Graphic Display in Project Views](#) on page 198.

Sample topographical surface defined by picking points in a site plan view



Creating a Toposurface by Picking Points

- 1 Open a 3D or site plan view.
- 2 Click **Massing & Site** tab ► **Model Site** panel ► **Toposurface**.
Revit Architecture enters sketch mode.
- 3 On the **Options Bar**, set a value for **Elevation**.
This value determines the elevation of the point being placed. (The points and their elevations are used to create the surface.)
- 4 Next to the **Elevation** text box, select one of the following:
 - **Absolute Elevation**. Points display at the specified elevation. You can place points anywhere in the active drawing area.
 - **Relative to Surface**. Allows you to edit an existing toposurface by placing points on it at the elevation you specify. To use this option effectively, you may want to work in a shaded 3D view.
- 5 Click in the drawing area to place points. If needed, change the elevation on the **Options Bar** as you place additional points.
- 6 To complete the surface, click **Finish Surface**.

If you need to modify the toposurface, select it and click **Modify Topography** tab ► **Surface** panel ► **Edit Surface**. Edit the sketch, and click **Finish Surface**.

Related topics

- [Splitting a Toposurface](#) on page 959
- [Toposurface Subregions](#) on page 958
- [Toposurface and Subregion Properties](#) on page 961

Creating a Toposurface from Imported 3D Data

You can automatically generate a toposurface based on 3D contour data imported in DWG, DXF, or DGN formats. Revit Architecture analyzes the 3D contour data and places a series of elevation points along the contour lines.

You must import the 3D contour data before creating the surface. See [Importing or Linking CAD Formats](#) on page 1387.

NOTE When you import data with the Current View Only option selected, you cannot use the data to create a toposurface.

To create a toposurface from imported 3D data:

- 1 Open a 3D view of the site plan.
- 2 Click Massing & Site tab ► Model Site panel ► Toposurface.
- 3 Click Edit Surface tab ► Tools panel ► Create from Import drop-down ► Select Import Instance.
- 4 Select the imported 3D contour data in the drawing area.
The Add Points from Selected Layers dialog displays.
- 5 Select the layers to which you want to apply elevation points, and click OK.
Revit Architecture analyzes the imported 3D contour data and generates a toposurface based on the elevation points placed along the contour lines.
- 6 Click Finish Surface.

Related topics

- [Splitting a Toposurface](#) on page 959
- [Toposurface Subregions](#) on page 958
- [Toposurface and Subregion Properties](#) on page 961

Creating a Toposurface from a Points File

You can automatically generate a toposurface based on a points file. A points file is typically generated by a civil engineering software application. The file provides contour data using a regularized grid of elevation points.

The points file must contain x, y, and z coordinate numbers as the first numeric values in the file. The file must also be in a comma-delimited file format (a CSV or TXT file). Additional information in the file (such as a point name) is ignored. Any additional numeric information for a point must occur after the x, y, and z coordinate values. If the file contains 2 points with the same x and y coordinates, Revit Architecture uses the point with the largest z value.

To create a toposurface from a points file:

- 1 Open a 3D or site plan view.
- 2 Click Massing & Site tab ► Model Site panel ► Toposurface.
- 3 Click Edit Surface tab ► Tools panel ► Create From Import drop-down ► Specify Points File.
- 4 In the Open dialog, do the following:
 - a Navigate to the location of the points file.
 - b For Files of type, select the type of points file: CSV or comma-delimited text.
 - c Select the points file, and click Open.
- 5 In the Format dialog, specify the units used to measure the points in the points file (for example, decimal feet or meters), and click OK.
Revit Architecture generates points and a toposurface from the coordinate information in the file.
- 6 Click Finish Surface.

Related topics

- [Splitting a Toposurface](#) on page 959
- [Toposurface Subregions](#) on page 958
- [Toposurface and Subregion Properties](#) on page 961

Simplifying a Toposurface

Simplifying a surface can improve system performance, particularly on surfaces with a large number of points.

- 1 Open the site plan view and select the toposurface.
- 2 Click Modify Topography tab ► Surface panel ► Edit Surface.
- 3 Click Edit Surface tab ► Tools panel ► Simplify Surface.
- 4 Enter a value for surface accuracy, and click OK.
- 5 Click Finish Surface.


Related topics

- [Merging Toposurfaces](#) on page 960
- [Toposurface and Subregion Properties](#) on page 961
- [Toposurfaces](#) on page 955

Toposurface Subregions

Toposurface subregions are areas that you sketch inside existing toposurfaces. For example, you can use subregions to draw parking lots on a graded surface, roads, or islands. Creating a subregion does not result in separate surfaces. It merely defines an area of the surface where you can apply a different set of properties, such as material.

To add a toposurface subregion:

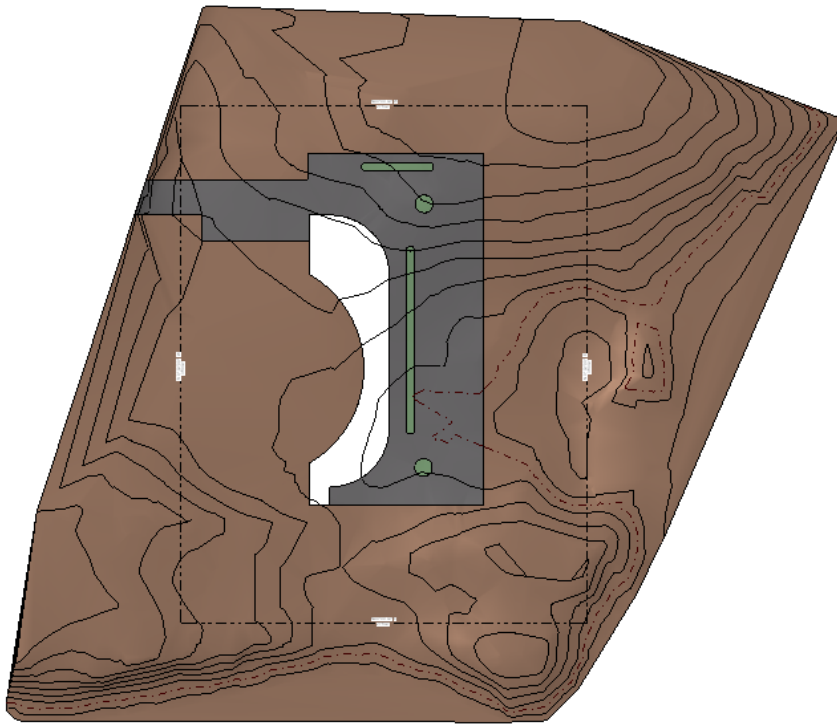
- 1 Click Massing & Site tab ► Modify Site panel ► Subregion.
Revit Architecture enters sketch mode.
- 2 Click Create Subregion Boundary tab ► Draw panel ►  (Pick Lines) or use other sketch tools to create a subregion on the toposurface. See [Sketching](#) on page 303.
- 3 Click Finish Subregion.

If you need to modify the shape of the subregion, select it, and click Modify Topography tab ► Subregion panel ► Edit Boundary. Edit the sketch, and click Finish Subregion.

Related topics

- [Splitting a Toposurface](#) on page 959
- [Graded Regions](#) on page 960
- [Toposurface and Subregion Properties](#) on page 961

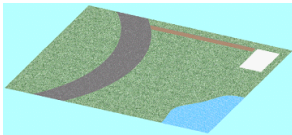
The following image shows a toposurface that has a toposurface subregion, shown in gray.




Splitting a Toposurface

You can split a toposurface into 2 distinct surfaces and then edit those surfaces independently. After splitting a surface, you can assign different materials to these surfaces to depict roads, lakes, plazas, or hills. You can also delete entire portions of the toposurface.

Sample split surface



To split a toposurface:

- 1 Open a site plan or 3D view.
- 2 Click Massing & Site tab ► Modify Site panel ► Split Surface.
- 3 In the drawing area, select the toposurface to split.
Revit Architecture enters sketch mode.
- 4 Click Split Surface tab ► Draw panel ►  (Pick Lines), or use other sketch tools to split the toposurface.
You cannot pick toposurface lines with the Pick Lines tool. You can pick other valid lines, such as walls.
- 5 To sketch the split surface, use one of the following methods:
 - Sketch a single closed loop that does not touch boundaries of the surface.

- Sketch any number of open loops. Both ends of an open loop must lay on the boundary of the surface. No part of the open loop can intersect or be coincident with the boundary of the surface.

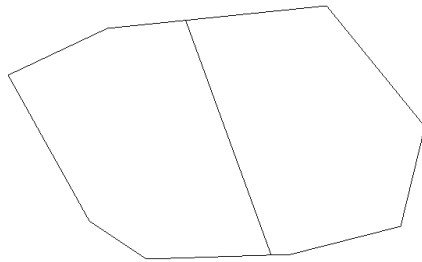
6 Click Finish Split Surface.

Merging Toposurfaces

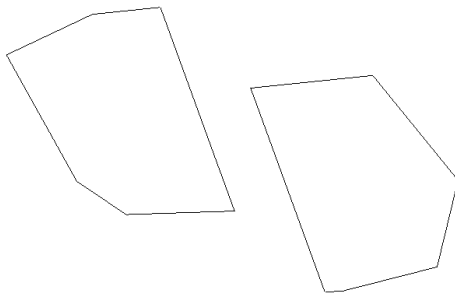
You can merge 2 separate toposurfaces into one surface. This tool is useful after previously splitting the surface. See [Splitting a Toposurface](#) on page 959.

The surfaces to be merged must share a common edge or overlap.

Valid split surfaces for merging



Invalid split surfaces for merging



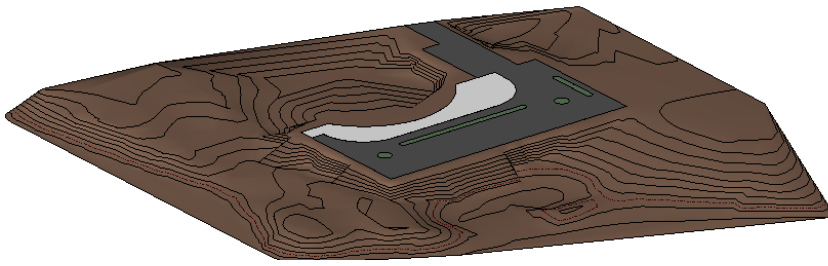
To merge toposurfaces

- 1 Click Massing & Site tab ► Modify Site panel ► Merge Surfaces.
- 2 If desired, on the Options Bar, clear Remove points on common edges.
This option removes excess points that were inserted after a surface was split. The option is selected by default.
- 3 Select the primary surface.
- 4 Select the secondary surface.

The 2 surfaces merge into one.

Graded Regions

To create a graded region, you select a toposurface to modify. The surface should be an existing surface in the current phase. (See [Phase Filters](#) on page 1333.) Revit Architecture marks the original surface as demolished and makes a copy with a matching boundary. Revit Architecture marks the copy as new in the current phase.



To grade a toposurface

- 1 Click Massing & Site tab ► Modify Site panel ► Graded Region.
- 2 In the Edit Graded Region dialog, select one of the following:
 - Create a new toposurface exactly like the existing one.
 - Create a new toposurface based on the perimeter points only.
- 3 Select the toposurface.

If you are editing the surface, Revit Architecture enters sketch mode. You can add or delete points, change the elevation of points, or simplify the surface.
- 4 When you are finished editing the surface, click Finish Surface.

If you drag the new graded region, notice that the original remains. Select the original, right-click, and click Element Properties. Notice that the Phase Demolished property has the value of the current phase.

Related topics

- [Reporting Cut and Fill Volumes on a Site](#) on page 964
- [Toposurface Subregions](#) on page 958
- [Toposurface and Subregion Properties](#) on page 961

Toposurface and Subregion Properties

Name	Description
Materials and Finishes	
Material	Select the surface material from the list. You can create your own toposurface material. Topographical surfaces do not support materials with surface patterns. See Materials on page 468.
Dimensions	
Projected Area	The projected area is the area that the surface covers when you look down on it. This is a read-only value.
Surface Area	Displays the total surface area. This is a read-only value.
Identity Data	
Comments	User-defined comments about the toposurface, which can display in schedules.
Name	The name of the toposurface, which can display in schedules.

Name	Description
Mark	A unique identifier you can assign.
Phasing	
Phase Created	The phase when the toposurface is created.
Phase Demolished	The phase when the toposurface is demolished.

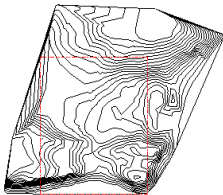
Property Lines

To create property lines, you can use the sketching tools in Revit Architecture or enter survey data directly into the project. Revit Architecture aligns the survey data with True North. See [Rotating a View to True North](#) on page 449.


In addition to viewing property lines in a drawing, you can do the following with them:

- **Scheduling.** You can schedule property lines. The schedule can include the Name and Area property line parameters. (The format of the area comes from the Area Units Format type property of the property lines.) When you create the schedule, select Property Lines as the category to schedule. See [Creating a Schedule or Quantity](#) on page 173.
- **Tagging.** You can tag property lines that can report square footage or acreage. Load the tags from the Annotations folder of the Revit Architecture family library. The tags are Property Tag - Acres.rfa (acreage), Property Tag - SF.rfa (square footage), and M_Property Tag.rfa (metric).
- **Exporting.** You can export property line area information when you export your project to an ODBC database. For more information about creating an ODBC database, see [Exporting to ODBC](#) on page 1362.

Property lines on a topographical surface



Sketching Property Lines

- 1 Open a site plan view.
- 2 Click Massing & Site tab ► Modify Site panel ► Property Line.
- 3 In the Create Property Line dialog, select Create by sketching.
- 4 Click Create Property Line Sketch tab ► Draw panel ►  (Pick Lines) or other sketch tools to sketch lines.
- 5 Sketch the property lines.
Lines should form a closed loop. If you sketch an open loop, and click Finish Property Line, Revit Architecture issues a warning that it will not calculate the area. You can ignore the warning to continue, or close the loop. See [Sketching](#) on page 303.
- 6 Click Finish Property Line.

Related topics

- [Property Lines](#) on page 962
- [Converting Sketched Property Lines to Table-Based Property Lines](#) on page 963

Converting Sketched Property Lines to Table-Based Property Lines

- 1 Open a site plan view.
- 2 In the drawing area, select the sketched property line.
- 3 Click Modify Property Lines tab ► Property Lines panel ► Edit Table.
- 4 Read the Constraints Lost warning, and click Yes to continue.
- 5 In the Property Lines dialog, make any necessary changes and click OK.

Creating Property Lines with Survey Data

- 1 Open a site plan view.
- 2 Click Massing & Site tab ► Modify Site panel ► Property Line.
- 3 In the Create Property Lines dialog, select Create by entering distances and bearings.
- 4 In the Property Lines dialog, click Insert, and add the distances and bearings from your survey data.
- 5 To describe a property line as an arc, do the following:
 - For Distance and Bearing, enter values that describe a line segment between 2 points on the arc.
 - For Type, select Arc.
 - For Radius, enter a value.
The radius value must be greater than half the length of the line segment. The larger the radius, the larger the circle becomes, resulting in a flatter arc.
 - For L/R, select L if the arc appears to the left of the line segment. Select R if the arc appears to the right of the line segment.
- 6 Insert additional lines as needed.
- 7 Click Up and Down to modify the order of the property lines.
- 8 If the From Last to First Point value is not Closed, you can insert a new line or click Add Line to Close.
- 9 Click OK.

NOTE If you sketch an open loop and click OK, Revit Architecture issues a warning that it will not calculate the area. You can ignore the warning to continue.

- 10 In the drawing area, move the property lines to their exact placement, and click to place.
- 11 If the property line boundary does not have the desired look, select the boundary, and click Modify Property Lines tab ► Property Lines panel ► Edit Table.

NOTE You can snap the property line to a benchmark using the Move tool. See [Moving Elements with the Move Tool](#) on page 373.

Related topic

- [Property Lines](#) on page 962

Reporting Cut and Fill Volumes on a Site

Revit Architecture can report cut and fill volumes on a site to aid in determining the costs of landscape modification during site development.

Revit Architecture reports the values by making a comparison between a surface from one phase and, from a later phase, another surface whose boundary lies within the earlier surface. For example, Revit Architecture can compare a toposurface created in Phase 1 and a toposurface created in Phase 2 that lies within the boundary of the surface from Phase 1. (See [Project Phasing](#) on page 1331.)

When you select the later surface and click Element Properties, you see the following instance properties:

- The Cut value is the volume removed (where the later surface is lower than the earlier surface).
- The Fill value is the volume added (where the later surface is higher than the earlier surface).
- Net Cut/Fill value comes from subtracting the cut value from the fill value.

Viewing the Cut/Fill Volumes

This procedure is a general method of reporting cut/fill values. There are other ways to report values, including sketching a new surface within an existing surface.

- 1 Create a toposurface in a site plan view. See [Toposurfaces](#) on page 955.
- 2 Select the finished toposurface.
- 3 Click Modify Topography tab ► Element panel ► Element Properties.
- 4 In the Instance Properties dialog, set Phase Created to a phase earlier than the view's phase.
For example, when the view's phase is New Construction, set the Phase Created value to Existing.
- 5 To create a graded region on the toposurface, do the following:
 - Click Massing & Site tab ► Modify Site panel ► Graded Region.
 - In the Edit Graded Region dialog, select Create a new toposurface exactly like the existing one.
 - Select the toposurface.

This demolishes the original surface and creates a copy that occupies the same boundary as the original.

- 6 Click Finish Surface.
- 7 Select the toposurface copy, and click Modify Topography tab ► Element panel ► Element Properties.

Revit Architecture lists the new cut/fill properties for the toposurface.

NOTE You may need to press *Tab* to select the copied surface. You can apply a phase filter to the view to see only new elements, and not demolished ones. See [Phase Filters](#) on page 1333.

Cut and Fill in a Schedule

You can create a topography schedule that includes cut, fill, and net cut/fill values. You should also name the different surfaces to distinguish them in your schedule. See [Creating a Schedule or Quantity](#) on page 173.

Cut and Fill Reporting with Building Pads

If you add a building pad to a graded surface, you will see cut and fill reported separately for the pad and the toposurface in a topography schedule. This is because the pad divides the graded surface into 2 surfaces: one is the surface under the pad (the graded surface), and one is the surface that is not under the pad (the pad surface).

You should name both the graded surface and the pad surface to distinguish them in your schedule.

To select the surface under the pad, press *Tab* to highlight it, or turn off the pad's visibility. See [Overriding Visibility and Graphic Display of Individual Elements](#) on page 199.

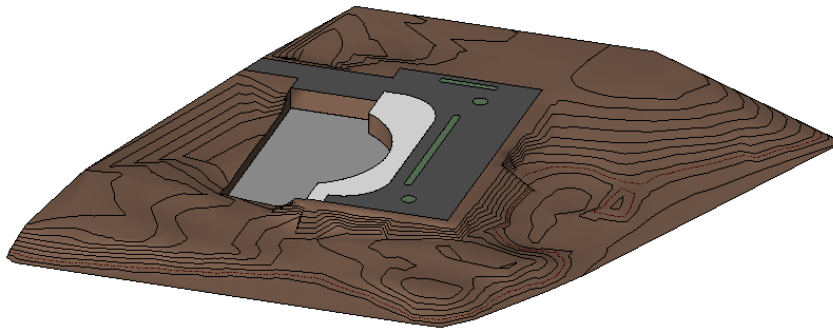
Building Pads

You can add a building pad to a toposurface and then modify the pad's structure and depth. You add a building pad by sketching a closed loop on a toposurface. After sketching the pad, you can specify a value to control the height offset from the level and other properties. You can define openings in the pad by sketching closed loops inside the perimeter of the building pad, and you can define a slope for the building pad.

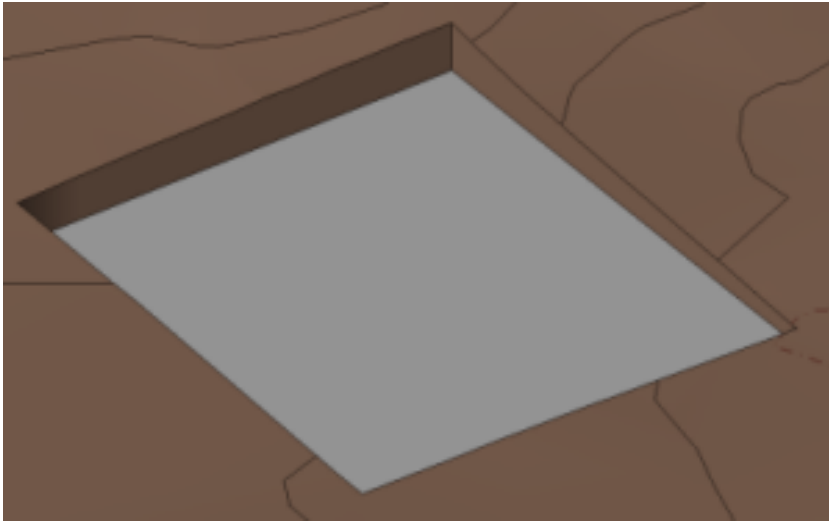
The following image shows a section view of a building pad offset from the surface.



The following image shows a 3D view of a building pad on a graded toposurface.



The following image shows a 3D view of a sloped building pad on a toposurface.



You can add a building pad to a toposurface only. It is recommended that you create the building pad within a site plan. However, you can add a building pad to a toposurface in a floor plan view. The pad may not be immediately visible in the floor plan view if the view range or building pad offset are not adjusted appropriately. For example, suppose that you sketch a toposurface at an elevation of 10 meters in a floor plan view. You then sketch a pad on the surface at an offset of –20 meters from the surface. If the view depth of the plan view is not low enough, you will not see the pad. See [View Range](#) on page 247.

Adding a Building Pad

- 1 Open a site plan view.
- 2 Click Massing & Site tab ► Model Site panel ► Building Pad.
- 3 Click Create Pad Boundary tab ► Draw panel, and use the draw tools to sketch the building pad as a closed loop. See [Sketching](#) on page 303.
- 4 Click Create Pad Boundary tab ► Element panel ► Building Pad Properties.
- 5 In the Instance Properties dialog, set the Height Offset From Level and other building pad properties as needed. See [Building Pad Properties](#) on page 968.
- 6 Click OK.
- 7 Click Finish Building Pad.

TIP To see the building pad in a Floor Plan view, set the building pad offset to a value higher than Level One, or adjust the view range.

Related topics

- [Modifying Building Pads](#) on page 966
- [Modifying the Structure of a Building Pad](#) on page 967
- [Sloping a Building Pad](#) on page 967
- [Building Pad Properties](#) on page 968

Modifying Building Pads

- 1 Open the site plan that contains the building pad.
- 2 Select the building pad.

NOTE Use *Tab* to cycle through the selection options. Selection options are displayed on the left side of the status bar.

3 Click Modify Pads tab ► Edit panel ► Edit Boundary.

4 Click Modify Pads ► Edit Boundary tab ► Draw panel ► Boundary Line, and use the sketch tools to make the necessary changes.

5 Click Finish Building Pad.

Modifying the Structure of a Building Pad

1 Open the site plan that contains the building pad.

2 Select the building pad.

NOTE Use *Tab* to cycle through the selection options. Selection options are displayed on the left side of the status bar.

3 Click Modify Pads tab ► Element panel ► Element Properties drop-down ► Type Properties.

4 In the Type Properties dialog, for Structure, click Edit.

5 In the Edit Assembly dialog, set the function for each layer.

Each layer must have a function assigned to it, so Revit Architecture can match layers accurately. Layers can be assigned for the following functions:

- **Structure.** A layer that supports the remainder of the building pad.
- **Substrate.** A material that acts as a foundation for another material.
- **Thermal/Air Layer.** A layer that provides insulation and prevents air penetration
- **Finish 1.** A finish layer, for example, the top surface of the building pad.
- **Finish 2.** A finish layer, for example, the bottom surface of the building pad.
- **Membrane Layer.** A membrane of zero thickness that prevents water vapor penetration.

NOTE The Wraps check box can be left unchecked.

6 Set the Material and Thickness for each layer.

7 Click Insert to add a new layer. Click Up or Down to change the layer order.

8 Click OK twice.

Related topics

- [Compound Structure](#) on page 813
- [Modifying Building Pads](#) on page 966
- [Building Pad Properties](#) on page 968

Sloping a Building Pad

1 Open the site plan that contains the building pad that you want to slope.

2 Select the building pad.

NOTE Use *Tab* to cycle through the selection options. Selection options are displayed on the left side of the status bar.

- 3 Click Modify Pads tab ► Edit panel ► Edit Boundary.
- 4 Click Modify Pads ► Edit Boundary tab ► Draw panel ► Slope Arrow.
- 5 Sketch the slope arrow on the building pad.
- 6 With the slope arrow highlighted, click Draw panel ► Properties.
- 7 For Specify, select either Height at Tail or Slope.
 - If you select Height at Tail, then select a level, and specify a height offset for both the tail and head of the arrow.
 - If you select Slope, then select a level, and specify a height offset for the tail, then the input value for Slope.
- 8 Click OK.
- 9 Click Finish Building Pad.

Related topic

- [Slope Arrow](#) on page 685

Building Pad Properties

You can change the properties of building pad types and building pad instances.

Modifying Building Pad Properties

- 1 Open a site or plan view.
- 2 Select the building pad.

NOTE Use *Tab* to cycle through the selection options. Selection options are displayed on the left side of the status bar.

- 3 Click Modify Pads tab ► Element panel ► Element Properties.
 - To change the properties of the building pad instance, change the values in the Instance Properties dialog.
 - To change the properties of the building pad type, click Edit Type in the Instance Properties dialog, and change the properties as desired.
- 4 Property changes made to a building pad type affect all building pads of this type in the project. (To create a new building pad type, click Duplicate.)
- 5 When finished, click OK twice.

Building Pad Type Properties

Name	Description
Construction	

Name	Description
Structure	Defines the building pad structure. See Modifying the Structure of a Building Pad on page 967.
Thickness	Displays the total building pad thickness. This is a read-only parameter.
Graphics	
Coarse Scale Fill Pattern	Sets a fill pattern for a building pad in coarse-scale view. Click in the value box to open the Fill Patterns dialog.
Coarse Scale Fill Color	Applies a color to the fill pattern for a building pad in coarse-scale view.

Building Pad Slope Arrow Properties

Name	Description
Constraints	
Specify	Indicates the method for determining slopes.
Level at Tail	Starts the slope arrow at the designated level.
Height Offset at Tail	Sets the start height of the slope arrow line. The default value is 0.
Level at Head	Ends the slope arrow at the designated level.
Height Offset at Head	Sets the end height of the slope arrow line. Revit Architecture uses both parameters to calculate the rise of the slope.
Dimensions	
Slope	Sets the slope angle for the selected building pad. The default value is 0. This parameter is enabled when Defines Slope Property is turned on.
Length	The actual length of a sketch line for the building pad. This is a read-only property.

Building Pad Instance Properties

Name	Description
Constraints	
Level	Sets the level of the building pad.
Height Offset From Level	Sets the height from which the building pad is offset from the level.
Room Bounding	Used to define the extents of a room.
Dimensions	
Slope	The building pad slope. This is a read-only parameter.

Name	Description
Perimeter	The building pad perimeter. This is a read-only parameter.
Area	The area of the building pad. This is a read-only parameter.
Volume	The volume of the building pad. This is a read-only parameter.
Phasing	
Phase Created	Sets the phase when the building pad is created.
Phase Demolished	Sets the phase when the building pad is demolished.

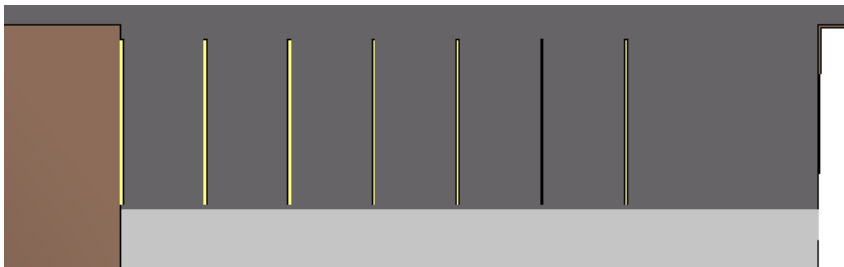
Parking Components

Parking components are parking spaces that you can add to a toposurface. After placing a parking component, you define the toposurface as its host.

To add parking components

- 1 Open a view that displays the toposurface to modify.
- 2 Click Massing & Site tab ► Model Site panel ► Parking Component.
- 3 Click Parking Component tab ► Element panel, and select the parking component type from the Type Selector drop-down.
- 4 Place the cursor on the toposurface and click to place the component. Place as many components as desired.
You can create an array of parking components. See [Using Arrays of Elements](#) on page 365.
- 5 After placing the components, click Selection panel ► Modify.
- 6 Select the parking components.
- 7 Click Modify Parking tab ► Host panel ► Pick Host.
- 8 Select the toposurface.

When you use the Pick Host tool, you are deliberately setting the parking component on top of the toposurface. If you move the parking component around on the toposurface, it remains attached to the toposurface.



You can create a schedule of parking components.

Site Components

Use the Site Component tool to place site-specific components (such as trees, utility poles, and fire hydrants) in a site plan. The Type Selector lists site-specific components to select from. If no site components are

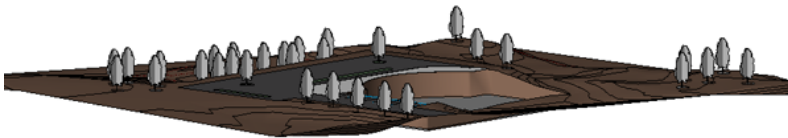
loaded into your project, a message indicates that no appropriate families are loaded. See [Loading Families](#) on page 427.

To add site components

- 1 Open a view that displays the toposurface to modify.
- 2 Click Massing & Site tab ► Model Site panel ► Site Component.
- 3 Click Site Component tab ► Element panel, and select the desired item from the Type Selector drop-down.
- 4 Click in the drawing area to add one or more components.

To pick a host for the components (optional)

- 5 After placing the components, click Selection panel ► Modify.
- 6 Select the components.
- 7 Click Modify <element> tab ► Host panel ► Pick Host.
- 8 Select the host.



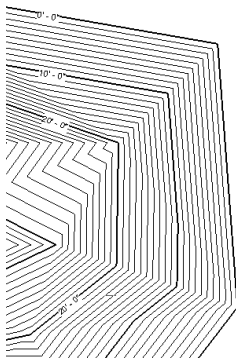
Related topics

- [Toposurfaces](#) on page 955
- [Parking Components](#) on page 970
- [Plants and Entourage](#) on page 1203

Contour Line Labels

You can label contour lines to indicate their elevation. Contour labels display in site plan views.

Labeled contour lines



Labeling Contour Lines

- 1 Create a topographic surface with different elevations. See [Toposurfaces](#) on page 955.
- 2 Open a site plan view.

3 Click Massing & Site tab ► Modify Site panel ► Label Contours.

4 Sketch a line that intersects one or more contour lines.

If the line does not intersect a contour line, Revit Architecture issues an error.

Labels display on the contour lines. (You may need to zoom in to see the labels.) The label line itself is not visible, unless you select a label.

Related topics

- [Modifying the Label Line](#) on page 972
- [Changing the Appearance of Contour Line Labels](#) on page 972
- [Contour Label Type Properties](#) on page 973

Modifying the Label Line

1 Open a site plan view.

2 Click a contour line label.

The label line is selected and visible.

3 Drag the end controls to resize the contour label line.

You can also move the contour label line on the toposurface to obtain different elevation values.

Changing the Appearance of Contour Line Labels

You can change the display characteristics of labels for contour lines. For example, you can use a different font, size, or typeface setting (such as bold or italics). Also, you can specify label units and whether labels display for primary contour lines only, or for both primary and secondary contour lines.

To change the appearance of contour line labels

1 Open a site plan view.

2 Right-click a contour line label, and click Element Properties.

The Instance Properties dialog displays parameters for the contour label type.

3 Click Edit Type.

4 In the Type Properties dialog, do either of the following:

- To change parameters for the current contour label type, change the parameters as desired, and click OK twice.
- To create a new type of contour label, do the following:
 - 1 Click Duplicate.
 - 2 Enter a name for the new contour label type, and click OK.
 - 3 Change the parameters as desired, and click OK twice.

See [Contour Label Type Properties](#) on page 973.

Revit Architecture displays labels for the contour lines using the new parameters.

Contour Label Type Properties

Name	Description
Color	Sets the color of label text.
Text Font	Sets the font for label text.
Text Size	Sets the size of label text.
Bold	Applies bold to label text.
Italic	Applies italics to label text.
Underline	Applies underlining to label text.
Label primary contours only	If selected, only the primary contour lines are labeled. See Site Settings on page 953.
Units Format	Specifies units and rounding properties for contour lines. By default, this option uses the project settings.
Elevation Base	Specifies the source of the elevation base: project, shared, or relative.

Rooms and Areas

16

Architects, designers, and structural engineers use rooms, areas, and color schemes to plan occupancy and usage of a building, and to perform basic analysis of a design. In Revit MEP, mechanical engineers can use room-bounding information as a starting point for defining spaces and zones for heating and cooling loads analysis.



Rooms and Areas Overview

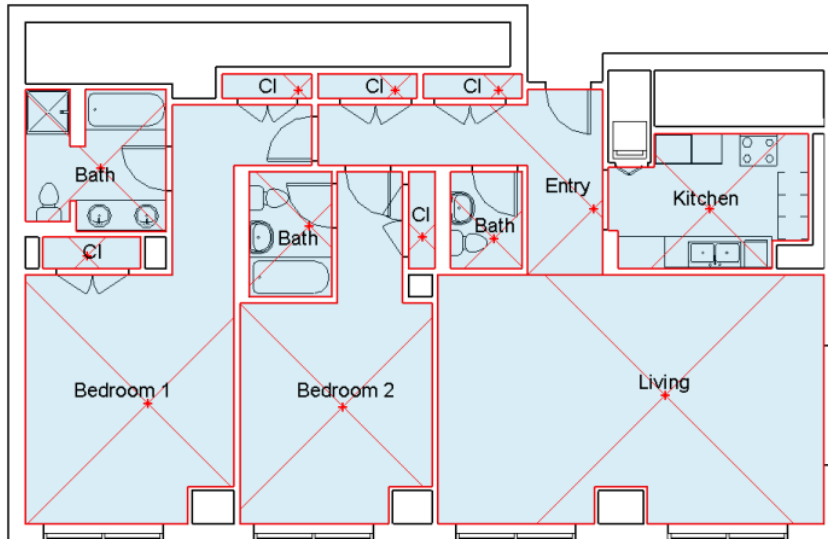
A room is a subdivision of space within a building model, based on elements such as walls, floors, roofs, and ceilings. These elements are defined as room-bounding. Revit Architecture refers to these room-bounding elements when computing the perimeter, area, and volume of a room.

In Revit Architecture, you can turn on/off the Room Bounding parameter of many elements. You can also use room separation lines to further subdivide space where no room-bounding elements exist. When you add, move, or delete room-bounding elements, the room's dimensions update automatically.

Rooms

You can create rooms using the Room tool or by placing them from a room schedule. To add rooms to a schedule, open a room schedule view and click **Modify Schedule/Quantities** tab ► **Schedule** panel ► **New**. This is helpful when creating an early design, before defining walls or other bounding elements in a project. Then you can place the predefined rooms in the project.

You can create rooms only in plan views and schedule views.



Related topics

- [Rooms and Areas Overview](#) on page 975

Creating a Room

- 1 Open a plan view.
- 2 Click **Home** tab ► **Room & Area** panel ► **Room**.
- 3 On the **Options Bar**, do the following:
 - To display a room tag with the room, click **Tag** on placement.
 - For **Upper Limit**, specify the level from which to measure the upper boundary of the room. See [Defining the Upper Boundary of a Room](#) on page 993.
For example, if you are adding a room to a Level 1 floor plan, and you want the room to extend from Level 1 to Level 2 or some point above Level 2, specify an **Upper Limit** of Level 2.
 - For **Offset**, measuring from the **Upper Limit** level, enter the distance at which the upper boundary of the room occurs. Enter a positive number to go above the **Upper Limit** level, or enter a negative number to go below it. The default is 10' (4000 mm).
 - Indicate the desired orientation of the room tag.
See [Tag Orientation](#) on page 986.
 - To include a leader line with the room tag, select **Leader**.
 - For **Room**, select **New** to create a new room, or select an existing room from the list.
- 4 To see room-bounding elements, click **Place Room** tab ► **Room** panel ► **Highlight Boundaries**.

Revit Architecture highlights all room-bounding elements in gold, and displays a warning. To see a list of all room-bounding elements in the model, including those that do not display in the current view, click Expand in the warning dialog. To exit the warning and remove the highlighting, click Close.

5 Click in the drawing area to place the room.

NOTE Revit Architecture will not place a room in a space that is less than 1' or 306 mm wide.

6 If you placed a tag with the room, name the room as follows:

- a Click Place Room tab ► Select panel ► Modify.
- b In the room tag, click the room text to select it, and replace it with the room name.

If you place a room inside bounding elements, it expands to the element boundaries. You can also place a room in a free space or one that is not entirely bounded, and then draw room-bounding elements around the room later. When you add bounding elements, the room expands to the boundaries. See [Room Boundaries](#) on page 979.

Related topics

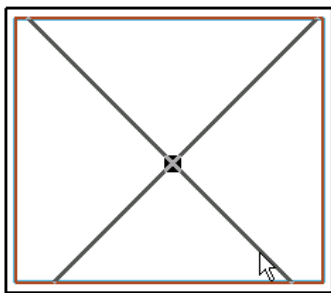
- [Controlling the Visibility of Rooms](#) on page 979
- [Room Tags](#) on page 985
- [Room Properties](#) on page 1003
- [Color Schemes](#) on page 1019

Selecting a Room

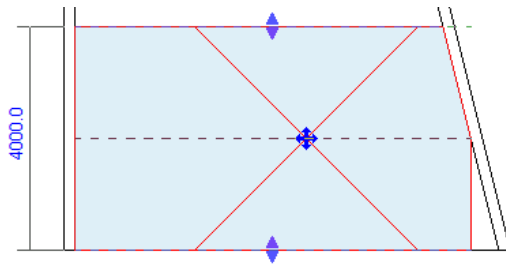
You can select rooms in plan views and section views. Select a room to check its boundaries, change its properties, remove it from the model, or move it to another location.

To select a room, move the cursor over the room until its reference lines display, and click. You can also place the cursor over the room perimeter, press *Tab* to cycle through choices until the reference lines display, and then click.

A selected room in a plan view



A selected room in a section view



Move a selected room by dragging it using the move control. If the room has a tag, move the tag with the room by selecting both and dragging them to the new location. As an alternative, you can delete the tag before moving the room, and then tag the room in its new location.

When you select a room in a section view, you can visually check its upper and lower boundaries and use the arrow controls to adjust them, if needed. See [Rooms in Section Views](#) on page 980 and [Changing the Room Height Graphically](#) on page 995.

Controlling the Visibility of Rooms

By default, rooms do not display in plan views and section views. However, you can change visibility/graphic settings to make rooms and their reference lines visible in these views. These settings become part of the view properties.

BEST PRACTICE Create view templates with the desired room visibility settings. Apply these view templates to views in which you want to display and work with rooms. See [View Templates](#) on page 507.

To display rooms

- 1 Open the plan view or the section view.
- 2 Type **vg**, or click View tab ► Graphics panel ► Visibility/Graphics.
- 3 On the Model Categories tab of the Visibility/Graphic Overrides dialog, scroll down to Rooms, and click to expand it.
- 4 To display rooms in the view using an interior fill color, select Interior Fill.
- 5 To display reference lines for rooms, select Reference.
- 6 Click OK.

Room Boundaries

Revit Architecture uses room boundaries when computing the area, perimeter, and volume of a room. You can check room boundaries in plan views and section views.

To check room boundaries, you can select rooms or change visibility/graphic settings for the view. See [Selecting a Room](#) on page 978 and [Controlling the Visibility of Rooms](#) on page 979.

TIP When working with rooms, open a plan view and a section view, and type **wt** to tile the windows. This strategy allows you to see the perimeter of the room and its upper and lower boundaries at the same time.

Related topics

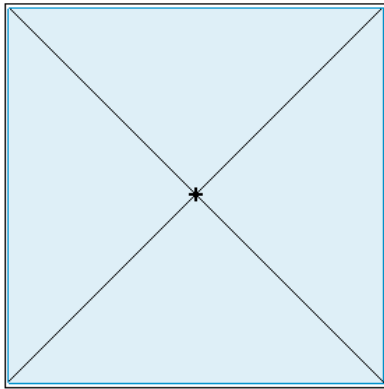
- [Room Area](#) on page 989
- [Room Volume](#) on page 991

Rooms in Plan Views

Use a plan view to visually check the outer boundaries (perimeter) of a room.

By default, Revit Architecture computes the room area using the wall finish as the outer boundary. You can specify the wall center, wall core layer, or wall core center as the outer boundary. See [Changing the Room Area Boundary Location](#) on page 991.

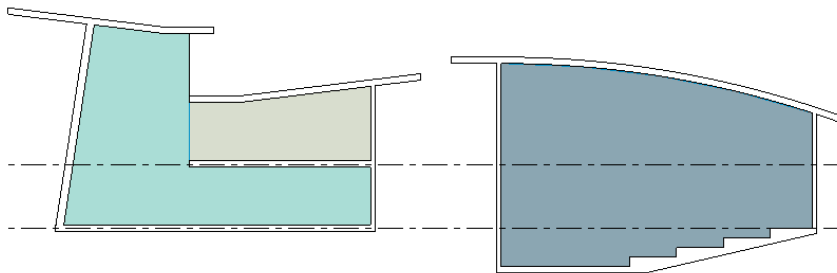
If you need to change the boundaries of a room, change the Room Bounding parameter for model elements, or add room separation lines. See [Room-Bounding Elements](#) on page 981 and [Room Separation Lines](#) on page 982.



If a room has sloped walls, ceilings, or other surfaces, you can check a section view to determine whether Revit Architecture is measuring the room perimeter at the appropriate height. See [Computation Height](#) on page 989.

Rooms in Section Views

Use a section view to visually check the upper and lower boundaries of a room. You can also use a section view to check the perimeter of a room that has sloped walls or other atypical features.

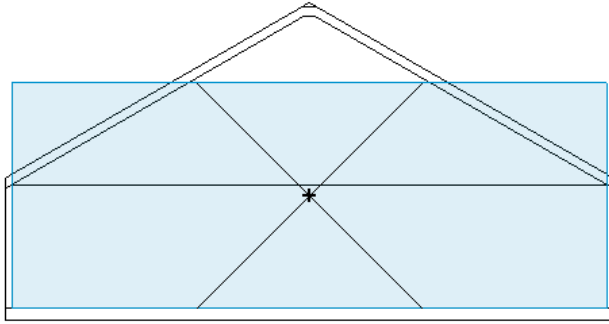


In section views, the graphic display of room boundaries varies depending on whether volume computation is turned on or off. (See [Enabling Volume Computations](#) on page 993.)

When volume computation is turned off

When volume computation is turned off, Revit Architecture shows the room as a rectangle in a section view. If any part of the room (such as the walls, ceiling, or roof) slopes, the room boundary does not follow the slope. This representation of the room does not reflect actual boundary settings and volume computations. Instead, it shows a rough estimation of the upper and lower boundaries of the room.

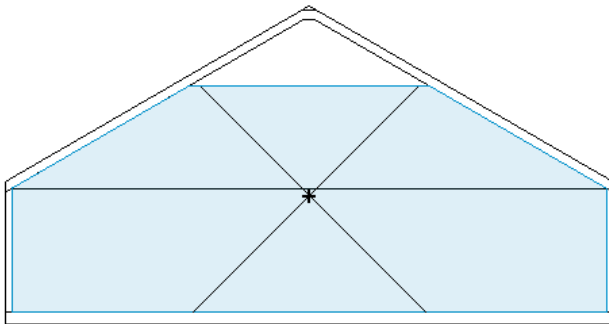
Section view of a room when volume computation is turned off



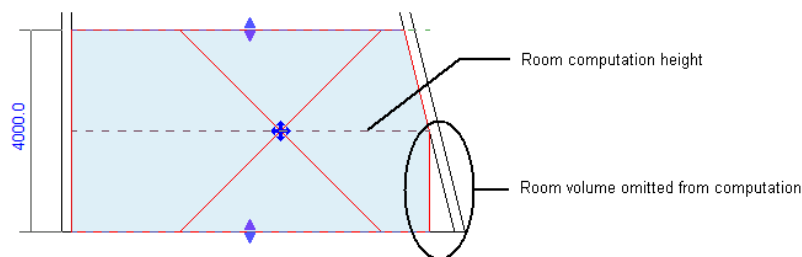
When volume computation is turned on

When volume computation is turned on, Revit Architecture shows the actual boundaries used to compute the volume of the room. These boundaries include sloping elements, such as the walls, ceiling, and roof.

Section view of a room when volume computation is turned on



In a section view, you can also check whether Revit Architecture is omitting parts of the room from its volume computations. This may be caused by a combination of sloping walls and the computation height that is defined for the corresponding level, or by other situations. See [Computation Height](#) on page 989 and [Situations That Can Affect Room Volume Computations](#) on page 992.



Room-Bounding Elements

The following elements are bounding elements for room area and volume computations:

- Walls (curtain, standard, in-place, face-based)
- Roofs (standard, in-place, face-based)
- Floors (standard, in-place, face-based)
- Ceilings (standard, in-place, face-based)

- Columns (architectural, structural with material set to concrete)
- Curtain systems
- Room separation lines (see [Room Separation Lines](#) on page 982)
- Building pads

NOTE Floors and ceilings are always room-bounding. These elements do not have a room-bounding property that you can turn off.

You can indicate whether many elements are room-bounding by changing element properties. For example, you may want to define toilet partitions as non-bounding because they are not usually included in room computations. When you specify that an element is non-bounding, the element is not used when Revit Architecture computes the area or volume of the room or any adjacent rooms that share the non-bounding element.

Making an Element Room Bounding

When you turn on the Room Bounding parameter for a model element, Revit Architecture uses the element as a boundary for a room. This boundary is used to compute the area and volume of the room.

To turn on the Room Bounding parameter

- 1 Select the element.
- 2 Click Modify <element> tab ► Element panel ► Element Properties.
- 3 In the Instance Properties dialog, under Constraints, select Room Bounding.
- 4 Click OK.

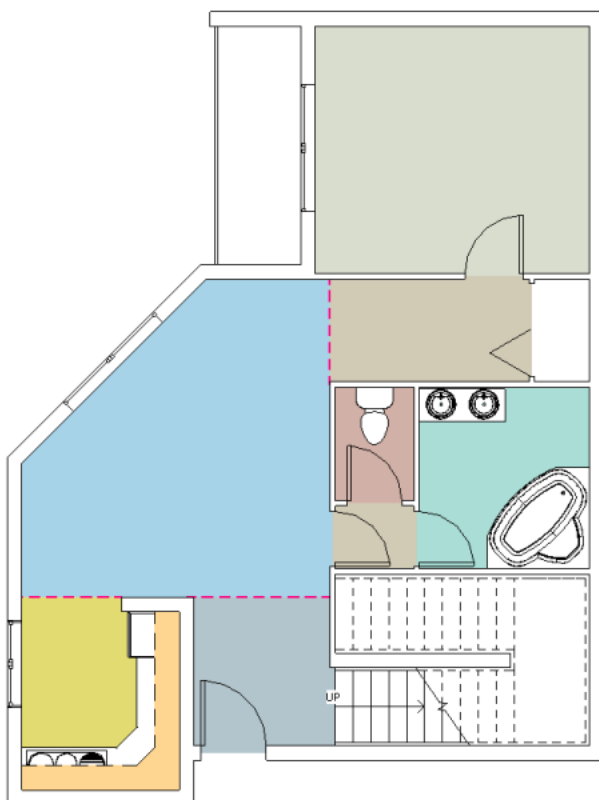
Related topics

- [Room-Bounding Elements](#) on page 981
- [Room Boundaries in Linked Models](#) on page 984
- [Room Areas and Perimeters for Design Options](#) on page 1323

Room Separation Lines

Use the Room Separation Line tool to add and adjust room boundaries. Room separation lines are room-bounding. They are useful for designating one room within another, such as a dining area within a living room, where a wall between the rooms is not desired. Room separation lines are visible in plan views and 3D views.

If you create a room bounded by walls, the room area is computed from the inside face of the walls by default. If you add openings to those walls and still want to maintain separate room area computations, you must sketch room separation lines through the openings to maintain the room area as it was first computed.



Adding Room Separation Lines

- 1 Open a floor plan view.
- 2 Click Home tab ► Room & Area panel ► Room drop-down ► Room Separation Line.
- 3 Sketch the room separation lines.

If the space already contains a room, the room boundaries adjust to the new room separation lines. If the space does not yet contain a room, you can add one. (See [Creating a Room](#) on page 977.) You can also do the following:

- Tag the room. (See [Tagging a Room](#) on page 985.)
- Apply a color scheme to the plan view or to a section view. (See [Color Schemes](#) on page 1019.)

Showing or Hiding Room Separation Lines

- 1 Open a plan view or 3D view.
- 2 Type **vg**, or click View tab ► Graphics panel ► Visibility/Graphics.
- 3 Click the Model Categories tab.
- 4 In the Visibility column, expand the Lines group.
- 5 Select or clear Room Separation.
- 6 Click OK.

Related topics

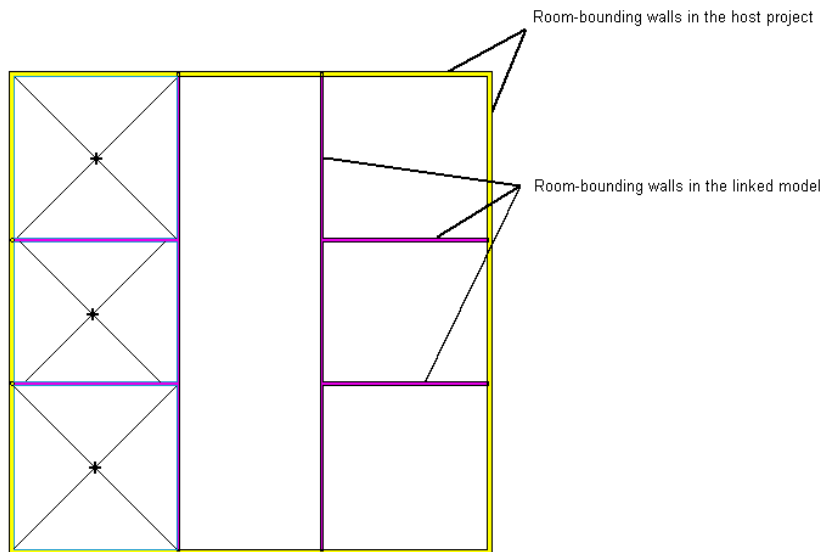
- [Room Separation Lines](#) on page 982

- [Showing or Hiding Room Separation Lines](#) on page 983
- [Room Boundaries](#) on page 979
- [Making an Element Room Bounding](#) on page 982

Room Boundaries in Linked Models

When you link Revit models together, by default Revit Architecture does not recognize room-bounding elements in the linked model. If you try to place a room between walls in the host project and walls (or other elements) in a linked model, Revit Architecture does not automatically recognize the room-bounding elements of the linked model. However, you can force Revit Architecture to recognize the room-bounding elements of a linked model. See [Using Room Boundaries in a Linked Model](#) on page 984.

Placing rooms in a host project (building exterior) using walls in a linked model (building interior)



More about rooms and linked models

- If you unload a linked model, rooms in the host project are no longer bounded by the room-bounding elements in the linked model.
- Elements in a nested link are room-bounding when you turn on the Room Bounding parameter of the nested linked model and the Room Bounding parameter of its parent model.

Related topics

- [Working with Linked Models](#) on page 1277
- [Room-Bounding Elements](#) on page 981

Using Room Boundaries in a Linked Model

Use the following procedure to make the host project recognize the Room Bounding parameter of elements in the linked model.

To use room boundaries in a linked model

- 1 In a plan view of the host project, select the linked model symbol.
The status bar displays the following:
RVT Links: Linked Revit Model: <model name>.
- 2 Click Modify RVT Links tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 In the Type Properties dialog, select Room Bounding.
- 4 Click OK.

Now you can place rooms in the plan view, using the boundaries defined by room-bounding elements in the host project and the room-bounding elements in the linked model. See [Creating a Room](#) on page 977.

Rooms Spanning Floors or Levels

Rooms can span multiple floors or levels. For example, a building that has a public space or atrium that spans multiple floors can be represented with a single room. Use the Upper Limit and Limit Offset parameters to define the upper boundary of the room. See [Defining the Upper Boundary of a Room](#) on page 993.



Room Tags

Rooms and room tags are separate but related Revit Architecture components. Rooms are model elements in Revit Architecture, like walls and doors. Room tags are annotation elements that can be added and displayed in plan views and section views. Room tags can display values for related parameters, such as room number, room name, computed area, and volume.

Related topics

- [Creating Sequential Room Number Tags](#) on page 1130
- [Room Tags for Design Options](#) on page 1324

Tagging a Room

Before you can tag a room, you must add the room to the project. See [Creating a Room](#) on page 977. If you do not use the Tag on placement option when creating rooms, you can use the following procedure to tag rooms later.

NOTE As an alternative, use the Tag All Not Tagged tool to tag all untagged rooms in a view. This tool can be useful, for example, when you place and tag rooms in a floor plan view, and you want to see tags for the same rooms in a reflected ceiling plan (RCP) view. See [Tag All Not Tagged](#) on page 1126.

To tag a room

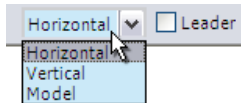
- 1 Open a plan or section view.
- 2 Click Home tab ► Room & Area panel ► Tag drop-down ► Tag Room.
- 3 On the Options Bar, do the following:
 - Indicate the desired orientation of the room tag.
See [Tag Orientation](#) on page 986.
 - To include a leader line with the room tag, select Leader.
- 4 Click in a room to place the room tag.

NOTE As you place room tags, they align with existing tags. See [Aligning Tags](#) on page 1125.

After placing a room tag, you can modify its properties. See [Room Tag Properties](#) on page 988.

Tag Orientation

When tagging a room or area, you can specify the orientation of the tag to the view. The Orientation parameter displays in the tag instance properties. It also displays on the Options Bar when you are adding a room, area, or tag to a view.



Select one of the following options:

- **Horizontal:** The tag displays horizontally in the view (the default).
- **Vertical:** The tag displays vertically in the view.
- **Model:** The tag can align with walls and boundary lines in the building model or rotate to a specified angle. (See [Rotating a Tag](#) on page 987.)

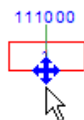
Tagging Rooms on Placement

To tag rooms when you create or place rooms in a view, use the Tag on placement option of the Options Bar. For instructions, see [Creating a Room](#) on page 977.

Moving a Tag

Use the following procedure to move a tag for a room or area.

- 1 Select the tag.
The status bar displays the category and family type for the tag.
- 2 Drag the blue arrow control to the desired position.



If you drag a tag outside its room or area boundary, Revit Architecture displays a warning. For instructions, see [Room Tag Is Outside of Its Room](#) on page 1007.

Rotating a Tag

Use the following procedure to rotate a tag for a room or area.

1 Select the tag.

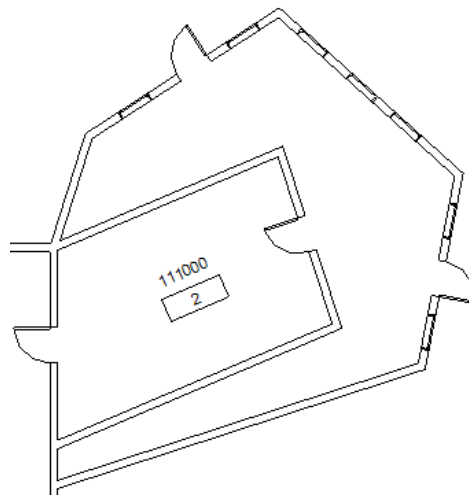
The status bar displays the category and family type for the tag.

2 On the Options Bar, select Model.

3 To change the orientation of the tag, use one of the following methods:

- To rotate the tag, click Modify Room Tags tab ► Modify panel ► Rotate. For more information, see [Rotating Elements](#) on page 379.
- To align the tag with walls or boundary lines in the building model, press the *Spacebar* one or more times until the tag aligns with the desired element.

A tag aligned with an angled wall



Room and Room Tag Relationship

When you create a room, if it is properly bounded by elements (such as walls) and room separation lines, Revit Architecture computes the room area between the boundaries. Revit Architecture displays a warning if the room is not in a properly enclosed region.

To place a room tag when creating or placing a room in a view, select the Tag on placement option of the Options Bar. If you place a room without a tag, you can tag it later using the Tag Room tool. (See [Tagging a Room](#) on page 985.) You can also use the Tag All Not Tagged tool to tag several untagged rooms in one operation. (See [Tag All Not Tagged](#) on page 1126.)

As an aid to early design and programmatic studies, you can add rooms (for example, from a program list) to a schedule before you define walls or place rooms in a plan view. To add rooms to a room schedule, open a room schedule view and click Modify Schedule/Quantities tab ► Schedule panel ► New. You can then place those predefined rooms in the project by selecting them in the Room list on the Options Bar while the Room tool is active.

If you place a new room within bounding elements or separation lines that contain a room that you placed previously, Revit Architecture warns you that the new room is redundant and suggests that you either move it or delete it.

You can delete a room by deleting it from a room schedule. The corresponding room tag is deleted as well. If you delete a room tag in a plan view, the room remains in the project and in the schedule. (See [Removing Rooms](#) on page 1000.)

Room Schedules and Room Tags

The room schedule and rooms are associated; therefore, all fields that appear in the room schedule are part of the properties list for the room. If you modify field values in the schedule, the corresponding property values update for the room, and vice versa. Also, this association extends to room tags. For example, if you change the room name in the schedule, the room and related tags update and display the new name.

Room tags are annotation elements that display values from the room properties. The properties of a room tag are the properties of the annotation family. If a room is selected in a schedule, you can click Show on the Modify Schedule/Quantities tab to see the position of the room in any related view.

For more information about schedules, see [Creating a Schedule or Quantity](#) on page 173.

Room Tag Properties

Use room tag properties to control the appearance and behavior of room tags.

Related topic

- [Room Properties](#) on page 1003

Modifying Room Tag Properties

- 1 In a plan or section view, select a room tag, and click Modify Room Tags tab ► Element panel ► Element Properties.
- 2 In the Instance Properties dialog, edit room tag instance parameters.
See [Room Tag Instance Properties](#) on page 989.
- 3 To edit room tag type parameters, click Edit Type.
See [Room Tag Type Properties](#) on page 988.
- 4 Click OK.

Room Tag Type Properties

Name	Description
Graphics	
Show Volume	Displays the room’s computed volume in the tag. If Not Computed displays, turn on volume computation. See Enabling Volume Computations on page 993.
Show Room Number	Displays the room’s assigned number in the tag.
Show Area	Displays the room’s computed area in the tag.

Name	Description
Leader Arrowhead	Specifies the shape of the arrowhead on the leader line.

Room Tag Instance Properties

Name	Description
Graphics	
Leader Line	Turns on/off the leader line.
Orientation	Specifies the orientation of the room tag: horizontal, vertical, or model. See Tag Orientation on page 986.

Room Area

To compute the area of a room, Revit Architecture does the following:

- **Finds room boundaries.** Many model elements have a Room Bounding parameter. For some elements (such as walls and columns), the Room Bounding parameter is turned on by default. For other elements, you must turn on the Room Bounding parameter. (See [Room-Bounding Elements](#) on page 981.) To define room boundaries where no walls exist, use room separation lines. (See [Room Separation Lines](#) on page 982.) You can also change the wall layer at which the room boundary is located. (See [Changing the Room Area Boundary Location](#) on page 991.)
- **Uses the computation height.** The computation height is a defined height above the base level of the room. Revit Architecture measures the perimeter of the room at this height. If a building includes sloped walls or other atypical features, you may need to adjust the computation height to achieve more accurate room areas and volumes. See [Computation Height](#) on page 989.

By measuring the perimeter of the room at the defined height, Revit Architecture determines the area of the room.

Related topics

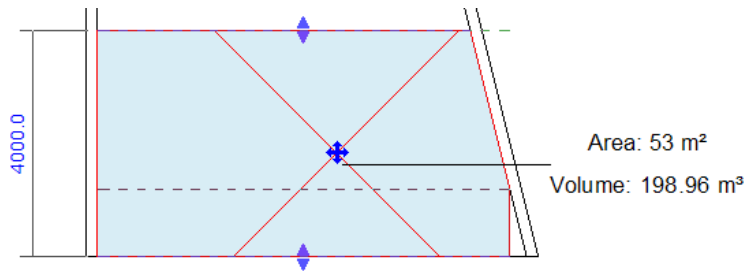
- [Room Volume](#) on page 991
- [Creating Room/Area Reports](#) on page 1366
- [Analyzing a Conceptual Design](#) on page 594
- [Room Areas and Perimeters for Design Options](#) on page 1323

Computation Height

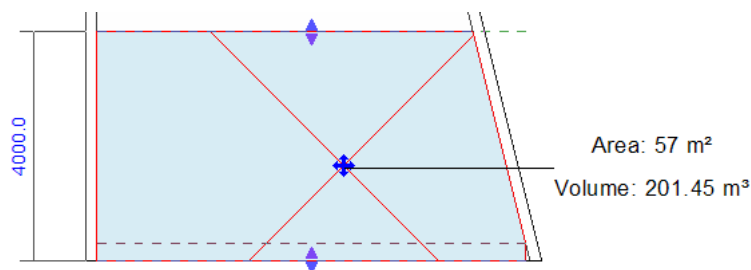
Revit Architecture measures the perimeter of a room at a defined distance above the base level of the room. This distance is the computation height. It is used to compute the room perimeter, area, and volume. By default, the computation height is 4' or 1200 mm above the base level of the room (the height of the default cut plane).

For buildings with vertical walls, the default computation height usually gives accurate results. However, if a building includes sloped walls or other atypical features, you may need to adjust the computation height to achieve more accurate room areas and volumes.

For example, the following drawing shows a section of a room with a sloped wall. The dotted line across the lower part of the room indicates the current computation height. (This line displays when you select the room.) Revit Architecture uses the perimeter of the room at the computation height when computing the room area and volume.



Changing the computation height affects the room perimeter, and thus the room area and volume. For example, the following drawing shows the same room, but the computation height has been moved lower (indicated by the dashed line). The room tag shows the changed room area and volume.



The computation height is defined as a parameter of a level family. If needed, you can change this parameter. You can also create multiple level families that use different computation heights. For example, you may want to define one level family for stories and another level family for plenums.

NOTE Changing the computation height can affect the performance of Revit Architecture.

Changing the Computation Height

- 1 Open a section view (or any view in which you can see defined levels).
(Optional) Make rooms visible in the section view. (See [Controlling the Visibility of Rooms](#) on page 979.)
- 2 Select a level datum in the view, and click Modify Levels tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 In the Type Properties dialog, under Dimensions, do one of the following:
 - To use a default computation height, select Automatic Room Computation Height. By default, the computation height is 4' or 1200 mm above the base level of the room (the height of the default cut plane). See [Computation Height](#) on page 989.
 - To specify a computation height, clear Automatic Room Computation Height. For Computation Height, enter the distance above the base level to use when computing the room area and perimeter.
If the room includes a sloped wall, consider using a computation height of 0 (zero).
- 4 Click OK.

The change in computation height affects all rooms that use this level type family for its base level.

Automatic Computation Height

In most cases, the automatic computation height is 4' (1200 mm) above the base level of the room. In some situations, however, the automatic computation height is different.

- Suppose the top of a room-bounding wall is lower than 4' (1200 mm) above the base level of the room), and it is joined to a room separation line. In this case, the computation height defaults to 0 (zero) to bound rooms by joined lower walls for that level.
- Suppose the top of a room-bounding wall is higher than 4' (1200 mm), and its bottom is above the base level of the room. In this case, the automatic computation height is 4' (1200 mm).

Changing the Room Area Boundary Location

By default, Revit Architecture computes the room area using the wall finish as the boundary. You can change the boundary, specifying the wall center, wall core layer, or wall core center.

NOTE You cannot change boundary locations separately for each room. All rooms in the project use the new boundary location.

To change the room area boundary location

- 1 Click Home tab ► Room & Area panel drop-down ► Area and Volume Computations.
- 2 On the Computations tab of the Area and Volume Computations dialog, for Room Area Computation, select one of the following options:
 - **At wall finish:** The room boundary is located at the finish face inside the room.
 - **At wall center:** Locates the room boundary at the centerline of the wall.
 - **At wall core layer:** Locates the room boundary at the interior or exterior layer of the core closest to the room.
 - **At wall core center:** Locates the room boundary at the centerline of the wall core.
- 3 Click OK.

For information about defining the structure and core layers of a wall, see [Vertically Compound Walls](#) on page 639.

Room Volume

Room volumes display in the Instance Properties dialog, in tags, and in schedules for rooms. By default, Revit Architecture does not compute room volumes.

When volume computation is turned off, room tags and schedules display Not Calculated for the Volume parameter. Because volume computation may affect Revit Architecture performance, turn it on only when you want to prepare and print schedules or other views that report volumes. To turn on volume computation, see [Enabling Volume Computations](#) on page 993.

Revit Architecture uses the Room component to maintain information about the area where it is placed. Rooms store values for a variety of parameters that affect the heating and cooling for a project. An effective energy analysis can only be accomplished if all the areas in your model are defined by room components in the building model and the entire volume of the building model is included.

When project information is exported as an analytical model to a gbXML file, the volume for areas that are not typically considered as rooms in an architectural model must be included in the overall volume for the project. This includes spaces such as attics, shafts, chases, and the spaces between a ceiling and the floor

above. Also, rooms in the building model should be defined to the center line of bounding walls and from floor height to floor height, so that there are no gaps between the spaces in a building. You can examine a shaded 3D analytical model in the gbXML Export dialog to detect gaps. When there are gaps in the analytical model, you must adjust the room properties in the building model to correct the volume.

Related topics

- [Analyzing a Conceptual Design](#) on page 594
- [Room Volumes for Design Options](#) on page 1324
- [Exporting Your Design to gbXML](#) on page 1372

How Room Volume is Computed

Because volume computation may affect Revit Architecture performance, it is turned off by default. Turn it on only when you want to prepare and print schedules or other views that report room volumes. To turn on volume computation, see [Enabling Volume Computations](#) on page 993.

When it computes room volumes, Revit Architecture does the following:

- Determines the room area. See [Room Area](#) on page 989.

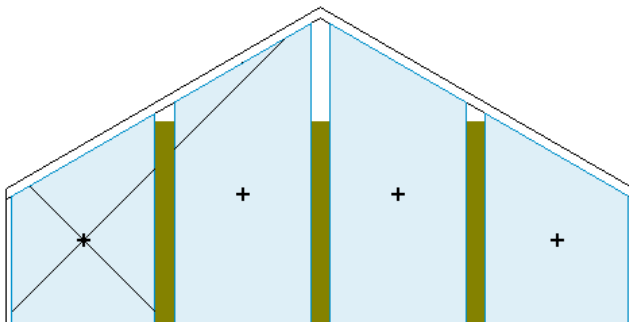
NOTE Room volumes are computed to the wall finish, regardless of the Room Area Computation setting.

- Determines the room height. See [Defining Room Height](#) on page 993 and [Considering Ceilings and Floors in Room Volume Computations](#) on page 996.
- Uses the room area and the room height to compute the room volume.

Situations That Can Affect Room Volume Computations

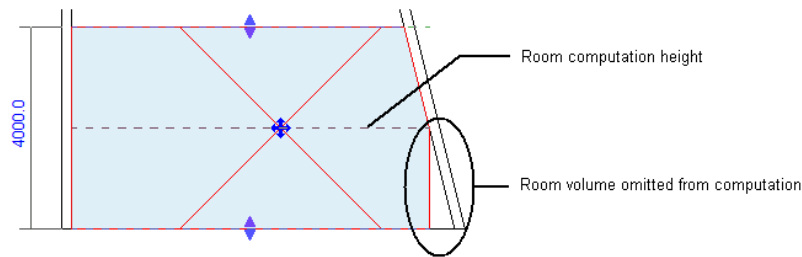
In a few cases, the room volume that Revit Architecture computes may not reflect unique features of a room. For example, if a room-bounding element does not reach the upper boundary of the room, space above the element may not be included in the room volume.

For example, if a partial wall or architectural column that does not reach the ceiling or roof is defined as room-bounding, Revit Architecture does not include the space above the element in the room volume. In the following section view, the green columns do not reach the roof, and the white space above them indicates space that Revit Architecture omits from the room volume computation.



To avoid this situation, turn off the Room Bounding parameter for the elements. (Right-click the element, and click Element Properties. Clear the Room Bounding parameter, and click OK.) In this case, the volume of those elements (and the space above them) is included in the room volume computation.

Note that Revit Architecture may also omit parts of the room from its volume computations due to a combination of sloping walls and the defined computation height. See [Computation Height](#) on page 989.



Enabling Volume Computations

NOTE Volume computations may affect Revit Architecture performance. You can turn on volume computation to prepare and print schedules or other views that report volumes. Then turn off the feature.

- 1 Click Home tab ► Room & Area panel drop-down ► Area and Volume Computations.
- 2 On the Computations tab of the Area and Volume Computations dialog, under Volume Computations, select Areas and Volumes.
- 3 Click OK.

Defining Room Height

Revit Architecture uses the height of a room to compute its volume. You can specify the height of a room in the following ways:

- **Define room height parameters.** In a plan or section view, select the room and edit its properties. The Upper Limit, Limit Offset, Level, and Base Offset parameters define the height of the room.
- **Change the room height graphically.** After adding a room to a plan view, open a section view that shows the room. In the section view, you can select the room and use controls to adjust the upper and lower boundaries of the room. See [Rooms in Section Views](#) on page 980.

Defining Room Height Parameters

To define the height of a room, use room instance parameters, as described in the following topics. In a plan or section view, select a room and click Modify Rooms tab ► Element panel ► Element Properties.

The Unbounded Height parameter shows the largest potential height of the room, based on the room height parameters. This value is read-only. (The room's actual height may be changed by room-bounding elements, such as intervening floors and roofs. See [Considering Ceilings and Floors in Room Volume Computations](#) on page 996.)

Defining the Upper Boundary of a Room

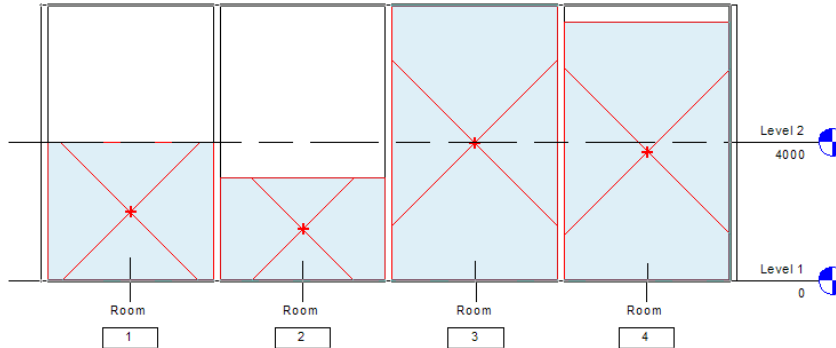
Together, the Upper Limit and Limit Offset parameters define the upper boundary of the room.

NOTE If room-bounding elements intersect the upper limit offset, those elements form the upper boundary instead. (See [Considering Ceilings and Floors in Room Volume Computations](#) on page 996.)

For example, suppose a room starts at Level 1. To indicate that it should extend upward 4000 mm above Level 2, specify an Upper Limit of Level 2 and a Limit Offset of 4000 mm. By default, the Limit Offset is the distance between levels (10' or 4000 mm).

In the following section view:

- Room 1 has an Upper Limit of Level 1 and a Limit Offset of 4000.
- Room 2 has an Upper Limit of Level 1 and a Limit Offset of 3000.
- Room 3 has an Upper Limit of Level 2 and a Limit Offset of 4000.
- Room 4 has an Upper Limit of Level 2 and a Limit Offset of 3500.



Defining the Lower Boundary of a Room

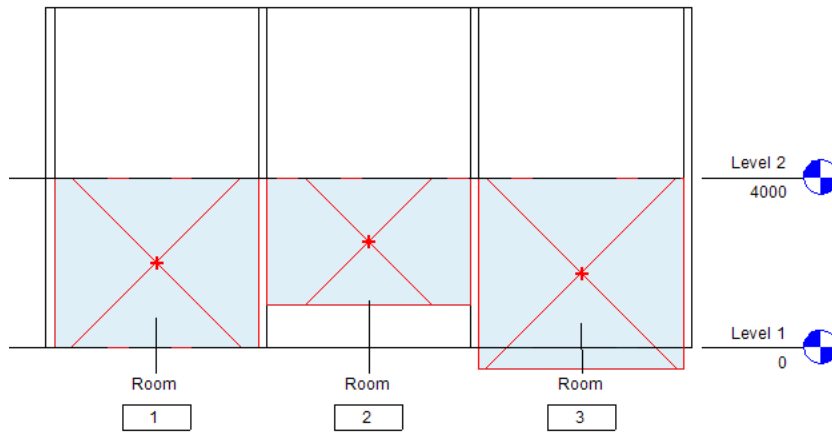
Together, the Level and Base Offset parameters define the lower boundary of a room.

In the room properties, the Level parameter is read-only. This parameter reflects the level of the plan view in which you place the room. For example, if you place a room on a Level 2 floor plan, the Level parameter for the room is Level 2.

Use the Base Offset parameter to indicate the distance between the base level and the lower boundary of the room. To use the base level as the lower boundary, enter 0 (zero). To move the lower boundary above the base level, enter a positive number. To move the lower boundary below the base level, enter a negative number.

For example, in the following section view:

- Room 1 has a Base Offset of 0. The lower boundary of the room starts at Level 1.
- Room 2 has a Base Offset of 1000. The lower boundary of the room starts 1000 mm above Level 1.
- Room 3 has a Base Offset of -500. The lower boundary of the room starts 500 mm below Level 1.



Changing the Room Height Graphically

In a section view, you can change the height of a room graphically by adjusting the upper and lower boundaries of the room. When you change the boundaries of a room graphically, Revit Architecture automatically updates the corresponding room parameters: Upper Limit, Limit Offset, and Base Offset. (See [Defining Room Height Parameters](#) on page 993.)

To change the height of a room graphically

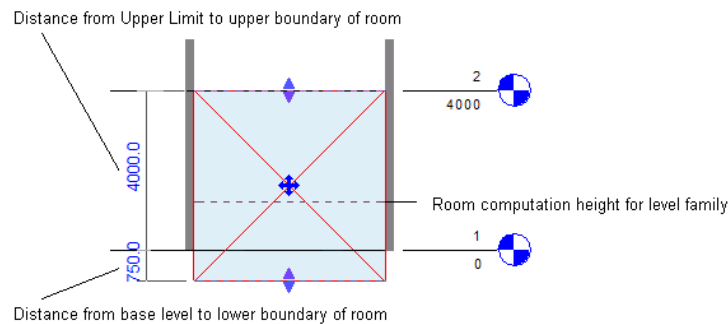
- 1 Open a section view that contains rooms.

See [Rooms in Section Views](#) on page 980.

- 2 Select the room whose height you want to change.

See [Selecting a Room](#) on page 978.

Revit Architecture displays upper and lower arrow controls.



- 3 To change the upper or lower boundary of the room, pull the corresponding control up or down.

Revit Architecture displays listening dimensions to indicate the distance of the upper and lower boundaries from the upper limit and base level of the room. You can enter a value directly, if desired. See [Listening Dimensions](#) on page 283.

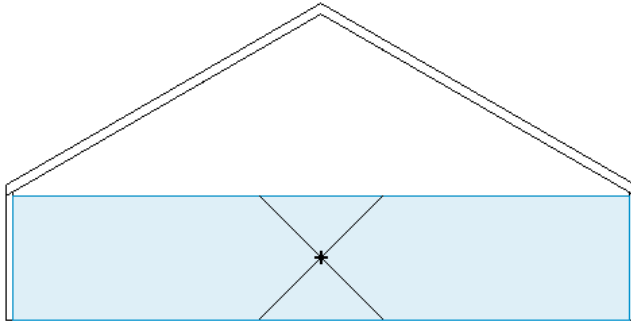
The dashed line across the room indicates the computation height, that is, the height at which Revit Architecture computes the area and perimeter of the room. Computation Height is a type parameter for levels. See [Computation Height](#) on page 989. The dashed line for the computation height displays only when you select the room in a section view.

If the Areas and Volumes option is turned on, the room boundary follows any sloping elements, such as roofs, walls, and ramps. If Areas and Volumes is turned off, the room boundary does not follow sloping elements.

Considering Ceilings and Floors in Room Volume Computations

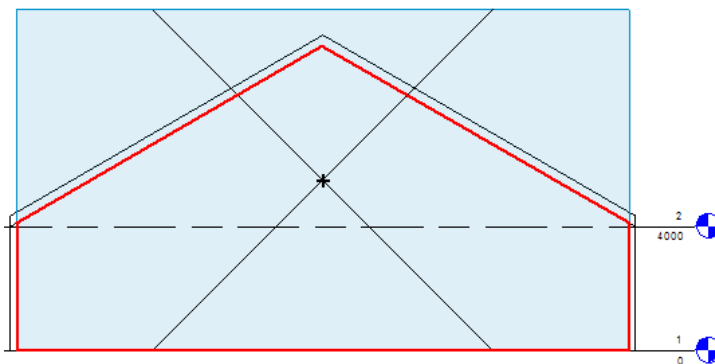
If the room height does not reach upper or lower room-bounding elements, Revit Architecture uses the specified upper and lower boundaries to compute the height and the resulting volume of the room.

For example, the following section view shows a room that starts at Level 1 and goes up to Level 2, but its upper boundary is not defined by a ceiling, roof, or other room-bounding element. Regardless, Revit Architecture uses the specified room height when computing the room volume.



However, if room-bounding elements occur within the range of the room's defined limits, Revit Architecture uses the space defined by the room-bounding elements when computing the volume. For example, if a ceiling or roof occurs below the specified upper limit of a room, then Revit Architecture computes the volume up to the room-bounding element.

For rooms under roofs, such as attic spaces, specify an upper boundary that is greater than the height of the roof. This strategy ensures that the volume is computed up to the roof pitch. For example, the following section view shows a room that starts at Level 1 and extends 7000 mm above Level 2 (indicated in blue). When computing the room volume, however, Revit Architecture uses the intervening roof as the upper boundary for the room (indicated in red).



When a floor occurs above the computation height, it becomes top-bound, not bottom-bound, which results in an incorrect room volume. This situation typically occurs when the ceiling is modeled as part of the floor or when you move a floor to a point above the room's lower boundary. If this occurs, create a new level for the elevated floor, and add the room on this level. Then Revit Architecture can compute the room volume correctly.

Sharing Room/Space Information Between Revit Architecture and Revit MEP

In Revit Architecture, architects use rooms and areas to divide a building model by usage, occupancy, or other criteria. In Revit MEP, engineers use spaces and zones for analysis of heating and cooling loads.

Architects and mechanical engineers who collaborate on a Revit project need to understand some behavior about Revit rooms and spaces.

Workflow: Linking an MEP Model to an Architectural Model

The following describes a typical workflow for an architect and a mechanical engineer collaborating on a project:

- 1 The architect uses Revit Architecture to create a project.
All building geometry is defined in the Revit Architecture project. The project may include rooms defined by room-bounding elements and room separation lines.
- 2 The mechanical engineer does the following:
 - a Uses Revit MEP to create a new project.
 - b Creates a link to the Revit Architecture project.
See [Linking Revit Models](#) on page 1277.
 - c Creates desired views and uses Revit MEP tools to develop the design.
 - d Turns on the Room Bounding parameter for the linked model.
This step ensures that the Revit MEP project recognizes room-bounding elements in the Revit Architecture project. See [Using Room Boundaries in a Linked Model](#) on page 984.
 - e Places spaces in the Revit MEP model.
The spaces use the room boundaries defined by the Revit Architecture project.

As an alternative, teams can create a Revit project and enable worksharing. The architect and the mechanical engineer each use separate worksets. See [Working in a Team](#) on page 1249.

How Revit Architecture and Revit MEP Share Information

When you link a Revit Architecture project to a Revit MEP project, consider the following:

- Spaces (created in Revit MEP) can be bounded by elements in linked models, in the host model, or in both.
- Spaces are affected by room separation lines. Rooms are not affected by space separation lines.
- Spaces are measured from the wall finish face.
- In Revit MEP, spaces use the computation height that is defined in the architectural model. See [Computation Height](#) on page 989.
- A space understands in which room of a linked model it resides, and it can report the identity of that room. This information is based on relative locations, not on a link to a specific room ID.
- Multiple spaces can access the identity of a single room in a linked model.

- Rooms can exist in design options. (See [Design Options and Rooms](#) on page 1322.) Spaces cannot exist in design options.
- If the architectural model changes, spaces are not deleted in the host MEP model. Spaces can become unenclosed, redundant, or ambiguous, as they would if the same changes were made in the host model.
- Modification of one model does not propagate to linked models. If the architectural model and the MEP model link to each other, changes to the architectural model may not be matched by changes in the MEP model until the MEP model is opened, resaved, and reloaded.

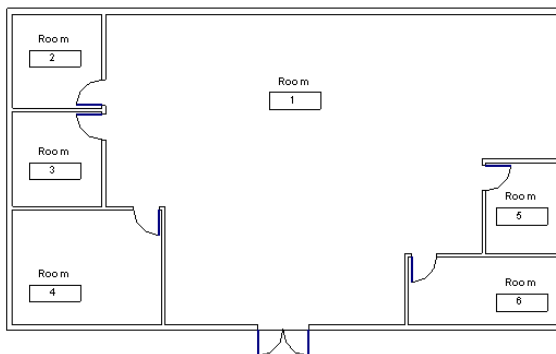
Phase-Specific Rooms and Boundaries

All rooms are phase-specific in a project. When you add a room to a plan view or create a room by adding a row to a room schedule, the room is automatically assigned to the phase specified for the view.

As the project progresses, you can report room areas for different phases. Also, the same room name and number can exist in the same or different locations of the model, as long as they are in different phases. To achieve this, do not switch the phase in the same plan view, but make duplicate plan views with dedicated phases.

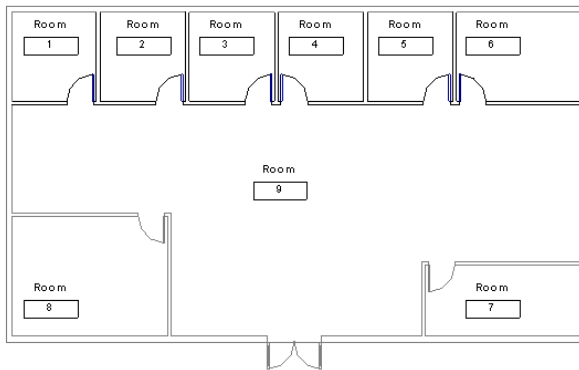
You can make edits to room-bounding elements in one phase without affecting other phases. For example, you can delete room-bounding walls in one phase and, provided those walls do not exist in other phases, not impact room boundaries in other phases. Revit Architecture ignores any room-bounding elements that do not exist in the active phase in which you are working.

Rooms become part of the phase as you place them in the view. In the following picture, rooms placed on Level 1 of the model are specific to Phase 0, which represents existing conditions.



In the next picture, rooms placed on Level 1 of the model are specific to Phase 1, which represents new construction.

Notice that the same room numbers and names can display in the view, and room tags occupying the same location can have different names and numbers.



Related topics

- [Room Boundaries](#) on page 979
- [Project Phasing](#) on page 1331

Scheduling Phase-Specific Rooms

Schedules for modelling and drafting elements have phases. You can create a room schedule specific to a phase and include room area (and other information) in that schedule. When you create a room schedule, select the phase you want it to represent in the New Schedule dialog. You can also specify the phase through the properties of the schedule. When you change the phase, the schedule view updates accordingly.

Related topics

- [Schedule Views](#) on page 172
- [Project Phasing](#) on page 1331

Copying Rooms Between Phases

Rooms in Revit Architecture let you specify properties for a region of the building model, such as a Name, Surface Finishes, and Level Offset. After setting these parameters to identify the characteristics of a room in one phase, you may want to use that room specification in another phase. This is useful when changing an existing region with new construction. To do this, copy the room from a view assigned to one phase to a view assigned to a different phase to preserve the parameter settings.

For example, to copy room specifications from the Existing phase to the New Construction phase, use the following procedure.

To copy room specifications from one phase to another

- 1 Open the plan view where you have added a room.
- 2 Right-click in the view, and click View Properties.
- 3 Scroll down to the Phasing section. For Phase, specify Existing, and click OK.
- 4 Select the room that you want to copy, and click Modify Rooms tab ► Clipboard panel ► Copy.
- 5 Repeat steps 2 and 3 above, but, for Phase, specify New Construction.
- 6 Click Modify Rooms tab ► Clipboard panel ► Paste Aligned drop-down ► Current View.
The room is added to the New Construction phase with the same properties that were specified in the Existing phase.

Phase-Specific Rooms and Linked Models

If phase-specific rooms in a linked model do not reflect the correct phases, check phase mapping for the linked model.

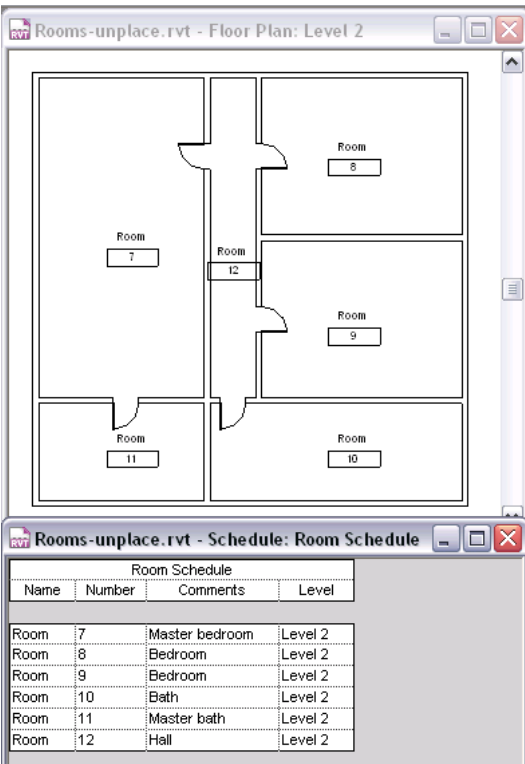
When you link a model to the host project, Revit Architecture performs phase mapping to align phases in the linked model with phases in the host project. If the automatic phase mapping does not give the desired result, you can map phases between projects manually. See [Phase Mapping Linked Revit Models](#) on page 1280.

Removing Rooms

After creating rooms, you can remove rooms from a building model in the following ways:

- **Unplace:** Removes the room from its location in building model, but the project still contains information about the room. Then you can place the room in another location later during a project redesign. See [Unplacing or Moving Rooms](#) on page 1000.
- **Delete:** Completely removes the room (including all information about the room) from the project. See [Deleting Rooms](#) on page 1002.

A floor plan containing rooms, and a room schedule



Unplacing or Moving Rooms

When you add a room to a plan view, the project stores information about the room. This can include information that you add using room properties, such as the room name, surface finishes, occupancy, and so on. (See [Room Properties](#) on page 1003.) You can see information about rooms in a room schedule. If you want to retain information about a room but remove it from its current location in the building model, unplace the room as follows.

To unplace a room

1 Open a plan view or a section view that displays the room.

2 Select the room.

Check the status bar to be sure that you are selecting the room and not the room tag. The status bar displays the following:

Rooms: Room: <room name>

3 Delete the room from the plan view, using any of the following methods:

- Press *Delete* or *Ctrl+X*.
- Right-click the room, and click Delete.
- Click Modify Rooms tab ► Modify panel ► Delete.

The room is removed from its location in the building model. However, the project still contains the information about the room. In a room schedule, the room is listed as Not Placed. If desired, you can place the room in another location. See [Placing an Unplaced Room](#) on page 1001.

Placing an Unplaced Room

1 Open a plan view where you want to place the room.

2 Click Home tab ► Room & Area panel ► Room.

3 On the Options Bar, for Room, select the desired room from the Room list.

4 In the drawing area, click to place the selected room in the desired location.

Room schedules update automatically to reflect the new location of the room.

Viewing a List of Unplaced Rooms

1 If the project does not include a room schedule, create one.

See [Creating a Schedule or Quantity](#) on page 173.

2 Display the room schedule in the drawing area.

The room schedule lists all rooms defined in the building model. For any rooms that are currently unplaced, the schedule displays Not Placed for any read-only fields, including: Area, Perimeter, Level, Upper Limit, and Volume.

3 Click Modify Schedule/Quantities tab ► Filter Unplaced or Unenclosed Items panel ► Isolate.

This option filters the schedule so that it lists only the rooms that are not placed or enclosed. You may want to save this schedule so that you can quickly determine which rooms need to be placed or enclosed.

Hiding Unplaced Rooms in a Room Schedule

1 Display the room schedule in the drawing area.

The room schedule lists all rooms defined in the building model. For any rooms that are currently unplaced, the schedule displays Not Placed for any read-only fields, including: Area, Perimeter, Level, Upper Limit, and Volume.

2 Click Modify Schedule/Quantities tab ► Filter Unplaced or Unenclosed Items panel ► Hide.

This option filters the schedule so that it lists only the rooms that are currently placed (and enclosed).

To redisplay the rooms that are not placed or enclosed in the schedule, click Show.

Deleting Rooms

Delete selected rooms from a project when you no longer want to retain any information about the rooms.

To delete one or more rooms

- 1 If the project does not include a room schedule, create one.
See [Creating a Schedule or Quantity](#) on page 173.
- 2 Display the room schedule in the drawing area.
- 3 To delete one room, place the cursor in the schedule row for that room.
- 4 To delete multiple rooms, do the following:
 - a Click Modify Schedule/Quantities tab ► Filter Unplaced or Unenclosed Items panel ► Isolate.
This option filters the schedule so that it lists only the rooms that are not placed or enclosed.
 - b Drag the cursor across the schedule rows for the rooms to delete.
- 5 Click Schedule panel ► Delete.
- 6 At the warning message, click OK.

The selected rooms are deleted from the project. The project no longer stores any information about the rooms.

Rooms and Areas as Polylines


When exporting AutoCAD files, you can export rooms and areas as closed polylines. The exported polylines match the boundaries of rooms in Revit Architecture. The room boundaries are exported onto a single layer. That layer is turned off by default in the AutoCAD file.

The polylines include the following XDATA information for room boundaries: Name, Number, Occupancy, Occupant, Department, and Comments. The polylines include the following information for area boundaries: Name and Comments.

Related topics

- [Creating Room/Area Reports](#) on page 1366
- [Exporting Your Design to gbXML](#) on page 1372
- [Exporting to CAD Formats](#) on page 1341

Exporting Rooms and Areas as Polylines

- 1 In a Revit project, click  ► Export ► CAD Formats ► DWG or DXF.
- 2 In the Export CAD Formats dialog, click the DWG/DXF Properties tab and select Export rooms and areas as polylines.
- 3 Specify other options as desired.
See [Exporting to CAD Format Properties](#) on page 1349.
- 4 Click Export.

- 5 In the Export CAD Formats dialog, specify a name and location for the exported file.
- 6 Click Export.

Room Properties

As model elements, rooms have instance properties. You can change the values of some parameters. Other parameters are read-only values.

Related topic

- [Room Tag Properties](#) on page 988

Modifying Room Properties

- 1 In a plan view or section view, select a room and click Modify Rooms tab ► Element panel ► Element Properties.
See [Selecting a Room](#) on page 978.
- 2 In the Instance Properties dialog, edit room instance parameters.
See [Room Instance Properties](#) on page 1003.
- 3 Click OK.

If you have created a room schedule that includes parameters that can be modified, you can change the parameter values in the schedule.

Room Instance Properties

Name	Description
Constraints	
Level	The base level on which the room resides. A read-only value. See Defining the Lower Boundary of a Room on page 994.
Upper Limit	The level from which to measure the upper boundary of the room. See Defining the Upper Boundary of a Room on page 993.
Limit Offset	The distance at which the upper boundary of the room occurs, measuring from the Upper Limit level. Enter a positive number to go above the Upper Limit level, or enter a negative number to go below it. Enter 0 (zero) to use the level specified for the Upper Limit. The default is 10' (4000 mm). See Defining the Upper Boundary of a Room on page 993.
Base Offset	The distance at which the lower boundary of the room occurs, measuring from the base level (defined by the Level parameter). Enter a positive number to go above the base level, or enter a negative number to go below it. Enter 0 (zero) to use the base level. The default is 0. See Defining the Lower Boundary of a Room on page 994.
Dimensions	

Name	Description
Area	The net area computed from the room-bounding elements. A read-only value. See Room Area on page 989.
Perimeter	The perimeter of the room. This is a read-only value. See Room Area on page 989.
Unbounded height	The largest potential height of the room, based on the room height parameters: Level, Upper Limit, Limit Offset, and Base Offset. This value is read-only. See Defining Room Height on page 993. (The room's actual height may be changed by room-bounding elements, such as intervening floors and roofs. See Considering Ceilings and Floors in Room Volume Computations on page 996.)
Volume	The volume of the room when volume computation is enabled. See Room Volume on page 991. A read-only value.
Identity Data	
Number	An assigned room number. This value must be unique for each room in a project. Revit Architecture warns you if the number is already used but allows you to continue using it. (See Reviewing Warning Messages on page 1415 or Warnings for Selected Elements on page 1415.) Room numbers are assigned sequentially. See Creating Sequential Room Number Tags on page 1130.
Name	The room name, such as Conference Room or Kitchen.
Comments	User-specified information about the room.
Occupancy	Type of occupancy for the room, such as Retail.
Department	Department for which the room will be used.
Base Finish	Finish for the base.
Ceiling Finish	Finish for the ceiling, such as stucco.
Wall Finish	Finish for the wall, such as painted.
Floor Finish	Finish for the floor, such as carpeting.
Occupant	Name of the person, group, or organization that will use the room.
Phasing	
Phase	The project phase to which the room belongs. A read-only value based on view properties. See Phase-Specific Rooms and Boundaries on page 998.

Troubleshooting Rooms

If problems occur with rooms in a project, Revit Architecture provides explanations in dialogs, room tags, or room schedules.

When an error occurs, you can select the tag or the schedule row that displays the error, and click Modify Room Tags tab ► Warning panel ► Show Related Warnings or click Modify Schedule/Quantities tab ► Error

panel ► Explain Error. Revit Architecture shows the message that it displayed when the problem first occurred. You can use standard error dialog features (like Show) to find the relevant tags.

Related topics

- [Warnings for Selected Elements](#) on page 1415
- [Reviewing Warning Messages](#) on page 1415

Can't Create Any Energy Analysis Surfaces

Error: Can't create any energy analysis surfaces. There are no room bounding elements defined in the current phase. Please check the Project Information settings.

Issue: This warning displays when you attempt to export to gbXML and the building model does not contain any room-bounding elements in the specified phase.

Solution: Do the following:

- Make sure that appropriate elements (such as walls and roofs) in the building model are room-bounding. See [Making an Element Room Bounding](#) on page 982.
- Click Manage tab ► Project Settings panel ► Project Information. In the Instance Properties dialog, for Energy Data, click Edit. In the Type Properties dialog, for Project Phase, specify the phase for which you want to perform the energy analysis. This phase should be one in which room-bounding elements exist.

Energy Analysis Model Does Not Contain Any Roof Surfaces

Warning: The energy analysis model does not contain any roof surfaces. If there are roofs in your model, please verify that they are room bounding, and make sure that the room offsets are high enough to include the roofs.

Issue: This warning displays when you attempt to export to gbXML, and rooms in the building model do not include upper surfaces (roofs).

Solution: Do the following:

- Make sure that the roofs in the building model are room-bounding. See [Making an Element Room Bounding](#) on page 982.
- Where appropriate, adjust the upper boundaries of rooms to include the roofs. See [Defining Room Height](#) on page 993 and [Considering Ceilings and Floors in Room Volume Computations](#) on page 996.

Highlighted Room Separation Lines Overlap

Warning: Highlighted room separation lines overlap. One of them may be ignored when Revit finds room boundaries. Delete one of the lines.

Issue: The room separation line that you just added or moved overlaps an existing separation line.

Solution: Select one of the room separation lines, and delete it, move it, or change its length, so that it no longer overlaps the other line.

See [Room Separation Lines](#) on page 982.

Multiple Rooms Are in the Same Enclosed Region

Warning: Multiple rooms are in the same enclosed region. The correct area and perimeter will be assigned to one room, and the others will display “Redundant Room.” You should separate the regions, delete the extra rooms, or move them into different regions.

Issue: This message displays when multiple rooms reside in the same region of the building model. In schedules, Revit Architecture displays Redundant Room.

One of the rooms displays the correct area and perimeter. The others display Redundant Room so that the space is not counted more than once in schedule totals. When a view displays the rooms using the Interior Fill visibility setting, the rooms that report Redundant Room display in a darker color because the room areas overlap.

Solution: Do either of the following:

- Use room-bounding model elements or room separation lines to divide the region into multiple rooms. See [Room Boundaries](#) on page 979.
- Remove the extra rooms. See [Removing Rooms](#) on page 1000.

Not Computed

Warning: Not Computed

Issue: This message displays for the Volume parameter in room tags and room schedules when you have not enabled volume computation.

Because volume computation may affect Revit Architecture performance, enable it only when you want to prepare and print schedules or other views that report volumes.

Solution: To compute room volumes, click Home tab ► Room & Area panel drop-down ► Area and Volume Computations. On the Area and Volume Computations dialog, under Volume Computations, select Areas and Volumes.

Not Enclosed

Warning: Room is not in a properly enclosed region.

Issue: This message displays when a room is not properly enclosed by bounding elements or room separation lines. For a room in a schedule, Revit Architecture displays Not enclosed.

Solution: Add room separation lines, or turn on the Room Bounding parameter for elements, as appropriate. See [Room Boundaries](#) on page 979.

Redundant Room

Warning: Redundant room.

Solution: See [Multiple Rooms Are in the Same Enclosed Region](#) on page 1006.

Room Is Very Short

Warning: Room is very short. If this is not intended, change its Upper Limit and Offset.

Issue: This message displays when you adjust the height of a room to be shorter than 4' or 1200 mm.

Solution: If you intend to create a short room, ignore this warning.

If you did not intend to create a short room, adjust its upper and lower boundaries. See [Defining Room Height](#) on page 993.

Room Tag Is Outside of Its Room

Warning: Room Tag is outside of its Room. Enable Leader or move Room Tag within its Room.

Issue: This message displays when you move a room tag outside its room, or when you move a room to a new location but do not move its tag with it. This message can also display when you move a room to a new location in another view, so the room is no longer located with its tag.

Solution: You can ignore this message (click OK) and review it later (click Modify tab ► Inquiry panel ► Warnings, or see [Warnings for Selected Elements](#) on page 1415), or resolve it immediately.

To resolve the issue immediately, do one of the following:

- To return the room or room tag to its previous location, click Cancel.
- To move the room tag to its room, click Move to Room.
If the room and its tag display in several views, the room tag moves to the room location in all of those views.
- To draw a leader line from the room tag to its room, click OK. Select the room tag, and on the Options Bar, click Leader.

Room Tag Was Deleted

Warning: A Room Tag was deleted, but the corresponding Room still exists. You can place another tag for the room using the Room Tag tool, or select the room and delete it.

Issue: This message displays when you delete a room tag in a room.

Solution: You can ignore the warning, or you can remedy the situation by placing another tag for the room or deleting the room from the project. See [Tagging a Room](#) on page 985 or [Deleting Rooms](#) on page 1002.

Room Volumes Overlap

Warning: Room Volumes Overlap, adjust Upper Limit and Upper Offset.

Issue: This message displays when a room on a lower level is so tall that its volume intersects with a room on a higher level.

Solution: To resolve the overlap, select the lower level room, and adjust its Upper Limit and Upper Offset parameters until the rooms no longer overlap. See [Defining Room Height](#) on page 993.

Room's Lower Offset Is Above the Computation Height

Error: Room's lower offset is above the computation height.

Issue: This message displays when you move the lower boundary of a room above the computation height. See [Computation Height](#) on page 989.

Solution: In the error dialog, click Cancel. To adjust the position of the room's lower boundary, change the room height parameters, or change it graphically. See the following topics:

- [Defining the Lower Boundary of a Room](#) on page 994

- [Changing the Room Height Graphically](#) on page 995
- [Considering Ceilings and Floors in Room Volume Computations](#) on page 996

Setting for Areas and Volumes Is Not Checked

Warning: The setting for Areas and Volumes is not checked. The volumes will be approximate. Please check the Volume Computation settings in Area and Volume Computations.

Issue: This warning displays when you attempt to export to gbXML and volume computation is turned off. With volume computation turned off, exported information about room volumes is less accurate.

Solution: Turn on volume computation. See [Enabling Volume Computations](#) on page 993.

Area Analysis

Use area analysis tools to define spatial relationships in the building model.

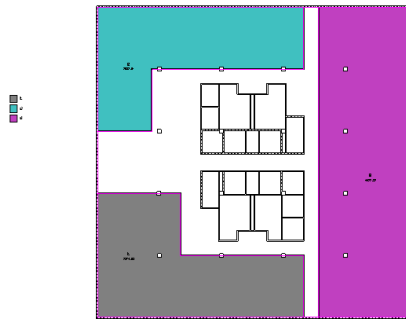
Related topics

- [Rooms and Areas Overview](#) on page 975
- [Analyzing a Conceptual Design](#) on page 594

Area Schemes

Area schemes are definable spatial relationships. For example, you can have an area scheme showing the relationship between core and circulation spaces in a floor plan.

Area plan with area scheme applied



You can create multiple area schemes. By default, Revit Architecture creates 2 area schemes:

- **Gross Building:** Total constructed area of a building.
- **Rentable:** Area measurements based on the standard method for measuring floor area in office buildings.

You cannot edit or delete the Gross Building area scheme. The Rentable area scheme is modifiable. You can create additional area schemes as needed.

Area Schemes and Schedules

You can create schedules for area schemes. For more information about defining a schedule for an area scheme, see [Creating a Schedule or Quantity](#) on page 173.

Creating an Area Scheme

- 1 Click Home tab ► Room & Area panel drop-down ► Area and Volume Computations.
- 2 In the Area and Volume Computations dialog, click the Area Schemes tab.
- 3 Click New.
- 4 For Name, enter a name for the new area scheme.
- 5 For Description, enter a description of the new area scheme.
- 6 Click OK.

Deleting an Area Scheme

NOTE If you delete an area scheme, all area plans associated with that scheme are also deleted.

- 1 Click Home tab ► Room & Area panel drop-down ► Area and Volume Computations.
- 2 In the Area and Volume Computations dialog, click the Area Schemes tab.
- 3 Select the area scheme.
- 4 Click Delete.
- 5 Click OK.

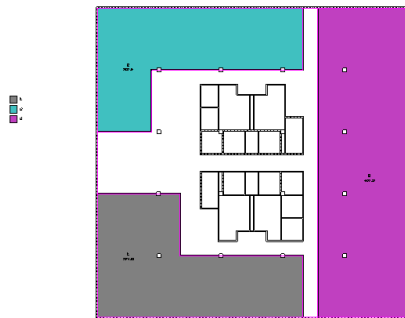
Area Plans

Area plans are views that show spatial relationships based on area schemes and levels in your model. You can have multiple area plans for every area scheme and level. Each area plan can have distinct area boundaries, tags, and color schemes.

Area plans are listed in the Area Plans node of the Project Browser. You can rename area plans. In the Project Browser, the area plan name indicates the level associated with the plan.

Create area schemes before creating area plans. See [Creating an Area Scheme](#) on page 1009.

Area plan with area scheme applied



Creating an Area Plan

1 Click Home tab ► Room & Area panel ► Area drop-down ► Area Plan.

2 In the New Area Plan dialog, for Type, select an area scheme.

3 Select a level for the area plan view.

If you select more than one level, Revit Architecture creates a separate area plan for each level and groups them by area scheme in the Project Browser.

4 To create unique area plan views, select Do not duplicate existing views.

5 To create copies of existing area plan views, clear Do not duplicate existing views.

6 For Scale, select the area plan scale.

7 Click OK.

Revit Architecture prompts you to automatically create area boundary lines associated with all external walls. See [Area Boundaries](#) on page 1010.

8 Select one of the following:

- **Yes:** Revit Architecture places the boundary lines along the exterior walls of a closed loop.
- **No:** You sketch the area boundary lines.

TIP Revit Architecture cannot automatically create area boundary lines in external walls that are not closed in a loop.

TIP If the project includes a ruled curtain system within the exterior wall loop, you must sketch the area boundary, because ruled curtain systems are not walls.

9 Add more area boundaries, as needed.

See [Creating Area Boundaries](#) on page 1010.

Related topics

- [Area Plans](#) on page 1009
- [Area Schemes](#) on page 1008
- [Areas and Area Tags](#) on page 1011
- [Color Schemes](#) on page 1019

Area Boundaries

Area boundaries define usable space in buildings. You can define these areas by drawing them or by picking walls.

If you select the Apply Area Rules option, Revit Architecture automatically changes the wall boundary position when you change the area type. (See [Area Types](#) on page 1016.) For example, office area is measured at the wall centerline, while exterior area is measured to the exterior wall face. By applying area rules, the area boundary position updates in accordance with area type changes.


Creating Area Boundaries

1 Open an area plan view.

Area plan views are listed in the Project Browser under Area Plans. See [Area Plans](#) on page 1009.

- 2 Click Home tab ► Room & Area panel ► Area drop-down ► Area Boundary Line.
- 3 Draw or pick the area boundaries. (Use Pick Lines to apply area rules.)
See the following procedures for details.

To pick area boundaries

- 1 Click Place Area Boundary tab ► Draw panel ►  (Pick Lines).
- 2 If you do not want Revit Architecture to apply area rules, on the Options Bar, clear Apply Area Rules, and specify the offset.

NOTE If you apply area rules, the area boundary position is dependent on the area type parameter of the area tag. You must place an area tag in the boundary to change the area type.

- 3 Select the boundary defining walls.

To draw area boundaries

- 1 Click Place Area Boundary tab ► Draw panel, and select a sketch tool.
- 2 Use the sketch tools to complete the boundary.
See [Sketching](#) on page 303.

Areas and Area Tags

Areas and area tags are separate but related Revit Architecture components. Areas are model elements in Revit Architecture, like walls and doors. Area tags are annotation elements that you can add to area plan views.

When creating an early design, before you define walls or other bounding elements in a project, you can create an area schedule. In the schedule, add information about the areas that you plan to use. Later, you can place these predefined areas in an area plan of the project.

Related topics

- [Moving a Tag](#) on page 986
- [Rotating a Tag](#) on page 987

Creating an Area

You can create areas using 2 methods:

- Add rows to an area schedule. This allows you to predefine areas in an early design of the project. See [Creating a Schedule or Quantity](#) on page 173. You can later use the Area tool to place the predefined areas in an area plan.
- Use the Area tool in an area plan view, as follows.

To create an area

- 1 Open an area plan view.
See [Area Plans](#) on page 1009.
- 2 Create area boundaries.
See [Area Boundaries](#) on page 1010.

3 Click Home tab ► Room & Area panel ► Area drop-down ► Area.

4 To display an area tag with the area, do the following:

- On the Options Bar, click Tag on placement.
- Indicate the desired orientation of the area tag.
See [Tag Orientation](#) on page 986.
- To include a leader line with the area tag, select Leader.

5 On the Options Bar, for Area, select New to create a new area, or select an existing area from the list.

6 Click in the area plan to place the area.

If you place an area inside area boundaries, it expands to the extents of the boundaries. You can also place an area in a free space or one that is not entirely bounded, and then draw area boundaries later. The area expands to the boundaries.

To make the area visible in the view, type **VG** to open the Visibility/Graphic Overrides dialog. On the Model Categories tab, expand Area, and select Interior Fill or Reference (or both). See [Overriding Graphic Display of Element Categories](#) on page 201.

Adding an Area Tag

Area tags display the total area within an area boundary. When you place an area tag, you can assign a unique name to the area.

Before you can add area tags, you must add areas to the area plan. See [Creating an Area](#) on page 1011. If you do not use the Tag on placement option when creating areas, you can use the following procedure to add area tags later.

NOTE As an alternative, use the Tag All Not Tagged tool to tag untagged areas. See [Tag All Not Tagged](#) on page 1126.

To add an area tag

- 1 Open an area plan view.
- 2 Click Home tab ► Room & Area panel ► Tag drop-down ► Tag Area.
Revit Architecture highlights defined areas in the area plan.
- 3 On the Options Bar, do the following:
 - Indicate the desired orientation of the area tag.
See [Tag Orientation](#) on page 986.
 - To include a leader line with the area tag, select Leader.
- 4 Click in an area to place the tag.

Deleting Areas and Area Tags

When you delete (unplace) an area in an area plan view, its tag is also deleted. However, the area is still defined in the project. (See [Removing Areas](#) on page 1014.)

When you delete an area tag from an area plan view, only the area tag is deleted. The area remains in the area plan view and the schedule view.

Area Properties

Parameter names, values, and descriptions for areas. Some values are modifiable.

Name	Description
Constraints	
Level	The level on which the area resides. This is a read-only value.
Dimensions	
Area	Total area within area boundaries. This is a read-only value.
Perimeter	The perimeter of the area boundaries. This is a read-only value.
Identity Data	
Number	The value for this parameter is automatically generated when you add an area to a project. You can modify the value of this parameter using numbers, characters, or a combination of numbers and characters. You will receive a duplicate value message if the same value for the number parameter is used for 2 areas in an area scheme. You can add this parameter to a schedule, and it can display in an area tag.
Name	Area name.
Comments	Specific comments about the area.
Other	
Area Type	Type of area. NOTE Changing the area type alters the position of area boundaries created with the Apply Area Rules options. See Area Types on page 1016 for type rules.

Area Tag Properties

Parameter names, values, and descriptions for area tags. Values are modifiable.

Area Tag Type Properties

Name	Description
Leader Arrowhead	The shape of the arrowhead on the leader line.

Area Tag Instance Properties

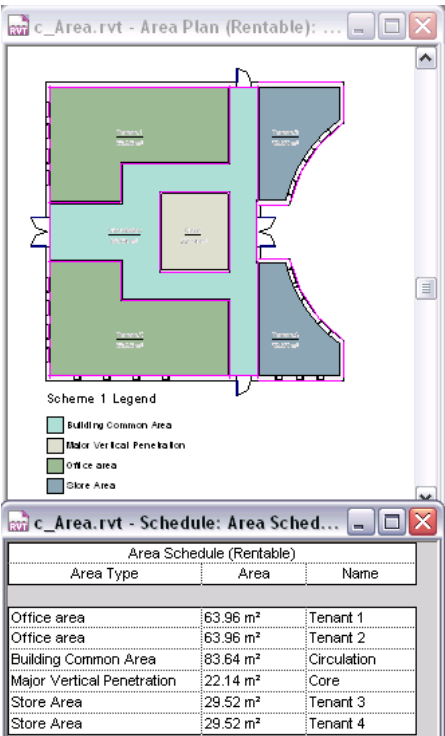
Name	Description
Leader Line	Adds a leader line to the area tag.
Orientation	The orientation of the area tag. See Tag Orientation on page 986.

Removing Areas

After creating areas, you can remove areas from a building model in the following ways:

- **Unplace:** Removes the area from its location in the area plan, but the project still contains information about the area. Then you can place the area in another location later during a project redesign. See [Unplacing or Moving Areas](#) on page 1014.
- **Delete:** Completely removes the area (including all information about the area) from the project. See [Deleting Areas](#) on page 1015.

An area plan and an area schedule



Unplacing or Moving Areas

When you add an area to a floor plan, the project stores information about the area. This can include information that you add using area properties, such as the area name, usage, and so on. (See [Area Properties](#) on page 1013.) You can see information about areas in an area schedule. If you want to retain information about an area but remove it from its current location in the building model, unplace the area as follows.

To unplace an area

- 1 Open an area plan view that shows the area.
- 2 Select the area.
Check the status bar to be sure that you are selecting the area and not the area tag.
- 3 Delete the area from the plan view using any of the following methods:
 - Press *Delete* or *Ctrl+X*.
 - Right-click the area, and click *Delete*.
 - Click *Modify Areas* tab ► *Modify* panel ► *Delete*.

The area is removed from its location in the building model. However, the project still contains the information about the area. In an area schedule, the area is listed as Not Placed. If desired, you can place the area in another location. See [Placing an Unplaced Room](#) on page 1001.

Placing an Unplaced Area

- 1 Open the area plan view where you want to place the area.
- 2 Click Home tab ► Room & Area panel ► Area drop-down ► Area.
- 3 On the Options Bar, for Area, select the desired area from the list.
- 4 In the drawing area, click to place the selected area in the desired location.
Area schedules update automatically to reflect the new location of the area.

Viewing a List of Unplaced Areas

- 1 If the project does not include an area schedule, create one.
See [Creating a Schedule or Quantity](#) on page 173.
- 2 Display the area schedule in the drawing area.
The area schedule lists areas defined in the building model. For any areas that are currently unplaced, the schedule displays Not Placed for any read-only fields, including: Area, Perimeter, Level, Upper Limit, and Volume.
- 3 Click Modify Schedule/Quantities tab ► Filter Unplaced or Unenclosed Items panel ► Isolate.
This option filters the schedule so that it lists only the areas that are not placed or enclosed. You may want to save this schedule that you can quickly determine which areas need to be placed or enclosed.

Hiding Unplaced Areas in an Area Schedule

- 1 Display the area schedule in the drawing area.
The area schedule lists areas defined in the building model. For any areas that are currently unplaced, the schedule displays Not Placed for any read-only fields, including: Area, Perimeter, Level, Upper Limit, and Volume.
- 2 Click Modify Schedule/Quantities tab ► Filter Unplaced or Unenclosed Items panel ► Hide.
This option filters the schedule so that it lists only the areas that are currently placed (and enclosed).
To redisplay the areas that are not placed or enclosed in the schedule, click Show.

Deleting Areas

Delete selected areas from a project when you no longer want to retain any information about the areas.

To delete one or more areas

- 1 If the project does not include an area schedule, create one.
See [Creating a Schedule or Quantity](#) on page 173.
- 2 Display the area schedule in the drawing area.
- 3 To delete one area, place the cursor in the schedule row for that area.

- 4 To delete multiple areas, do the following:
 - a Click Modify Schedule/Quantities tab ► Filter Unplaced or Unenclosed Items panel ► Isolate. This option filters the schedule so that it lists only the areas that are not placed or enclosed.
 - b Drag the cursor across the schedule rows for the areas to delete.
- 5 Click Schedule panel ► Delete.
- 6 At the warning message, click OK.

The selected areas are deleted from the project. The project no longer stores any information about the areas.

Showing Areas and Area Boundaries in Linked Models

- 1 Open the plan view that contains the linked model.
- 2 Click View tab ► Graphics panel ► Visibility/Graphics.
- 3 Click the Revit Links tab.
- 4 Select the linked model to display areas and area boundaries, and click the button in the Display Settings column.
- 5 Select By Linked view.
- 6 Select the area plan from the Linked view list.
- 7 Click Apply.
- 8 Click OK.

Area Types

Area types are an instance property of area tags. Area types contain area measurement rules that Revit Architecture applies to area boundaries. See [Area Type Rules](#) on page 1017.

Area type values come from the default area schemes: Gross Building and Rentable. The Gross Building area scheme has 2 area type values: Gross Building Area, and Exterior Area. The Rentable Area scheme has 6 type values: building common area, office area, exterior area, floor area, major vertical penetration, and store area.

When you create a new area scheme, it uses the type values from the Rentable area scheme. See [Area Schemes](#) on page 1008.

Gross Building Area Types	Definition and Examples
Gross Building Area	The total constructed area of a building. It is any area inside the outer face of the building's exterior walls.
Exterior Area	Any area outside the outer face of a building's external walls, for example, an exterior courtyard enclosed by 4 walls.
Rentable Area Types	Definition and Examples
Building Common Area	Lobbies, atriums, conference rooms, lounges, vending area, security desks, concierge areas, food service facilities, health or fitness centers, day care facilities, locker or shower facilities, and mail rooms.
Office Area	Area where a tenant normally houses personnel, furniture, or both.
Exterior Area	Any area outside the external walls of a building.

Rentable Area Types	Definition and Examples
Floor Area	Washrooms, janitorial closets, electrical rooms, telephone rooms, mechanical rooms, elevator lobbies, public corridors, and other areas that are available primarily for the use of the tenants on that floor.
Major Vertical Penetration	Stairs, elevator shafts, flues, pipe shafts, vertical ducts, and their enclosing walls.
Store Area	Area of an office building suitable for retail occupancy.

Area Type Rules

The following table shows area measurement rules. Rules are determined by one type of space bordering another space. To find the appropriate measurement rule, find the selected Area Type and the corresponding Bordering Area Type.

Related topic

- [Area Types](#) on page 1016

Gross Building Area Scheme Types

Area Type Selected	Bordering Area Type	Measurement Rule
Gross Building Area		
Gross Building Area	None	Area Boundary measured to the outside surface of building.
Gross Building Area	Exterior Area	Area Boundary measured from outside surface of building.
Exterior Area		
Exterior Area	Exterior Area	Area Boundary measured from wall centerline.
Exterior Area	Gross Building Area	Area Boundary measured from outside surface of building.

Rentable Area Scheme Types

NOTE Windows in Rentable Area Scheme Types: If you place windows within the exterior walls, Revit Architecture places the area boundary lines according to the following rules based on the height of the windows: If window height is greater than 50% of wall height, area boundary lines go to face of glass. If window height is less than 50% of wall height, area boundary lines go to interior face of the exterior walls.

Rentable Area Scheme Types

Area Type Selected	Bordering Area Type	Measurement Rule
Building Common Area		
Building Common Area	Building Common Area, Office, Store	Area Boundary measured from wall centerline.

Rentable Area Scheme Types

Area Type Selected	Bordering Area Type	Measurement Rule
Building Common Area	Exterior, Major Vertical Penetration	Area Boundary measured from wall face bordering Building Common Area.
Office Area		
Office Area	Building Common Area, Office, Store	Area Boundary measured from wall centerline.
Office Area	Exterior, Major Vertical Penetration	Area Boundary measured from wall face bordering the office area.
Exterior Area		
Exterior Area	Exterior	Area Boundary measured from wall centerline.
Exterior Area	Store	Area Boundary measured from wall face bordering Exterior Area.
Exterior Area	Any other areas	Area Boundary measured from the wall face bordering the other area.
Floor Area		
Floor Area	Office, Store or Building Common Area	Area Boundary measured from wall face bordering other area.
Floor Area	Exterior, Major Vertical Penetration	Area Boundary measured from the wall face bordering the floor area.
Floor Area	Floor Area	Area Boundary measured from the wall centerline.
Major Vertical Penetration		
Major Vertical Penetration	Major Vertical Penetration	Area Boundary measured from the wall centerline.
Major Vertical Penetration	Exterior	Area Boundary measured from the wall face bordering the Major Vertical Penetration area.
Major Vertical Penetration	Any other area (except Exterior)	Area Boundary measured from the wall face bordering the other area.
Store Area		
Store Area	Major Vertical Penetration, Floor	Area Boundary measured from the wall face bordering the Store area.
Store Area	Exterior	Area Boundary measured from the wall face bordering the Exterior area.
Store Area	Building Common Area, Office, Store	Area Boundary measured from the wall centerline.

Color Schemes

Use color schemes to color and apply fill patterns to rooms and areas. You can apply color schemes to floor plan views and section views based on a specific value or range of values. You can apply a different color scheme to each view.

NOTE To use color schemes, you must have rooms or areas defined in the project.

Color Scheme Overview

Colors schemes can be useful for graphically illustrating categories of spaces. For example, you can create a color scheme by room name, area, occupancy, or department. If you want to color rooms in a floor plan by department, set the Department parameter value for each room to the necessary value, and then create a color scheme based on the values of the Department parameter. You can then add a color scheme legend to identify the department that each color represents.

You can apply color schemes based on any parameter value for a room or area. You specify parameter values in the Instance Properties dialog.

The following image shows a plan view with a color scheme that uses a specific value defined for each room (for example, Office and Storage as values of the room's Department parameter).



The next image shows a plan view with a color scheme applied by a range of values (in this example, square footage).



NOTE To use color schemes, you must have rooms or areas defined in the project.

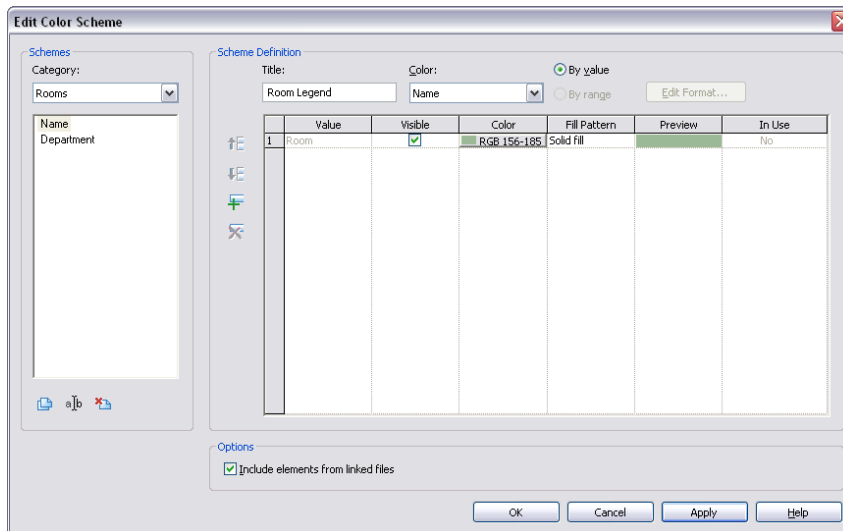
Opening the Edit Color Scheme Dialog

When working with color schemes, you use the Edit Color Scheme dialog to perform many tasks. Use any of the following methods to access this dialog.

- Click Home tab ► Room & Area panel drop-down ► Color Schemes.
- Open a floor plan view or section view that displays a color scheme legend. Select the legend, and click Modify Color Fill Legends tab ► Scheme panel ► Edit Scheme.
- For a floor plan view or section view, access view properties. (Right-click in the drawing area and click View Properties, or right-click the view name in the Project Browser and click Properties.) In the Instance Properties dialog, click in the cell for the Color Scheme parameter.

Related topics

- [Creating a Color Scheme](#) on page 1021
- [Adding Values to a Color Scheme Definition](#) on page 1022
- [Applying a Color Scheme](#) on page 1022
- [Modifying a Color Scheme](#) on page 1024




Creating a Color Scheme

1 Click Home tab ► Room & Area panel drop-down ► Color Schemes.

You can open the Edit Color Scheme dialog using [another method](#).

2 In the Edit Color Scheme dialog, select the category for which to create a color scheme: Areas (Gross Building), Areas (Rentable), or Rooms.

3 Select an existing scheme. Then right-click and click Duplicate, or click  under Schemes.

4 In the New color scheme dialog, enter a name for the new color scheme, and click OK.
The name displays in the color scheme list.

5 In the Scheme Definition field, enter a title for the color scheme legend.

The title displays above the legend when you apply the color scheme to a view. You can show or hide the color scheme legend title. See [Modifying a Color Scheme Legend](#) on page 1026.

6 From the Color menu, select the parameter to use as the basis of the color scheme.

NOTE Be sure that values are defined for the parameter you select. You can add or change parameter values in the Instance Properties dialog.



7 To color by a specific parameter value or by a range of values, select By Value or By Range.


NOTE By Range is not available for all parameters.

When you select By Range, the units display format appears next to the Edit Format button. If necessary, click Edit Format to change the format. In the Format dialog, clear Use project settings, and select the appropriate format settings from the menus. Click OK.

8 Modify color scheme definition values as necessary.

- At least: Edit the low end range value. This value only displays when you select By Range.
- Less than: This is a read-only value. This value only displays when you select By Range.
- Caption: Edit the legend text. This value only displays when you select By Range.
- Value: This is a read-only value. This value only displays when you select By Value.

- Visible: Indicates whether the value is colored and visible in the color scheme legend.
- Color: Specify the color option for the value. Click to change the color.
- Fill Pattern: Specify the fill pattern for the value. Click to change the fill pattern.
- Preview: Shows a preview of the color and fill pattern.
- In Use: Indicates whether the value is in use in the project. This is a read-only value for all list items, except any custom values you add.
- Select a row by clicking the row number. Click  or  to move the row up or down in the list. These options are available when you select By value.


- 9 Optionally, click  to add a new value to the scheme definition. For more information, see [Adding Values to a Color Scheme Definition](#) on page 1022.
- 10 (Optional) To allow coloring of elements (such as rooms and areas) in linked models, select Include elements from linked files.
- 11 Click OK.

To apply a color scheme to a view, see [Applying a Color Scheme](#) on page 1022.

Adding Values to a Color Scheme Definition

- 1 Click Home tab ► Room & Area panel drop-down ► Color Schemes.

You can open the Edit Color Scheme dialog using [another method](#).

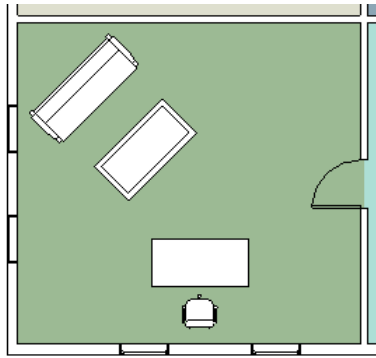
- 2 In the Edit Color Scheme dialog, click  (Add Value).
- 3 In the New Color Scheme Entry dialog, enter a name and click OK.
- 4 Edit value options as necessary. See [Creating a Color Scheme](#) on page 1021 for details on options.

NOTE Certain parameters only accept properly formatted values. For example, if you need to enter a value for area, you can enter a number or a formula. If the value does not have the correct format, a message displays to indicate this.

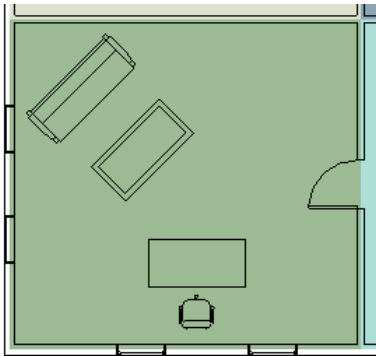
- 5 Click OK.

Applying a Color Scheme

- 1 In the Project Browser, right-click the floor plan view or section view to apply a color scheme to, and select Properties.
- 2 In the Instance Properties dialog, click in the Color Scheme cell.
- 3 In the Edit Color Scheme dialog, under Schemes, select a category and color scheme.
For information on creating a new color scheme, see [Creating a Color Scheme](#) on page 1021.
- 4 Click OK.
- 5 For Color Scheme Location, select one of the following values:
 - **Background:** Applies the color scheme to the background of the view only. For example, in a floor plan view, it applies the color scheme to the floor only. In a section view, it applies the color scheme to the background walls or surfaces only. The color scheme is not applied to foreground elements in the view.



- **Foreground:** Applies the color scheme to all model elements in the view.



6 Click OK.

Related topic

- [Color Schemes](#) on page 1019
- [Adding a Color Scheme Legend](#) on page 1025
- [Creating a Color Scheme](#) on page 1021
- [Adding Values to a Color Scheme Definition](#) on page 1022

Using a Color Scheme in a Section View

In addition to using a color scheme for a floor plan view, you can also use a color scheme to color and apply fill patterns to rooms or areas in a section view. See [Applying a Color Scheme](#) on page 1022.



Modifying a Color Scheme

1 Click Home tab ► Room & Area panel drop-down ► Color Schemes.

You can also open the Edit Color Scheme dialog using [another method](#).

2 In the Edit Color Scheme dialog, select the color scheme to edit, and make the necessary changes.
See [Creating a Color Scheme](#) on page 1021 and [Adding Values to a Color Scheme Definition](#) on page 1022 for details on options.

3 Click OK.

Applying the Host Model Color Scheme to Rooms and Areas in Linked Models

1 Click Home tab ► Room & Area panel drop-down ► Color Schemes.

You can open the Edit Color Scheme dialog using [another method](#).

2 In the Edit Color Scheme dialog, select the option Include elements from linked files, and click OK.

3 Click View tab ► Graphics panel ► Visibility/Graphics.

4 Click the Revit Links tab.

5 Select the linked model to apply the host color scheme to, and click the button in the Display Settings column.

6 If the linked model contains rooms, select By Host view or Custom.

If the linked model contains areas, select Custom. If you select Custom:

■ For Linked View, select the view from the linked model to display.

■ For Color Fill, select By Host View.

7 Click OK.

For more information about visibility of linked Revit models, see [Visibility for Linked Revit Models](#) on page 1282.

Applying the Linked Model Color Scheme to Rooms and Areas in Linked Models

1 Click Home tab ► Room & Area panel drop-down ► Color Schemes.

You can open the Edit Color Scheme dialog using [another method](#).

2 In the Edit Color Scheme dialog, select the option Include elements from linked files, and click OK.

3 Click View tab ► Graphics panel ► Visibility/Graphics.

4 Click the Revit Links tab.

5 Select the linked model to apply a color scheme to, and click the button in the Display Settings column.

6 Select By Linked View or Custom.

7 If you select Custom, for Color Fill, select By Linked View.

8 For Linked View, select the view to apply the color scheme to.

9 Click OK.

For more information about visibility of linked Revit models, see [Visibility for Linked Revit Models](#) on page 1282.

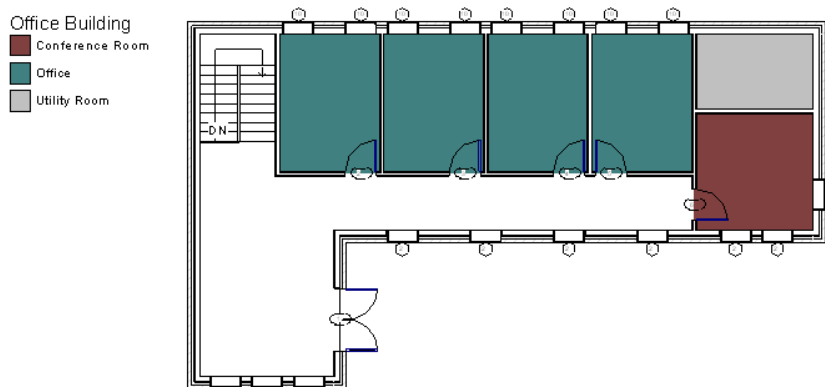
Removing the Color Scheme Display

- 1 In the Project Browser, right-click the view for which you want to remove the color scheme display, and select Properties.
- 2 In the Instance Properties dialog, click the value box for the Color Scheme parameter.
- 3 In the Edit Color Scheme dialog, select (none) from the list, and click OK.
- 4 Click OK to exit the Instance Properties dialog.

You can also remove the color scheme display by selecting the color scheme legend in the drawing area, and clicking Modify Color Fill Legends tab ► Scheme panel ► Edit Scheme. In the Edit Color Scheme dialog, select (none), and click OK.

Color Scheme Legend

Color schemes color rooms and areas in a floor plan or section view by values that you define. You can add a color scheme legend to the colored view to identify what the colors represent.



Color scheme legends can be placed anywhere in the floor plan. Multiple color scheme legends can be placed in a view, or you can apply a color scheme to a view and, if you do not want the color scheme legend to display, you can select it and delete it.

You can resize color scheme legends using drag controls. You can also resize the swatches in the color scheme legend, show or hide the legend title, modify the order of items in the legend, and modify the graphic appearance of the swatches.

Adding a Color Scheme Legend

- 1 Open a floor plan view or section view.
- 2 Click Home tab ► Room & Area panel ► Legend.
- 3 Click in the drawing area to place the color scheme legend.
- 4 In the Choose Space Type and Color Scheme dialog, select the space type and color scheme, and click OK.

If the color scheme legend that displays does not reflect the color scheme that you want to use, do the following:

- a In the drawing area, select the legend.

- b Click Modify Color Fill Legends tab ► Scheme panel ► Edit Scheme.
- c In the Edit Color Scheme dialog, select a different color scheme from the list, and click OK.
You can also create a new color scheme in this dialog. For more information, see [Creating a Color Scheme](#) on page 1021.

Modifying a Color Scheme Legend

You can resize a color scheme legend, resize the swatches (the color boxes that display in the legend), modify the order of items in the legend, change the graphic appearance of legend swatches, and change the legend title.

To resize the legend

- 1 In the drawing area, select the color scheme legend.
- 2 Drag the blue circle control up to move color swatches to new columns, or down to move color swatches to the previous column. You can have as many columns in your legend as you have swatches.
- 3 Drag the blue triangle control to resize column width.



To resize legend swatches

- 1 In the drawing area, select the color scheme legend.
- 2 Click Modify Color Fill Legends tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 In the Type Properties dialog, edit the values for Swatch Width and Swatch Height.

NOTE Changes made to these type parameters affect all color scheme legends of this type in the project.

- 4 Click OK.

To modify the order of items

- 1 In the drawing area, select the color scheme legend.
- 2 Click Modify Color Fill Legends tab ► Scheme panel ► Edit Scheme.
- 3 In the Edit Color Scheme dialog, select a row and click  or  to move values up or down in the list. These options are available when By value is selected.

NOTE When you modify the order of items, all project views that use the color scheme are affected.

- 4 Click Apply to view your changes. Click OK to exit the Edit Color Scheme dialog.

To modify the graphic appearance of legend swatches

- 1 In the drawing area, select the color scheme legend.
- 2 Click Modify Color Fill Legends tab ► Scheme panel ► Edit Scheme.
- 3 In the Edit Color Scheme dialog, change the color and fill patterns as necessary for the desired values.

NOTE When you modify the graphic appearance of legend swatches, all project views that use the color scheme are affected.

4 Click Apply to view your changes. Click OK to exit the Edit Color Scheme dialog.

To change the legend title

- 1 In the drawing area, select the color scheme legend.
- 2 Click Modify Color Fill Legends tab ► Scheme panel ► Edit Scheme.
- 3 Edit the text for Title.

NOTE When you modify the legend title for a color scheme, all project views that use the color scheme are affected.

4 Click Apply to view your changes. Click OK to exit the Edit Color Scheme dialog.

To show or hide the legend title

- 1 In the drawing area, select the color scheme legend.
- 2 Click Modify Color Fill Legends tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 In the Type Properties dialog, select or clear the Show Title parameter value.

NOTE Changes made to this type parameter affect all color scheme legends of this type in the project.

4 Click OK.

Color Scheme Legend Properties

Name	Description
Graphics	
Swatch Width	Controls the width of the swatches.
Swatch Height	Controls the height of the swatches.
Values Displayed	Filters the display of values in a view. By view shows only the values in the current view. All shows all values present in the color scheme.
Background	Sets the background of the legend to opaque or transparent.
Color	Sets the color of the legend text.
Show Title	Shows or hides the legend title. The legend title is specified in the color scheme definition.
Text	
Font	Sets the font of the legend values.
Size	Sets the size of the legend values.
Bold	Applies bold formatting to the legend values.
Italic	Applies italic formatting to the legend values.
Underline	Applies underline formatting to the legend values.

Name	Description
Title Text	
Font	Sets the font of the legend title.
Size	Sets the size of the legend title.
Bold	Applies bold formatting to the legend title.
Italic	Applies italic formatting to the legend title.
Underline	Applies underline formatting to the legend title.

Preparing Construction Documents

17

To create a construction document set in Revit Architecture, you create sheets, and add drawings and schedules to the sheets. Then you can print the sheets or publish them in another format, such as DWF, for electronic sharing and review. You can send the construction documents to the field, where clients or reviewers can mark up the designs for revisions. Revit Architecture provides tools for tracking the revisions.

Related topics

- [Project Views](#) on page 125
- [Dimensions](#) on page 263
- [Annotating and Detailing](#) on page 1087

Construction Documents Overview

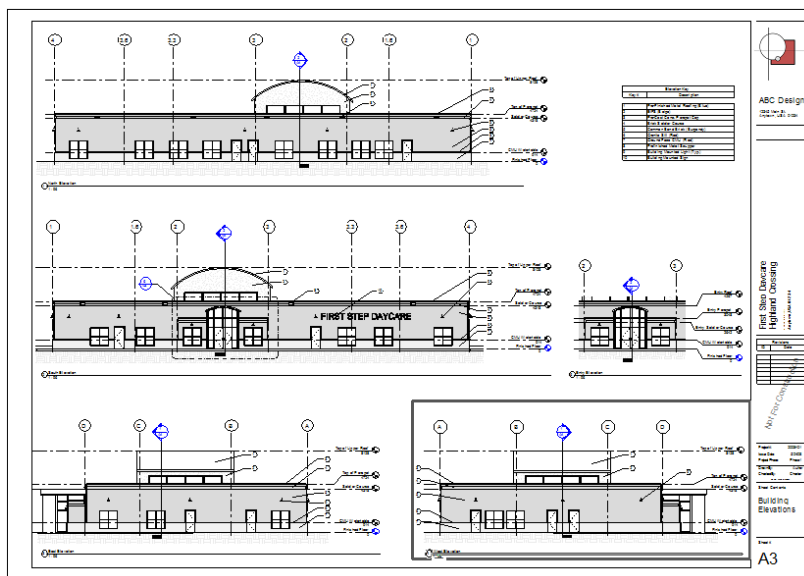
Construction documents are the records that you share with clients, engineers, and construction professionals to communicate a design. For example, clients need to see floor plans, elevations, and 3D drawings of the design for approval. Engineers from other disciplines will want to see those drawings, as well as more detailed drawings, to help them understand the building model and how it affects their work. Construction professionals need all of these drawings, as well as schedules and material takeoffs, to build the design.

A construction document set (also called a drawing set or a sheet set) consists of several sheets. Each sheet contains one or more drawings and schedules for the building design.



Sheets

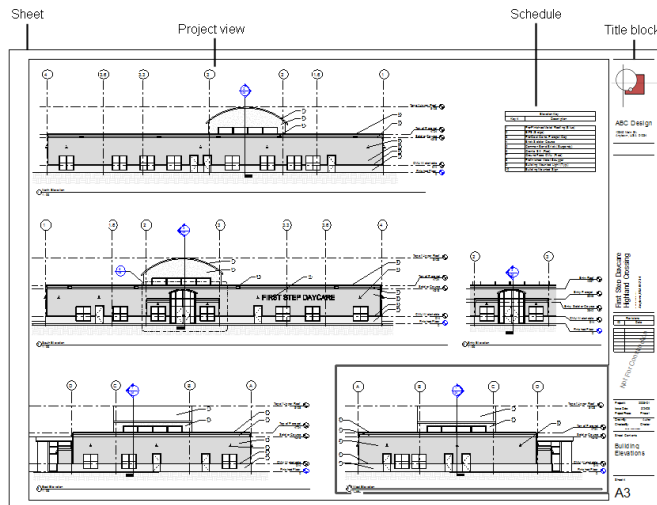
In Revit Architecture, you create a sheet view for each sheet in a construction document set. You can then place multiple drawings or schedules on each sheet.



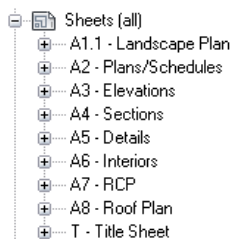
Sheets Overview

A sheet (also called a drawing sheet) is an individual page of a [construction document set](#). In Revit Architecture, you create a sheet view for each sheet in the construction document set. You can then place multiple drawings or schedules on each sheet view.

Parts of a sheet



When you add sheets to a Revit project, they are listed in the Project Browser under Sheets (all).



As you move a drawing or schedule onto a sheet, a viewport displays. A viewport is a representation of the drawing or schedule when it is placed on a sheet.

Digital Cartoon Sets

Some architects use a cartoon set to plan the document requirements for a project. A cartoon set is a rough plan for the sheets that you want to include in the construction document set, and the drawings, schedules, or other information to show on each sheet.

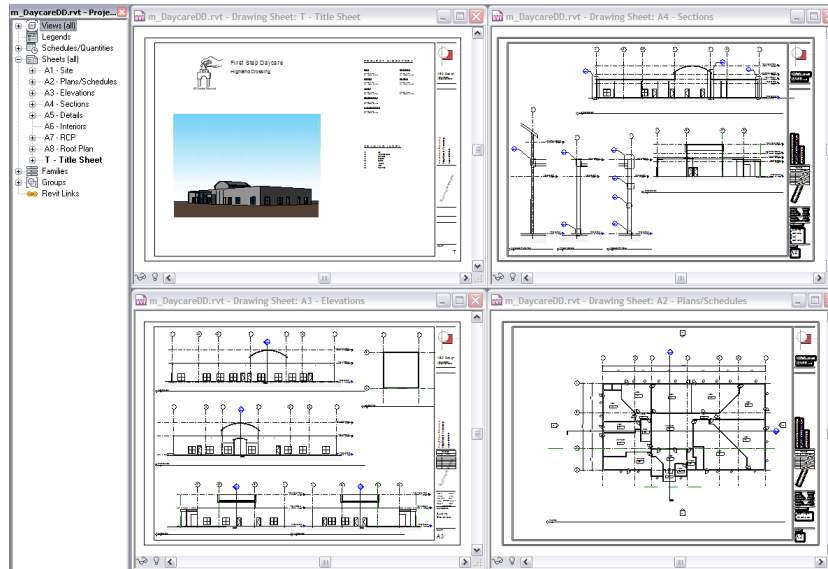
By creating a cartoon set, you can ensure that the final construction document set includes all desired information. You can also use this method to ensure that the construction document set meets standards established by your organization.

With Revit Architecture, you can create a digital cartoon set. First add the required views (drawings and schedules) to the project, and sketch the basic design of the building model. Add the desired sheets to the project, and give them appropriate names and numbers. Then add the views to the appropriate sheets. If desired, you can set the view scales, titles, and other attributes now, so the resulting sheets use the desired settings.

Even though these views and sheets do not yet show the completed design, they provide an overall structure for the project. As you develop the building model in the project views, the schedules update accordingly, and the sheets display the desired information. This technique streamlines the project documentation process.

When you create a digital cartoon set that reflects corporate standards or a typical project setup, you can use the project to create a project template. See [Sheets in Project Templates](#) on page 1032.

Planning sheets with a digital cartoon set



Sheets in Project Templates

When creating a project template, you can include sheets in the template. Start with a blank project file, and create the standard views and levels that each project should include. Leave the views empty, but assign standard names to them. To create a standard set of construction documents, create sheets using the desired title blocks. Add views to the sheets, using the desired viewport templates and view title types. Then save the empty project as a project template. (See [Creating a Custom Project Template](#) on page 445.)

When you create a project using this project template, all of the views and sheets are already created and listed in the Project Browser. As you start to draw the building model in the project views, the views on the sheets update automatically. This technique streamlines the project documentation process and maintains organizational standards.

Adding a Sheet

- 1 Open the Revit project.
- 2 Add a sheet using one of the following methods:
 - In the Project Browser, right-click Sheets (all), and click New Sheet.
 - Click View tab ► Sheet Composition panel ► New Sheet.
- 3 Select a title block, as follows:
 - a In the Select a Titleblock dialog, select a title block from the list.
If the list does not show the desired title block, click Load. In the Library folder, open the Titleblocks folder, or navigate to the folder where the title block resides. Select the title block to load, and click Open.
 - b Click OK.

For information about title blocks, see [Title Blocks](#) on page 1046.

- 4 Enter information in the title block of the sheet.
See [Specifying Title Block Information for Sheets](#) on page 1037.

5 Add views to the sheet.

See [Adding Views to a Sheet](#) on page 1033.

6 Change the default number and name that Revit Architecture assigned to the sheet.

See [Renaming a Sheet](#) on page 1037. The sheet number and name display in the Project Browser under Sheets (all).

NOTE To track printing times, Revit Architecture displays a date and time stamp on sheets. To format the display of this stamp, modify the regional and language settings on your computer.

Related topics

- [Sheets Overview](#) on page 1030
- [Creating a Title Sheet](#) on page 1040
- [Sheet Properties](#) on page 1044

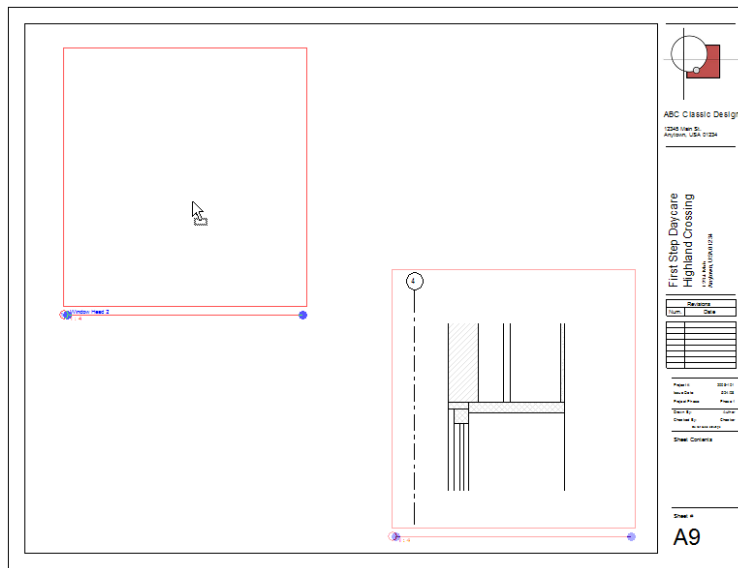
Adding Views to a Sheet

You can add one or more views of a building to a sheet, including floor plans, site plans, ceiling plans, elevations, 3D views, sections, detail views, drafting views, and rendered views. Each view can be placed on one sheet only. To add a particular view to multiple sheets in a project, create duplicate views, and place each one on a different sheet.

NOTE You can also place legends and schedules (including view lists and drawing lists) on sheets. Legends and schedules can be placed on multiple sheets. See [Adding a Schedule to a Sheet](#) on page 1063.

To add views to a sheet

- 1 Open the sheet.
- 2 To add a view to the sheet, use one of the following methods:
 - In the Project Browser, expand the list of views, locate the view, and drag it onto the sheet.
 - Click View tab ► Sheet Composition panel ► View. In the Views dialog, select a view, and click Add View to Sheet.
- 3 As you move the cursor over the sheet in the drawing area, a viewport for the selected view moves with it. Click to place the viewport in the desired location.
- 4 Repeat Steps 2 and 3 to add more views to the sheet, if desired.
- 5 If needed, you can modify the individual views on the sheet as follows:
 - To change the view title that displays on the sheet, double-click the title, and edit it. See [View Titles on Sheets](#) on page 1059.
 - To move the view to a new location on the sheet, select its viewport, and drag it.



You can now do any of the following, as explained in [Modifying a View on a Sheet](#) on page 1038:

- Change the scale of the view.
- Add dimensions to the view.
- Add text notes to the view.
- Pan the view.

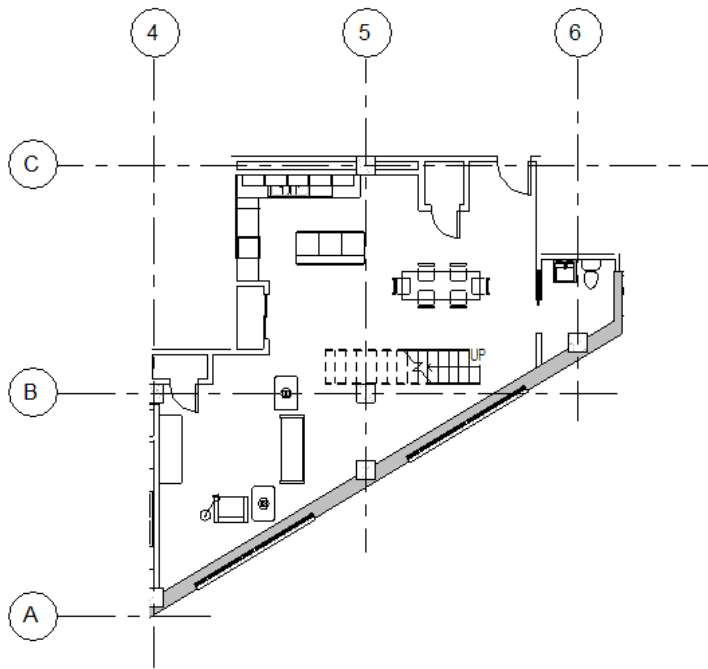
Related topics

- [Aligning Views on a Sheet](#) on page 1035
- [Locking the Position of a View on a Sheet](#) on page 1036
- [Dividing a View Across Multiple Sheets](#) on page 1039
- [Rotating a View on a Sheet](#) on page 1040

Hiding Parts of a View on a Sheet

When placing a particular view on a sheet, you can use the following techniques to hide parts of the view to focus on one area:

- **Crop region:** Use the crop region to focus the view on a particular area of the building model. See [Crop Regions](#) on page 211.
- **Masking regions:** Use masking regions to hide areas of the view (within the rectangular crop region) that are not relevant. For example, in the following floor plan, masking regions obscure the upper-right and upper-left corners of the apartment unit to hide irrelevant model geometry. See [Masking Regions](#) on page 1147.



TIP If you want to retain the original version of the view, first create a duplicate view. (In the Project Browser, right-click the view name, and click Duplicate View ► Duplicate.) Open the duplicate view, and apply crop regions and masking regions as needed. Then place the duplicate view on the sheet.

Applying Standard Settings to a View on a Sheet

You can apply standard settings to a view on a sheet by using a viewport type. For example, you can create a viewport type that does not display a view title on a sheet, or that uses a different color and weight for the line that separates the drawing from its title. See [Viewport Types](#) on page 1057.

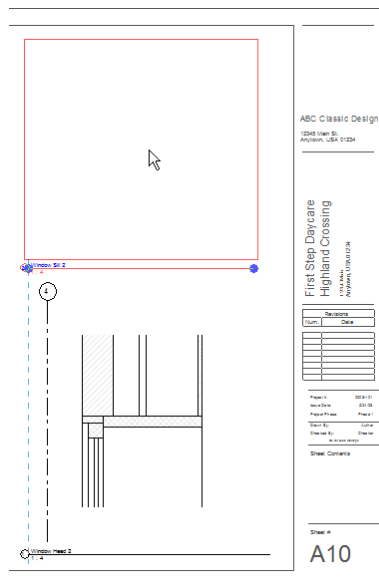
Aligning Views on a Sheet

When positioning views on a sheet, you can align the view titles. The view titles stay aligned even if the size of a viewport changes.

NOTE This method of aligning views on a sheet does not apply to schedules.

To align views on a sheet

- 1 In a project, add 2 or more views to a sheet.
See [Adding Views to a Sheet](#) on page 1033.
- 2 Drag a view to the desired location on the sheet.
- 3 If desired, change the length of the horizontal line that displays in the view title.
See [Modifying a View Title on a Sheet](#) on page 1059.
- 4 Drag the second sheet to the desired location.
When the view title of the second sheet aligns (vertically or horizontally) with the view title of the first sheet, Revit Architecture displays a dashed line.



5 (Optional) Lock the views in place on the sheet.

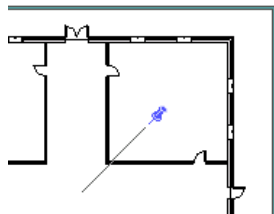
See [Locking the Position of a View on a Sheet](#) on page 1036.

Locking the Position of a View on a Sheet

After placing a view (or schedule) on a sheet and positioning it as desired, you can lock it in place so that it cannot be moved inadvertently.

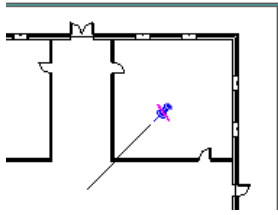
To lock a view on a sheet

- 1 Open the sheet.
- 2 Select the view to lock in place on the sheet.
- 3 Click **Modify Viewports** tab ► **Modify** panel ► **Pin**.
- 4 The pin icon displays on the view, indicating that it is locked in place.



To unlock a view on a sheet

- 1 On the sheet, select the locked view.
The pin icon displays on the view, indicating that it is locked in place.
- 2 Click the pin icon.
The pin icon changes, indicating that the view is no longer locked in place. To move the view on the sheet, drag it to a new location.



Renaming a Sheet

- 1 In the Project Browser, under Sheets (all), right-click the sheet name, and click Rename.
- 2 In the Sheet Name dialog, enter a new number and name for the sheet, and click OK.

Changes to the sheet number and name are propagated throughout the project, so that all references to the sheet are accurate.

As an alternative, you can change the sheet number and name as follows: open the view properties for the sheet, and change the values of the Sheet Number and Sheet Name parameters.

Specifying Title Block Information for Sheets

A title block typically displays information about the project, as well as information about individual sheets. Use the following procedures to specify the information that you want to display in the title blocks of sheets in a project.

NOTE To add custom fields to a title block, see [Adding Custom Fields to a Title Block](#) on page 1054.

Project #:	2328-101	Project-specific information
Issue Date:	24-May	
Project Phase:	Phase 1	
Drawn By:	Samir Bhatia	Sheet-specific information
Checked By:	Sue Smith	
Do not scale drawings		
Sheet Contents		
Floor Plan, Schedules		
Sheet #		
A2		

Entering Project-Specific Information

Project-specific information is data that remains the same on all sheets of a project. Examples include the project issue date and status, the client name, and the project's address, name, and number.

To update the title block of a sheet with project-specific information, open the project, and use either of the following methods:

- **Enter the information directly on a sheet.** Open a sheet. Click on the placeholder text for project-specific information in the title block. Update the text as desired.
- **Change project information settings.** Click Manage tab ► Project Settings panel ► Project Information. Under Other, enter values for the project information parameters. Click OK.

Revit Architecture updates all sheets in the project with the new information.

Entering Sheet-Specific Information

Sheet-specific information is data relating to an individual sheet in a project, such as the sheet name and number, designer, and reviewer.

To update the title block of a sheet with sheet-specific information, open the project, and use either of the following methods:

- **Enter the information directly on a sheet.** Open a sheet. Click on the placeholder text for sheet-specific information in the title block. Update the text as desired.
- **Change view properties.** Open a sheet. Right-click in the drawing area, and click View Properties. On the Instance Properties dialog for the sheet, change the values of the sheet-specific parameters that display in the title block. Click OK.

Modifying a View on a Sheet

1 Open the sheet.

2 In the drawing area, select a view on the sheet.

TIP If views on the sheet overlap, press Tab until the correct view highlights. Watch the status bar for the description of the viewport.

3 Click Modify Viewports tab ► Viewport panel ► Activate View.

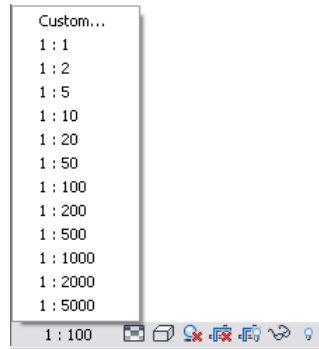
Revit Architecture displays the sheet title block and its contents in halftone. (See [Halftone/Underlay](#) on page 497.) Only the contents of the active view display normally. You can now edit the view as desired. You can zoom in to the drawing area to see the elements more clearly.

4 Modify the view as desired.

For example, you can do the following:

- Add dimensions. See [Placing Permanent Dimensions](#) on page 265.
- Add text notes. See [Adding Text Notes](#) on page 1088.
- Pan the view within its viewport, so that only a portion of the view is visible on the sheet. The crop region for the view does not move. Right-click the activated view, and click Pan Active View. Drag the cursor to pan the view.
- Change the scale of the view. On the View Control Bar, for Scale, select the desired scale.

Metric view scale



5 To deactivate the view on the sheet, click View tab ► Sheet Composition panel ► Deactivate.

Dividing a View Across Multiple Sheets

Sometimes a large view does not fit on a single sheet. In this case, you must create multiple sheets for the view, divide the view into parts, and show one part on each sheet. Or perhaps a view is too tall or wide for a sheet, and you want to show parts of the view next to each other on the same sheet.

To address these issues, use dependent views as follows.

To divide a view across multiple sheets

1 In a project, create and prepare the view that you want to divide into parts.

Add all annotations, details, dimensions, and other information required. See [Project Views](#) on page 125, [Annotating and Detailing](#) on page 1087, and [Dimensions](#) on page 263.

2 Create dependent views.

See [Creating Dependent Views](#) on page 194.

- In each dependent view, use crop regions to show the part of the model to display in that view, and the annotations to include. If any unwanted annotations or model elements display in a dependent view, right-click the element, and click Hide in view ► Elements.
- In the primary view, add matchlines to indicate where the view is split.
See [Adding Matchlines for Dependent Views](#) on page 195.

3 Create the sheets on which to place the dependent views.

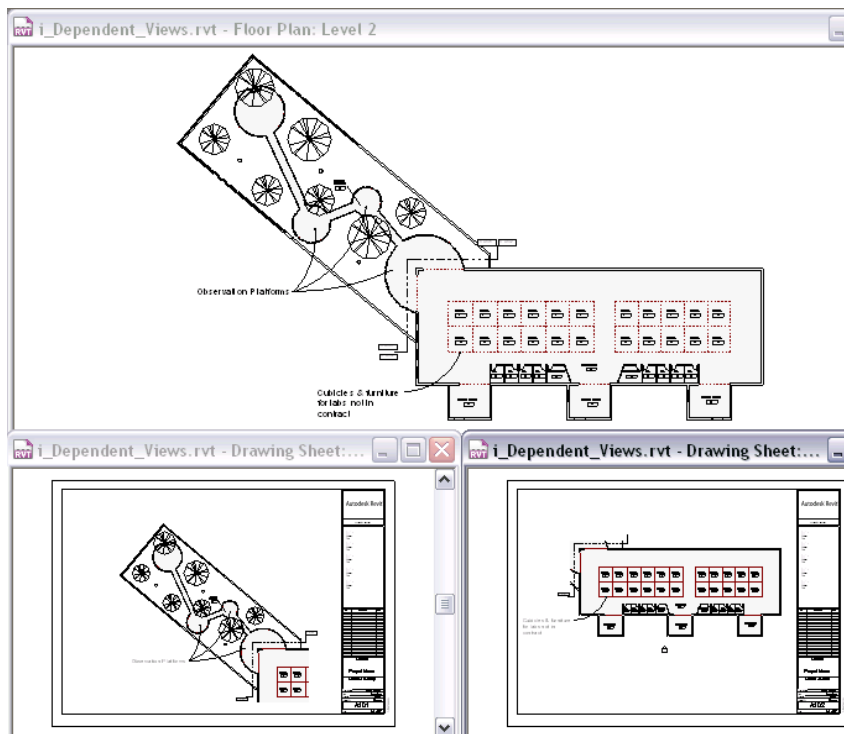
See [Adding a Sheet](#) on page 1032.

4 Add the dependent views to their respective sheets.

See [Adding Views to a Sheet](#) on page 1033.

5 (Optional) Add view references to the primary view.

View references indicate the sheet on which each dependent view displays. For instructions, see [Navigating Primary and Dependent Views](#) on page 196.



Rotating a View on a Sheet

You can rotate a view (or a schedule) on a sheet 90 degrees in either direction (clockwise or counterclockwise).

To rotate a view on a sheet

- 1 In a Revit project, open the sheet.
- 2 On the sheet, select the view to rotate.

NOTE You cannot rotate an active view. If the title block displays in halftone and you can select elements in the view, the view is active. Right-click the view, and click Deactivate View.

- 3 On the Options Bar, for Rotation on Sheet, select the desired rotation option.

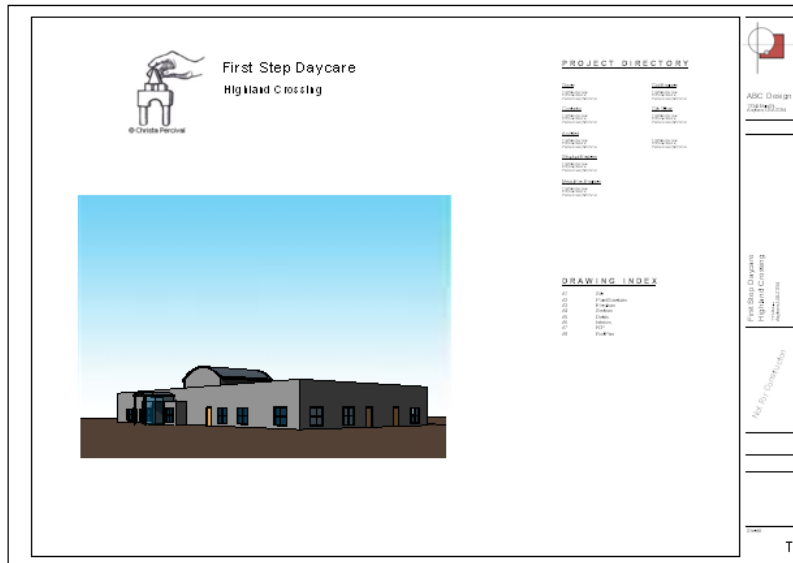
The view rotates on the sheet.

Creating a Title Sheet

A construction documentation set usually includes a title sheet (also called a cover sheet). The title sheet typically includes a rendering, 3D drawing, or other view of the building model. It may also include the following types of information:

- Table of contents (also called a drawing list, drawing index, or sheet index)
- Project name and address
- Client information
- Vicinity plan
- Zoning information

- Code compliance information
- List of project team members
- Legal description of the property and its boundaries
- General notes



Because it includes different types of information than other sheets in the set, the title sheet typically uses a different format. You may need to create a title block specifically designed for the title sheet. See [Title Blocks](#) on page 1046.

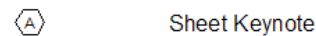
To create a title sheet

- 1 Add a sheet to the project, using the appropriate title block.
See [Adding a Sheet](#) on page 1032.
- 2 Rename the sheet to indicate that it is the title sheet.
See [Renaming a Sheet](#) on page 1037.
- 3 Add the desired view to the sheet.
See [Adding Views to a Sheet](#) on page 1033.
- 4 Create a drawing list, omit the title sheet from the list, and add the drawing list to the sheet.
See [Drawing Lists](#) on page 1066.
- 5 Add the required information to the title sheet.
The title block for the title sheet typically includes fields where you enter information about the project. Click the text areas to enter text. See [Specifying Title Block Information for Sheets](#) on page 1037.

Adding a Legend to a Sheet

Like a map legend, a legend on a sheet helps the building professional to interpret the drawings correctly. In a construction document set, you can include the following types of legends:

- **Component legend:** A list of components used in the building model, with details about their structure, representation in drawings, or visual appearance. For a sample component legend, see [Legend Views](#) on page 168.
- **Keynote legend:** A list of [keynotes](#) used to document the building model. See [Keynote Legend](#) on page 1120.
- **Symbol legend:** A list of the symbols that are used in drawings, similar to the following.



To add a legend to a sheet

- 1 Create the legend view in the project.
For component legends and symbol legends, see [Legend Views](#) on page 168. For keynote legends, see [Keynote Legend](#) on page 1120.
- 2 Open the sheet on which you want to place the legend view.
- 3 In the Project Browser, expand Legends, click the name of the legend view, drag it into the drawing area, and click to place it on the sheet.
You can place a legend view on multiple sheets.
- 4 (Optional) For a component legend or symbol legend, hide the view title.
See [Removing a View Title from a Sheet](#) on page 1060.
- 5 (Optional) For a keynote legend, do the following:
 - Filter the legend based on the views included on the sheet. See [Filtering Keynotes by Sheet](#) on page 1121.
 - Modify the way the keynote legend displays on the sheet. See [Schedules on Sheets](#) on page 1062.

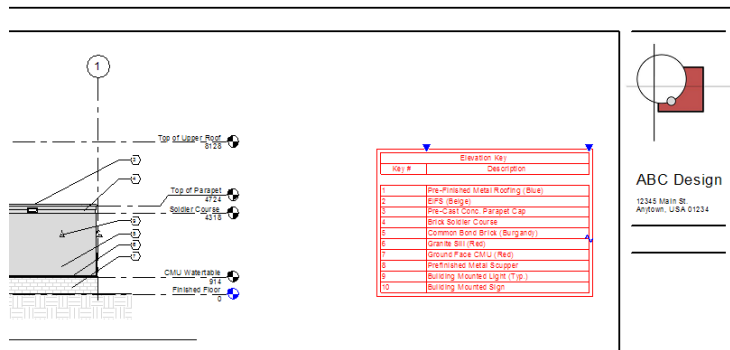
Adding a Note Block to a Sheet

A note block (also called an annotation schedule) is a list of construction notes for a drawing. You can create a note block and place it on a sheet to document the building model.

You can also document a building model using keynote legends. See [Adding a Legend to a Sheet](#) on page 1042.

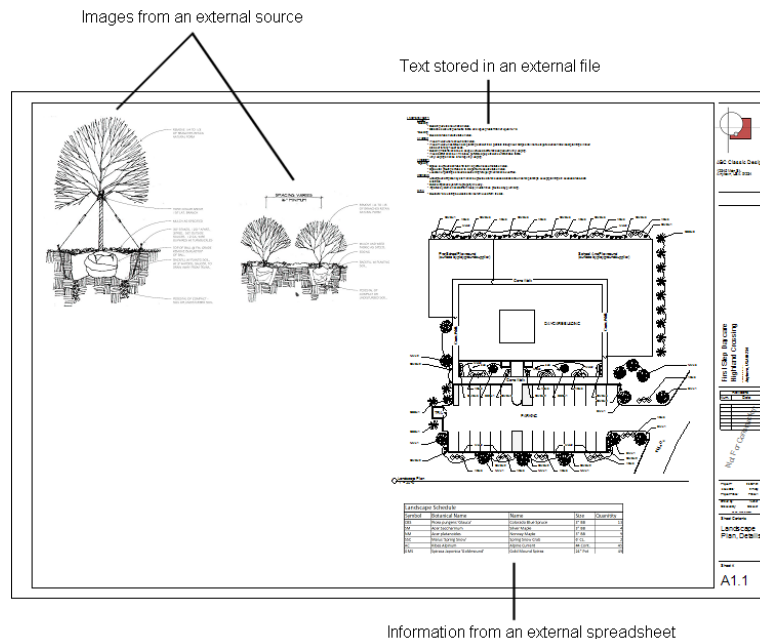
To add a note block to a sheet

- 1 In the project, create the project view to annotate.
See [Project Views](#) on page 125.
- 2 Add notes to the view, and create the note block.
See [Creating an Annotation Schedule \(Note Block\)](#) on page 175.
- 3 Add a sheet.
See [Adding a Sheet](#) on page 1032.
- 4 Place the note block on the sheet, as follows:
 - a In the Project Browser, expand Schedules/Quantities.
 - b Select the name of the note block, drag it onto the sheet, and click to place it.



Using External Information on a Sheet

You can include information that is external to a Revit project on the sheets that Revit Architecture generates. You can use external text, spreadsheets, and images on Revit sheets.



Adding Text from a File to a Sheet

- 1 In the Revit project, open the sheet.
- 2 Click Annotate tab ► Text panel ► Text.
- 3 Click Place Text tab ► Leader panel ► No Leader.
- 4 Click in the drawing area to place the text insertion point.
- 5 On the Windows desktop, open the text document, and copy its contents to the clipboard.
- 6 In Revit Architecture, press Ctrl+V, or click Modify tab ► Clipboard panel ► Paste.

The text box expands to contain the copied text. You can move the text box on the sheet, and edit its contents directly. (Editing its contents does not change the original document from which it was copied.) See [Modifying Text Notes](#) on page 1089.

Adding a Spreadsheet to a Sheet

- 1 In the spreadsheet application, open the spreadsheet. Display the data as you want it to display on the Revit sheet.
- 2 Use a screen capture utility to take a screenshot of the spreadsheet.
For example, you can use a screen capture utility such as SnagIt® by TechSmith Corporation or !Quick Screen Capture by Etrusoft, Inc.
Save the image using one of the following file types: BMP (bitmap), JPEG, JPG, PNG (portable network graphics), and TIFF.
- 3 Add the spreadsheet image to the Revit sheet.
See [Adding an Image to a Sheet](#) on page 1044.

Adding an Image to a Sheet

- 1 Prepare the image file.
Revit Architecture supports the following image file types: BMP (bitmap), JPEG, JPG, PNG (portable network graphics), and TIFF.
- 2 In the Revit project, open the sheet.
- 3 Click Insert tab ► Import panel ► Image.

NOTE If the legacy details are stored using a CAD format, such as DWG, click Insert tab ► Import panel ► Import CAD.

- 4 In the Import Image dialog, navigate to the location of the image file.
- 5 Select the image file, and click Open.
- 6 Click in the drawing area to place the image on the sheet.

To reposition the image, drag it to the desired location on the sheet. To resize the image, select it, and drag a blue corner dot.

Sheet Properties

Use sheet properties to control the appearance and behavior of a sheet. For example, you can specify the sheet name and number, and whether the sheet is included in the drawing list. You can also use sheet properties to define information that displays on the sheet, such as the issue date, designer, and reviewer.

NOTE To track printing times, Revit Architecture displays a date and time stamp on sheets. To format the display of this stamp, modify the regional and language settings on your computer.

Modifying Sheet Properties

To modify sheet properties, do either of the following:

- In the Project Browser, right-click the sheet name, and click Properties.
- Open the sheet. Right-click in the drawing area, and click View Properties.

You can modify the properties of multiple sheets in one operation. For example, you can change the Sheet Issue Date for several sheets in one step. In the Project Browser, while pressing Ctrl, click to select non-adjacent sheet names, or while pressing Shift, click to select adjacent sheet names. Then right-click, and click Properties. When you use this method, changes that you make to the view properties affect all selected sheets.

Sheet Instance Properties

Name	Description
Visibility/Graphics Overrides	Click Edit to display the Visibility/Graphics Overrides dialog for the sheet. See Visibility and Graphic Display in Project Views on page 198.
Scale	The scale of the views on the sheet. If the sheet contains multiple views displayed at different scales, this parameter shows the value As indicated.
Dependency	Indicates whether views on the sheet are dependent on other views. See Duplicate Dependent Views on page 192.
Referencing Sheet	See the description for Referencing Detail, which follows. From the example, the referencing sheet is A101.
Referencing Detail	This value comes from the referencing view that is placed on a sheet. For example, you create a section in a plan view and place the plan view as the first detail on a sheet numbered A101. The referencing detail number for the section view is 1. See Referencing a Drafting View on page 1141 and Referencing a Callout View on page 1137.
Current Revision Description	If the project has revisions, the description of the most recent revision displayed on the sheet. See Revisions on page 1069.
Current Revision	If the project has revisions, the sequence number of the most recent revision displayed on the sheet. See Revisions on page 1069.
Approved By	The person who approved the plans.
Designed By	The person who designed the plans.
Checked By	The person who checked the drawing.
Sheet Number	A unique identifier for the sheet in the construction document set.
Sheet Name	Brief description of the sheet. This name displays in the Project Browser, drawing lists, and other areas of Revit Architecture.

Name	Description
Sheet Issue Date	An issue date for the sheet. This value is separate from the Project Issue Date label contained in the title block.
Appears in Drawing List	Default value is selected. If you clear the check box, the sheet is excluded from drawing lists.
Revisions on Sheet	Click Edit to select the revisions to list in the revision schedule on this sheet. See Specifying the Revisions to Include in a Revision Schedule on page 1079.
File Path	Location of the project file.
Drawn By	The person who drew the plans.

Title Blocks

A title block is a template for a sheet. It generally includes a border for the page and information about the design firm, such as its name, address, and logo. The title block can also display information about the project, client, and individual sheets, including issue dates and revision information.

Title Blocks Overview

Title blocks define the size and appearance of a drawing sheet. Think of them as templates for the drawing sheet. You create a title block family using the Family Editor. For each title block, you specify the sheet size and add borders, a company logo, and other information. You save the title block family as a separate file with an RFA extension.

Typically, you create custom title blocks and save them in the Library\Titleblocks folder of the Revit Architecture program group. You then add these title blocks to a default project template, so they automatically load when you create a project.

If the custom title blocks are not included in the project template, you can load title blocks into a project. See [Loading a Title Block into a Project](#) on page 1048.




Creating a Title Block

- 1 Click  ► New ► Title Block.
- 2 In the New Title Block dialog, select one of the predefined title block sizes, or select New Size.rft to create a title block with a new size. Click Open.
The Family Editor opens.
- 3 Add lines and text to the title block.
For detailed instructions on how to use the Family Editor, see [The Families Guide](#) on page 418.
You can also add the following to a title block:
 - Images or corporate logos. See [Logos and Images in a Title Block](#) on page 1048.
 - Custom fields. See [Adding Custom Fields to a Title Block](#) on page 1054.
 - A revision schedule. See [Adding a Revision Schedule to a Custom Title Block](#) on page 1050.
- 4 To save the title block, click  ► Save. Specify a location and file name, and click Save.
- 5 Load the title block into a project.
See [Loading a Title Block into a Project](#) on page 1048.


Modifying a Title Block

Modify a title block to change the border and standard information that displays on a sheet.

To modify a title block

- 1 Open a title block for editing, using one of the following methods:
 - Open a project that contains sheets that use the title block (or a project into which you have loaded the title block). In the Project Browser, expand Families ► Annotation Symbols. Right-click the name of the title block to modify, and click Edit.
 - In the Revit window, click  ► Open ► Family. Navigate to the location of the title block family (RFA) file. Select the file, and click Open.
The Family Editor opens, displaying the title block in the drawing area.
- 2 Modify the title block as desired.
 - To rotate text or a label in a title block, select the text or label, and drag the rotation controls.
 - To change text in the title block, double-click the text, and edit it.
 - To create custom fields that display information on a title block, see [Adding Custom Fields to a Title Block](#) on page 1054.

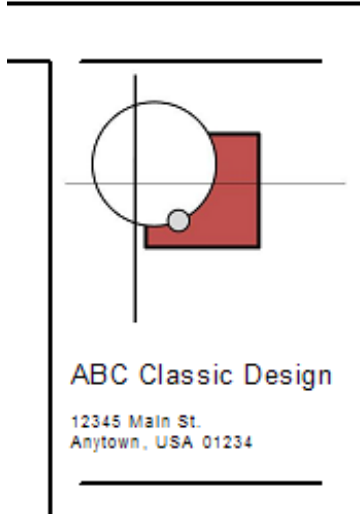
NOTE To update project-specific information or sheet-specific information that displays within the title block of sheets in a project, see [Specifying Title Block Information for Sheets](#) on page 1037.

- 3 To save the title block, on the Quick Access toolbar, click  (Save).
- 4 Load the new or changed title block into a project.
See [Loading a Title Block into a Project](#) on page 1048.

Logos and Images in a Title Block

To include a corporate logo or image in a title block, you can import an image file into a title block family. Revit Architecture supports the following image file types: BMP (bitmap), JPEG, JPG, PNG (portable network graphics), and TIFF.

A corporate logo in a title block



To import an image into a title block

- 1 Prepare the image or logo, and save it in a supported file format.

TIP Import the file using the image size at which you want it to display in the title block. If you load and resize a large image file in the title block, Revit Architecture retains the large file size, which can degrade performance. To improve performance, use the smallest acceptable image file.

- 2 Open the title block in the Family Editor.
See [Modifying a Title Block](#) on page 1047.
- 3 Click Insert tab ► Import panel ► Image.
- 4 In the Import Image dialog, navigate to the location of the image file.
- 5 Select the image file, and click Open.
- 6 Click in the drawing area to place the image.

To reposition the image, drag it to the desired location on the sheet. To resize the image, select it and drag a blue corner dot.

Loading a Title Block into a Project

You can load a title block into a project as follows:

- **When creating or modifying a title block.** After saving changes to the title block family, in the Family Editor, click Load into Project. If multiple projects are currently open, select the open projects into which you want to load the title block, and click OK. If only one project is open, Revit Architecture loads the title block into that project without further input.
- **When adding a sheet to a project.** See [Adding a Sheet](#) on page 1032.
- **Using the ribbon in a project.** Use the following procedure.

To load a title block using the ribbon

- 1 Open a project.
- 2 Click Insert tab ► Load from Library panel ► Load Family.
- 3 In the Load Family dialog, navigate to the location of the title block family file.
- 4 Select the title block family file, and click Open.

Revit Architecture loads the title block family into the project. In the Project Browser, title blocks display under Families ► Annotation Symbols.

Changing the Title Block Used on a Sheet

To change the title block that displays on a sheet, use one of the following methods:

Select and change

- 1 Open the sheet.
- 2 In the drawing area, select the title block.
- 3 Click Modify Title Blocks tab ► Element panel, and select the desired title block from the Type Selector drop-down.
(If the desired title block is not included in the list, [load it](#).)

Delete and drag

- 1 Open the sheet.
- 2 In the drawing area, select the title block, and press *DELETE*.
(If the sheet contains views and schedules, they remain in place in the drawing area.)
- 3 In the Project Browser, under Families ► Annotation Symbols, expand the desired title block.
- 4 Drag the title block from the Project Browser to the sheet, and click to place it.

Place title block

This method is useful when you have deleted the title block from a sheet and then performed other tasks without immediately placing a new title block on the sheet. To place a title block on an existing sheet that does not have one, do the following:

- 1 Open the sheet.
- 2 Click View tab ► Sheet Composition panel ► Title Block.
- 3 Click Place Title Block tab ► Element panel, and select the desired title block from the Type Selector drop-down.
- 4 Click in the drawing area to place the title block on the sheet.

Revision Schedules on Title Blocks

When designing a title block, you can include a revision schedule. You can specify the information to include in the revision schedule. You can also specify its layout, height, and placement on the title block. When you add a sheet to a project, the revision schedule displays information about revisions in that project.

Revisions		
ID	Date	Description
1	9.14	Wall Type Change
2	9.24	Accessible Modifications
3	10.15	Owner Request
4	11.02	Add Vision Lites

Adding a Revision Schedule to a Custom Title Block

1 Open a title block for editing.

See [Modifying a Title Block](#) on page 1047.

2 (Optional) In the title block, sketch a border for the revision schedule area.

3 Click View tab ► Create panel ► Revision Schedule.

4 On the Fields tab of the Revision Properties dialog, add the fields to include in the schedule.

These fields correspond to columns of the Sheet Issues/Revisions dialog for a project. (See [Entering Revision Information](#) on page 1070.)

The Revision Sequence field corresponds to the Sequence column of the dialog. This field indicates the overall sequence of revisions in a project, regardless of their assigned revision numbers.

See [Selecting Fields for a Schedule](#) on page 176.

5 Specify sorting for the revision schedule, as follows:

- a Click the Sorting/Grouping tab of the Revision Properties dialog.
- b For Sort by, select Revision Sequence, and specify Ascending or Descending.
- c Ensure that Itemize every instance is selected.

6 Specify formatting for column headings in the revision schedule, as follows:

- a Click the Formatting tab of the Revision Properties dialog.
- b In the Fields list, select a field.
- c Specify the heading, orientation, and alignment for the field.
- d If you want to omit the selected field from the revision schedule, select Hidden Field.
Use the Hidden Field option, for example, if you want to use the field for sorting or grouping but do not want it to display in the revision schedule.

Repeat these steps for each field in the revision schedule.

7 Specify display attributes for lines, text fonts, and schedule order and height, as follows:

- a Click the Appearance tab of the Revision Properties dialog.
- b For Build schedule, specify whether the revision schedule builds from the bottom up or the top down.
See [Building a Revision Schedule from the Top Down or Bottom Up](#) on page 1053.
- c For Height, specify whether the height of the revision schedule is user defined (fixed) or variable.
See [Defining the Height of the Revision Schedule](#) on page 1052.

- d Use the remaining options of the Appearance tab to define attributes for grid lines, header text, and body text.
See [Formatting a Schedule](#) on page 183.

8 Click OK.

Revit Architecture creates the revision schedule and displays it in the drawing area.

9 In the Project Browser, double-click the empty node under Sheets (all).


The title block displays in the drawing area.

10 In the Project Browser, under Views (all) ► Schedules, select the revision schedule, and drag it to the drawing area.

11 Place the revision schedule in the desired location on the title block.

To change the width of columns, select the revision schedule, and drag the blue triangles between column headers.

12 (Optional) To rotate the revision schedule on the title block, see [Rotating a Revision Schedule](#) on page 1051.

13 To save the title block, on the Quick Access toolbar, click  (Save).

14 Load the title block into one or more open projects.

See [Loading a Title Block into a Project](#) on page 1048.

Rotating a Revision Schedule

You can rotate a revision schedule 90 degrees clockwise or counterclockwise on a title block. To rotate a revision schedule, modify the title block family. You cannot rotate a revision schedule on a particular sheet in a project.

A horizontal revision schedule (left), and a rotated revision schedule (right)

Revisions		
ID	Date	Description
1	9.14	Wall Type Change
2	9.24	Accessible Modifications
3	10.15	Owner Request
4	11.02	Add Vision Lites

Revisions		
ID	Date	Description
1	9.14	Wall Type Change
2	9.24	Accessible Modifications
3	10.15	Owner Request
4	11.02	Add Vision Lites

To rotate a revision schedule

1 Open the title block for editing.

See [Modifying a Title Block](#) on page 1047.

2 In the drawing area, select the revision schedule of the title block.


The status bar displays Schedule Graphics : Schedule Graphics : Revision Schedule.

3 On the Options Bar, for Rotation on Sheet, select the desired rotation option.

4 Reposition the rotated revision schedule on the title block, if needed.

5 (Optional) Define a fixed height for the revision schedule.

Defining a fixed height ensures that the revision schedule does not expand beyond the boundaries of a sheet. See [Defining the Height of the Revision Schedule](#) on page 1052.

6 To save the title block, on the Quick Access toolbar, click  (Save).

7 Load the title block into a project.

See [Loading a Title Block into a Project](#) on page 1048.

Defining the Height of the Revision Schedule

By default, revision schedules use a variable height, so that the schedules can expand to accommodate all of the revisions for a sheet.

If needed, you can specify that a revision schedule has a fixed (user defined) height. On a sheet in a project, the schedule displays only the revisions that can fit in the allotted space. If the sheet refers to more revisions than can fit in the schedule, Revit Architecture shows the most recent revisions and omits the rest.

To specify a fixed height, modify the revision schedule in the title block family, and use the Height option of the Revision Properties dialog, as follows.

To define a fixed height for a revision schedule

1 Open the title block for editing.

See [Modifying a Title Block](#) on page 1047.

2 Modify the revision schedule properties, as follows:

- a In the Project Browser, under Views (all) ► Schedules, right-click Revision Schedule, and click Properties.
- b On the Instance Properties dialog, for Appearance, click Edit.
- c On the Appearance tab of the Revision Properties dialog, for Height, select User defined.
- d Click OK twice.

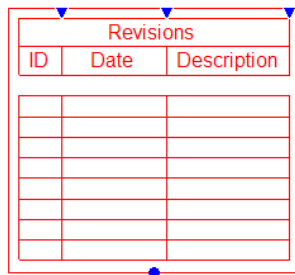
3 In the drawing area, select the revision schedule of the title block.

The status bar displays Schedule Graphics : Schedule Graphics : Revision Schedule.


The bottom of the revision schedule displays a blue dot. Grid lines display to indicate the amount of space required for each row of revision information (assuming one line per revision row; in a sheet, long values wrap to the next line). In this mode, these grid lines display regardless of whether the revision schedule is set to display grid lines.

4 Drag the blue dot up or down until the revision schedule is the desired height.

The blue dot indicates the bottom boundary of the revision schedule. If a sheet in a project has more revisions than can fit in this space, Revit Architecture omits the oldest revisions from the schedule.



Revisions		
ID	Date	Description

- 5 To save the title block, on the Quick Access toolbar, click  (Save).
- 6 Load the title block into a project.
- See [Loading a Title Block into a Project](#) on page 1048.

Building a Revision Schedule from the Top Down or Bottom Up


Revision schedules can display information in various ways. Some design firms use a top-down approach, with column headings and revision rows starting at the top of the schedule. Other design firms use a bottom-up approach, with column headings and revision rows starting at the bottom of the schedule. In either case, the revision schedule sorts the rows using the settings specified on the Sorting/Grouping tab of the Revision Properties dialog. (See [Adding a Revision Schedule to a Custom Title Block](#) on page 1050.)

Revisions		
ID	Date	Description
1	9.14	Wall Type Change
2	9.24	Accessible Modifications
3	10.15	Owner Request
4	11.02	Add Vision Lites

4	11.02	Add Vision Lites
3	10.15	Owner Request
2	9.24	Accessible Modifications
1	9.14	Wall Type Change

ID	Date	Description
Revisions		

To change the way that revision schedules display information

- 1 Open the title block for editing.
- See [Modifying a Title Block](#) on page 1047.
- 2 In the Project Browser, under Views (all) ► Schedules, right-click Revision Schedule, and click Properties.
- 3 On the Instance Properties dialog, for Appearance, click Edit.
- 4 On the Appearance tab of the Revision Properties dialog, for Build schedule, select one of the following values:
- **Top-down:** Column headings display at the top of the revision schedule. Revision rows start at the top of the schedule and go down.
 - **Bottom-up:** Column headings display at the bottom of the revision schedule. Revision rows start at the bottom of the schedule and go up.
- 5 Click the Sorting/Grouping tab of the Revision Properties dialog. Make sure that the revision schedule is sorted as desired.
- 6 Click OK twice.
- 7 If needed, adjust the position of the revision schedule on the title block.
- a In the drawing area, select the revision schedule of the title block.
 - The status bar displays Schedule Graphics : Schedule Graphics : Revision Schedule.
 - b Drag the revision schedule to the desired location.
- 8 To save the title block, on the Quick Access toolbar, click  (Save).
- 9 Load the title block into a project.
- See [Loading a Title Block into a Project](#) on page 1048.

Adding Custom Fields to a Title Block

In general, a title block contains placeholders for 2 types of information:

- **Project-specific information.** This information applies to all sheets in the project. Examples: project name, client information, project address.
- **Sheet-specific information.** This information differs for each sheet within a project. Examples: sheet name, sheet number, reviewer, sheet issue date.

When you add a sheet to a project, the project-specific information in the title block displays the appropriate information. You can enter the sheet-specific information directly on the sheet.

Revit Architecture provides default title block families. These title blocks include some project-specific information fields and some sheet-specific information fields. If you want to add more information (custom fields) to a title block, use shared parameters.

NOTE Use shared parameters (not project parameters) so that they are available to the title block families and the projects that use them.

To add custom fields to a title block

- 1 Create (or edit) a shared parameter file, and add shared parameters to the file.

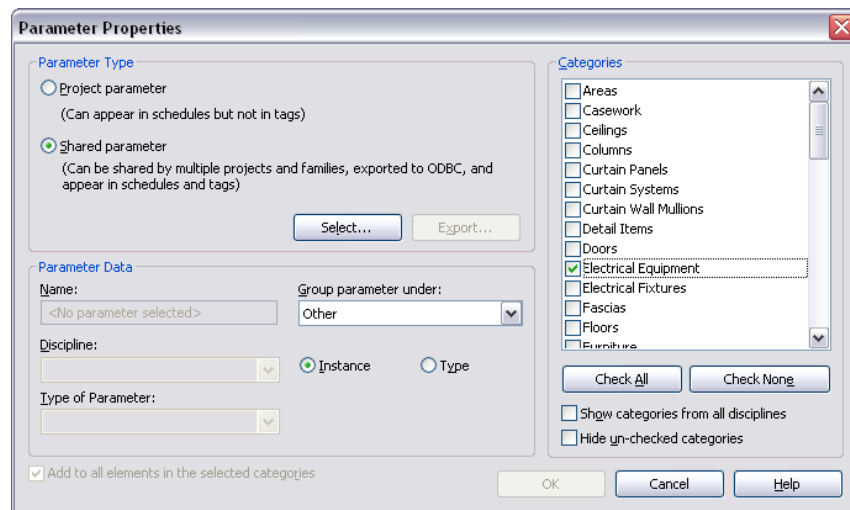
Click **Manage** tab ► **Project Settings** panel ► **Shared Parameters**. Add one shared parameter for each new project-specific or sheet-specific field. See [Shared Parameters](#) on page 451.

- 2 Add the shared parameters to the project.

See [Creating Shared Project Parameters](#) on page 459.

When adding each parameter using the **Parameter Properties** dialog, under **Categories**, select one of the following:

- **Drawing Sheets** for a sheet-specific field
- **Project Information** for a project-specific field




Now these fields are available to the project.

- 3 Add the shared parameters to a title block using labels.

See [Labels](#) on page 1156.

NOTE You can add static text to describe a parameter in the title block. See [Text Notes](#) on page 1087.

4 To save the title block, on the Quick Access toolbar, click  (Save).

After loading the title block into a project and adding sheets, you can see the custom fields on the sheets.

- **Project-specific fields:** Click Manage tab ► Project Settings panel ► Project Information to display the shared parameters that belong to the Project Information category. You can change these values in that dialog or on a sheet. Whenever you change project-specific information, Revit Architecture updates all sheets in the project with the changes. See [Entering Project-Specific Information](#) on page 1037.
- **Sheet-specific fields:** The shared parameters that belong to the Drawing Sheets category display when you view sheet properties. You can change these values in the sheet properties dialog or on a sheet. These changes apply only to the individual sheet. See [Entering Sheet-Specific Information](#) on page 1038.


Related topics

- [Loading a Title Block into a Project](#) on page 1048
- [Adding a Sheet](#) on page 1032

Importing a Title Block from Another CAD Program

If you created a title block using another CAD application, you can import it into Revit Architecture. Some text in the imported title block may reflect information that is specific to the project or sheet. Replace this text with Revit parameters so that the information can update automatically.

To import a title block

- 1 In the CAD application, do the following:
 - a Prepare the title block. For example, remove unwanted text, or text that you plan to replace with Revit parameters.
 - b Export the title block to a DXF or DWG file.
- 2 In Revit Architecture, create the title block, as follows:
 - a Click  ► New ► Title Block.
 - b In the New Title Block dialog, select the appropriate sheet size for the title block, and click Open.
If the imported title block uses a non-standard size, select New Size.rft, and click Open.
- 3 Import the title block, as follows:
 - a Click Insert tab ► Import panel ► Import CAD.
 - b In the Import CAD Formats dialog, navigate to the location of the title block file to import.
 - c For Files of type, select the type of file to import.
 - d For File name, specify the file to import.
 - e Specify the desired import options.
See [Import and Link Options for CAD Formats and Revit Models](#) on page 1392.
 - f Click Open.

If you cannot see the imported title block in the drawing area, type **ZF** (Zoom to Fit).

4 If needed, adjust the defined print area.

When you selected a title block size in the New dialog, Revit Architecture placed lines in the drawing area. These lines define the size of the printed page (the print area) for the sheet. If the imported title block is larger or smaller than the selected title block size, drag the lines to the edges of the title block.

5 If needed, explode the imported file.

If the imported title block includes text, perform a full explode to separate the imported object into its component objects. (See [Exploding Imported Geometry](#) on page 1404.) Then you can delete the text in the title block and replace it with Revit labels. (When you add a sheet to a project, these labels update to display project-specific or sheet-specific information.)

To explode the imported file:

- a** In the drawing area, select the imported title block.

The status bar displays the following:

Imports in Families : Import Symbol : location <Not Shared>.


- b** Click Modify Imports in Families tab ► Import Instance panel ► Explode drop-down ► Full Explode.

You can now select individual lines or pieces of text to move or delete them.

6 Replace project-specific or sheet-specific text from the imported title block with Revit labels.

For example, if the imported title block includes the text Client Name as a placeholder, select this text and delete it. Then replace it with the Project Name parameter that Revit Architecture provides, or another parameter that you have defined. See [Adding Custom Fields to a Title Block](#) on page 1054.

7 Make any other changes required.

- 8** To save the title block, on the Quick Access toolbar, click  (Save).

- 9** Load the title block into a project template or a project where you want to use it.

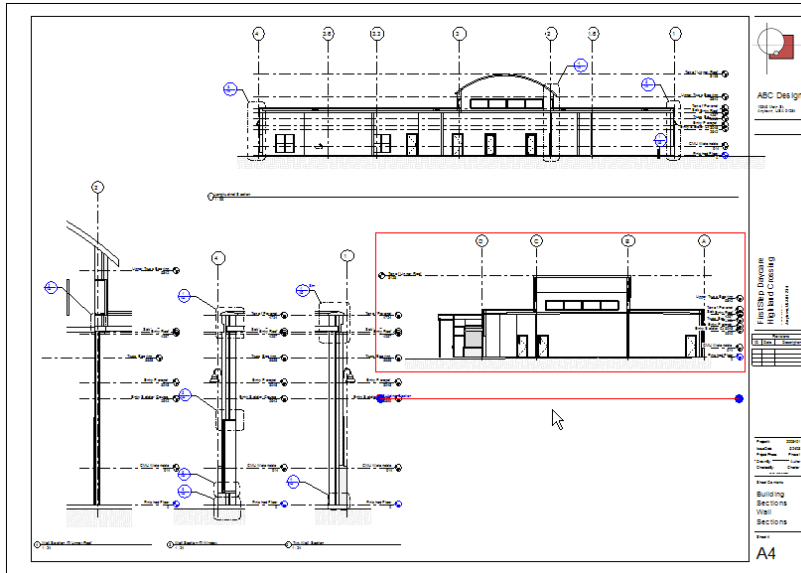
See [Loading a Title Block into a Project](#) on page 1048.

Viewports

When you add a view to a sheet, a viewport displays on the sheet to represent the view. The viewport is like a window through which you can see the actual view. If desired, you can activate the view and modify the building model from the sheet. (See [Modifying a View on a Sheet](#) on page 1038.)

NOTE Viewports apply only to project drawings, such as floor plans, elevations, sections, and 3D views. They do not apply to schedules.

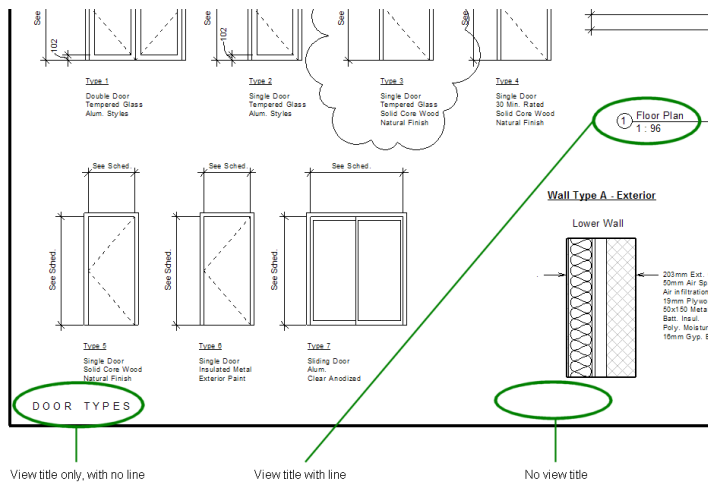
A viewport on a sheet



Viewport Types

Viewport types (also known as title marks) define settings for viewports. These settings control display attributes of the view title (for example, whether the view title and its horizontal line display on a sheet). You can apply viewport types to views on a sheet.

NOTE To change the information included in a view title or its display attributes, create or edit a view title type. See [View Title Types](#) on page 1061.



Creating a Viewport Type

The following procedure assumes that you have created sheets in a project, and placed views on the sheets.

To create a viewport type

- 1 Open a sheet.

- 2 Select a viewport for a view on the sheet.
The Type Selector displays a list of available viewport types.
- 3 Click Modify Viewports tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 4 On the Type Properties dialog, click Duplicate.
- 5 In the Name dialog, enter a name for the new viewport type, and click OK.
- 6 Complete the parameters for the viewport type.
See [Viewport Type Properties](#) on page 1058.
- 7 Click OK.

Revit Architecture applies the new viewport type to the selected viewport.

Applying a Viewport Type

After [creating a viewport type](#), you can apply it to viewports on sheets in a project. The following procedure assumes that you have created sheets in a project, placed views on the sheets, and created one or more viewport types.

To apply a viewport type to a view on a sheet

- 1 Open a sheet.
- 2 Select a viewport.
- 3 Click Modify Viewports tab ► Element panel, and from the Type Selector drop-down, select the viewport type to apply to the viewport.

Revit Architecture applies the viewport type to the selected viewport.

Modifying Viewport Type Properties

- 1 On a sheet, select a viewport, and click Modify Viewports tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 2 Edit viewport type properties.
See [Viewport Type Properties](#) on page 1058.
- 3 Click OK.

Viewport Type Properties

Name	Description
Title	Specifies the type of view title to use. The view title type specifies the information that is displayed in a view title and its text attributes. Select a view title type from the list, or, to omit a view title, select none. See View Title Types on page 1061.
Show Title	Controls the display of the view title. Use one of the following values: <ul style="list-style-type: none">■ Yes: Display view titles.■ No: Do not display view titles.■ When multiple viewports: Display view titles only when a sheet contains multiple views. If a sheet contains a single view, do not display the view title.

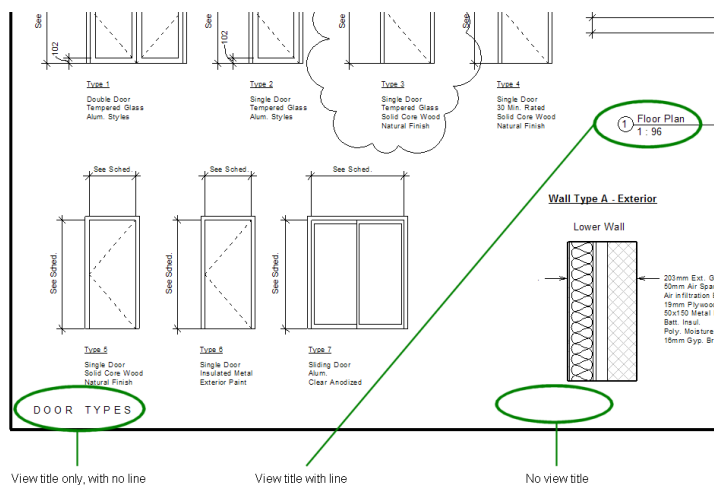
Name	Description
Show Extension Line	Shows or hides an extension line for the view title. The extension line displays only if the view title displays. See View Titles on Sheets on page 1059. To change the length of the line for an individual view title, see Modifying a View Title on a Sheet on page 1059.
Line Weight	Specifies the weight of the horizontal line for the view title.
Color	Specifies the color of the horizontal line for the view title.
Line Pattern	Specifies the pattern of the horizontal line for the view title.

View Titles on Sheets

When you place a view on a sheet, by default Revit Architecture displays a view title. You can specify text attributes for view titles, define the information to include in a view title, or omit view titles from sheets. You can define these attributes for individual view titles on sheets. You can also define view title types and use them to apply standard settings to view titles.

To change the weight, color, or pattern of the horizontal line in a view title, or omit the line from the view title, create or modify a viewport type. See [Viewport Types](#) on page 1057. To change the length of the horizontal line for an individual view title, see [Modifying a View Title on a Sheet](#) on page 1059.

NOTE View titles display only for views, such as floor plans, elevations, sections, and 3D views. View titles do not display for schedules.



Modifying a View Title on a Sheet

The following procedure assumes that you have created sheets in a project, and added views to the sheets.

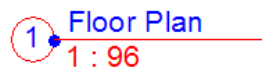
To modify an individual view title

- 1 Open a sheet.
- 2 Select the viewport for the view whose title you want to change.
- 3 To change the view title on the sheet, do either of the following:
 - Rename the view. This method changes the name of the view in the Project Browser and on the sheet. See [Renaming Views](#) on page 259.

- Change the view title. This method retains the current view name in the Project Browser, but specifies a different view title to display on the sheet.
 - a Click Modify Viewports tab ► Element panel ► Element Properties drop-down ► Instance Properties.
 - b On the Instance Properties dialog, under Identity Data, for Title on Sheet, enter the view title to display on the sheet.
 - c Click OK.

If you want to change the display attributes for the view title, create or modify a view title type. See [View Title Types](#) on page 1061.

- 4 To change the length of the horizontal line that displays with the view title, do the following:
 - a Zoom in on the view title until you can clearly see the blue drag controls.



NOTE Be sure that you have selected the viewport for the view on the sheet. If you try to select the view title without selecting the viewport, the blue drag controls for the horizontal line do not display.

- b Drag the controls to shorten or lengthen the horizontal line.

If you want to change or omit the horizontal line in a view title, create or modify a viewport type. See [Viewport Types](#) on page 1057.

Removing a View Title from a Sheet

If you do not want to display a view title on a sheet, create a viewport type that omits view titles. Then apply the viewport type to that view on the sheet.

The following procedure assumes that you have created sheets in a project, and added views to the sheets.

To remove a view title from a sheet

- 1 Open the sheet.
- 2 Select the viewport for a view whose title you want to remove.

The Type Selector displays the name of the viewport type that currently applies to the selected viewport.
- 3 Click Modify Viewports tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 4 If you want to create a viewport type, click Duplicate, and enter a name (for example, Viewport – No Title).

Otherwise, you are editing the viewport type. Changes will apply to all views that use this viewport type on sheets in the project.
- 5 For Show Title, select No.
- 6 Click OK.

The view title is removed from the selected view on the sheet. If needed, you can apply the same viewport type to other views. See [Applying a Viewport Type](#) on page 1058.

View Title Types

View title types provide standard settings for view titles on sheets. Use view title types to do the following:

- Define the type of information that displays in view titles on sheets (such as the view name, number, and scale).
- Define the font, text size and color, and other attributes for parts of the view title.

NOTE To control whether the view title and its horizontal line displays on a sheet, use viewport types. See [Viewport Types](#) on page 1057.

You create and edit view title types using the Family Editor. Revit Architecture provides several view title types. Some default view title types include sheet numbers and referencing sheet numbers to provide cross-referencing information between views and sheets.

The default view title types contain View Title in their file names. They reside in the following default location:

C:\Documents and Settings\All Users\Application Data\Autodesk\<product and release>\<Imperial or Metric Library>\Annotations

Modifying a View Title Type

1 Open the view title type for editing, using one of the following methods:

- Open a project that contains sheets that use the view title type (or a project into which you have loaded the view title type). In the Project Browser, expand Families ► Annotation Symbols. Right-click the name of the view title type to modify, and click Edit.

- Click  ► Open ► Family. Navigate to the location of the view title type (RFA) file. Select the file, and click Open.

The Family Editor opens, displaying the view title type in the drawing area.

2 Modify the view title type as desired.

- To rotate text or a label in a view title, select the text or label, and drag the rotation controls.
- To change text in the view title, double-click the text, and edit it.
- To change the type of text used to display a label, select the label in the drawing area. Then click Modify Label tab ► Element panel, and select another label type from the Type Selector drop-down. Or, to edit text parameters for the current label type, click Modify Label tab ► Element panel ► Element Properties drop-down ► Type Properties.

3 To save the view title type, on the Quick Access toolbar, click  (Save).

4 Load the view title type into a project.

See [Loading a View Title Type into a Project](#) on page 1062.

Loading a View Title Type into a Project

You can load a view title type into a project as follows:

- **When creating or modifying a view title type.** After saving changes to the view title type in the Family Editor, click Family Editor panel ► Load into Project. Select the open projects into which you want to load the view title type, and click OK.
- **Using the ribbon in a project.** The view title type is then available when you edit viewport types within the project. Use the following procedure.

To load a view title type using the ribbon

- 1 Open a Revit project.
- 2 Click Insert tab ► Load from Library panel ► Load Family.
- 3 In the Load Family dialog, navigate to the location of the view title type file.
The default view title types contain View Title in their file names. They reside in the following default location:
C:\Documents and Settings\All Users\Application Data\Autodesk\<product and release>\<Imperial or Metric Library>\Annotations
- 4 Select the view title type file, and click Open.

Revit Architecture loads the view title type into the project. In the Project Browser, the view title type displays under Families ► Annotation Symbols.

Applying a View Title Type to a Viewport Type

After creating or modifying a view title type to display the desired information and text attributes, apply it to a viewport type. All views (on sheets) that use this viewport type then display titles using that view title type.

To apply a view title type to a viewport type

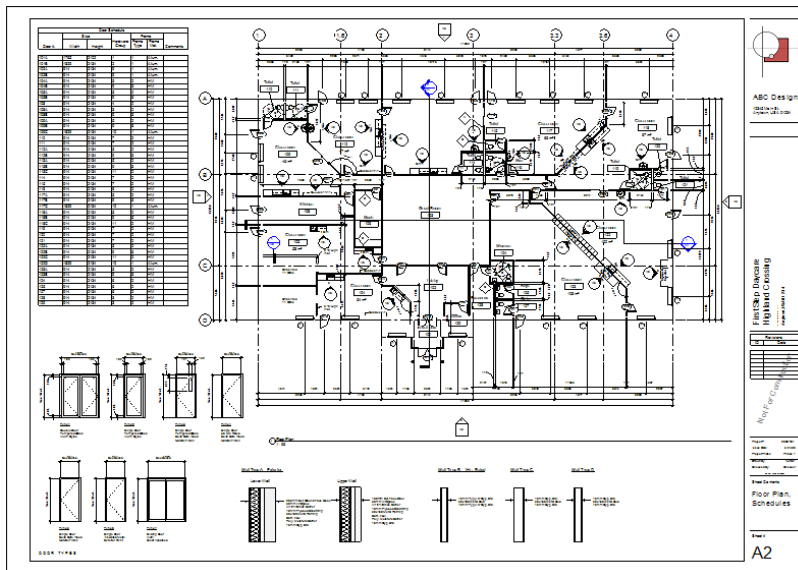
- 1 On a sheet, select the viewport to which you want to apply a different view title type.
The Type Selector displays the viewport type that currently applies to the selected viewport.
- 2 Click Modify Viewports tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 For Title, select the desired view title type from the list.

NOTE If the list does not include the desired view title type, click Cancel. Load the desired view title type. (See [Loading a View Title Type into a Project](#) on page 1062.) Then repeat this procedure to apply the view title type to the viewport type.

- 4 Click OK.

Schedules on Sheets

You can place schedules on sheets in a construction document set. The same schedule can reside on multiple sheets.



Adding a Schedule to a Sheet

- 1 In a project, open the sheet to which you want to add a schedule.
- 2 In the Project Browser, under Schedules/Quantities, select the schedule, and drag it onto the sheet in the drawing area. Release the mouse button when the cursor is over the sheet.
Revit Architecture displays a preview of the schedule at the cursor.
- 3 Move the schedule to the desired location, and click to place it on the sheet.

You can modify the schedule after placing it on the sheet. In the sheet view, right-click the schedule, and click Edit Schedule. The schedule view displays. You can now edit the cells of the schedule. See [Editing Cells in a Schedule](#) on page 189. You can also rotate the schedule on the sheet. See [Rotating a View on a Sheet](#) on page 1040.

Formatting a Schedule on a Sheet

You can change the attributes that control the display of a schedule on the sheet, including grid lines and text attributes.

The following procedure assumes that you have added a sheet to a project and placed a schedule on the sheet. See [Adding a Sheet](#) on page 1032 and [Adding a Schedule to a Sheet](#) on page 1063.

To format a schedule on a sheet

- 1 In the Project Browser, under Schedules/Quantities, right-click the schedule name, and click Properties.
- 2 On the Instance Properties dialog, for Appearance, click Edit.
- 3 On the Appearance tab of the Schedule Properties dialog, define the settings as desired.
The Appearance options affect the display of the schedule on sheets only. They do not affect the display in the schedule view.
For information and examples of how to set the Appearance options, see [Formatting a Schedule](#) on page 183 and [Schedule Formatting Samples](#) on page 186.
- 4 Click OK.
- 5 On the Instance Properties dialog, click OK.

6 Open the sheet to see the results.

Splitting a Schedule on a Sheet

When you place a schedule on a sheet, you can split the schedule into 2 or more sections to fit the space on the sheet.

NOTE You cannot split a schedule across multiple sheets.

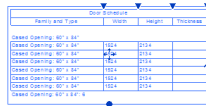
The following procedure assumes that you have added a sheet to a project and placed a schedule on the sheet. See [Adding a Sheet](#) on page 1032 and [Adding a Schedule to a Sheet](#) on page 1063.

To split a schedule on a sheet

1 Open the sheet.

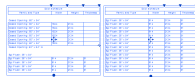
2 Select the schedule on the sheet.

Blue controls allow you to move and manipulate the schedule. The Z break control in the middle of the right border splits the schedule.



3 Click the Z break control.

The schedule divides into 2 sections, splitting at the approximate location of the Z break control.

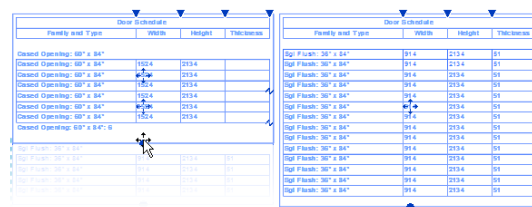


4 To split a section of the schedule further, click the Z break control again.

NOTE You cannot delete schedule sections from a sheet. You cannot drag schedule sections from one sheet to another.

5 To adjust the number of rows in a section of the schedule, drag the blue dot at the bottom of the first section.

If you shrink the schedule section, rows that do not fit automatically move to the next section. The last section contains the remaining rows, so you cannot resize it.

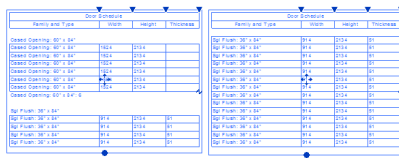


Moving Schedule Sections

The following procedure assumes that you have [added a sheet to a project](#), created a schedule and [placed it on the sheet](#), and [split the schedule](#).

To move a schedule section

- 1 Select the schedule section on the sheet.
- 2 Click the blue arrow control in the center of the schedule section, and drag it to a new location on the sheet.



Joining Split Schedules

You can rejoin the sections of a split schedule on a sheet. Schedule sections are sequential: you can join a section with its previous or subsequent section. For example, if you split a schedule into 4 sections, you can rejoin section 2 with section 1 or 3.

To rejoin schedule sections

- 1 On a sheet that displays a split schedule, drag one schedule section over the other.
- 2 Release the mouse button.

The split schedule sections rejoin into one section.



Adjusting Schedule Columns on a Sheet

When you place a schedule on a sheet, text that does not fit within a column wraps to a new line. To adjust the column width, select the schedule. A blue triangle displays to the upper right of each column. Drag a blue triangle to the left or right.

NOTE If the schedule is split into multiple sections, adjusting the width in one section changes the width in all sections.

Split schedules after column width adjustment



Related topic

- [Modifying Schedules](#) on page 189

Displaying Vertical Headings in a Schedule on a Sheet

When you place a schedule on a sheet, you can specify that one or more column headings display vertically instead of horizontally, as shown

Door Schedule						
Door #.	Size		Hardware Group	Frame		Comments
	Width	Height		Frame Type	Frame Mat.	
101A	1765	2102	1	1	Alum.	
101B	1829	2134	2	1	Alum.	
102A	914	2134	9	1	Alum.	
102B	914	2134	9	1	Alum.	
104A	914	2134	5	2	HM	
104B	914	2134	9	3	HM	
105A	914	2134	5	2	HM	
105B	914	2134	9	3	HM	

The following procedure assumes that you have [added a sheet](#) to a project, [created a schedule](#), and [placed it on the sheet](#).

To display vertical column headings for a schedule on a sheet

- 1 In the Project Browser, under Schedules/Quantities, right-click the schedule name, and click Properties.
- 2 On the Instance Properties dialog, for Formatting, click Edit.
- 3 For each field whose column heading is to display vertically in the sheet, do the following:
 - a On the Formatting tab of the Schedule Properties dialog, under Fields, select the field.
 - b For Heading orientation, select Vertical.
This setting affects the column heading on a sheet only. It does not affect its display in the schedule view.
- 4 Click OK twice.
- 5 Open the sheet to see the results.

In the schedule, the column headings for the selected fields display vertically instead of horizontally. See [Adjusting Schedule Columns on a Sheet](#) on page 1065.

Drawing Lists

A drawing list is a schedule of the sheets in a project. A drawing list can also be referred to as a drawing index or a sheet index. You can use a drawing list as a table of contents for a construction document set. The drawing list is typically placed on the [title sheet](#).

DRAWING INDEX

A1.1	Landscape Plan
A2	Plans/Schedules
A3	Elevations
A4	Sections
A5	Details
A6	Interiors
A7	RCP
A8	Roof Plan

Creating a Drawing List

- 1 In a project, click View tab ► Create panel ► Schedules drop-down ► Drawing List.
- 2 On the Fields tab of the Drawing List Properties dialog, select the fields to include in the drawing list.
See [Selecting Fields for a Schedule](#) on page 176.
- 3 (Optional) To create user-defined fields, click Add Parameter.
For further instructions, see [Custom Parameters](#) on page 450.
- 4 Specify the remaining schedule properties using the Filter, Sorting/Grouping, Formatting, and Appearance tabs. See [Specifying Schedule Properties](#) on page 176.
- 5 Click OK.

The resulting drawing list displays in the drawing area. In the Project Browser, it displays under Schedules/Quantities.

Omitting Sheets from a Drawing List

You can omit sheets from the [drawing list](#). For example, you may not want the cover sheet to display in the drawing list.

To omit a sheet from a drawing list

- 1 In the Project Browser, right-click the name of the sheet to omit, and click Properties.
- 2 On the Instance Properties dialog, clear Appears In Drawing List.
This option is selected for all sheets by default.
- 3 Click OK.

Revit Architecture updates the drawing list to exclude the sheet.

Adding a Drawing List to a Sheet

To add a drawing list to a sheet, use the procedure for adding a schedule to a sheet. See [Adding a Schedule to a Sheet](#) on page 1063.

When you add a drawing list to a sheet, you can perform the same functions as for schedules on sheets, including the following:

- Formatting the drawing list
- Splitting the drawing list
- Adjusting the width of columns
- Displaying column headings vertically instead of horizontally

For instructions, see [Schedules on Sheets](#) on page 1062.

Including External Sheets in a Drawing List

In a construction document set, you may want to include sheets from sources external to Revit Architecture. If so, you can include these external sheets in the drawing list.

To include external sheets in a drawing list

- 1 Add a sheet to the Revit project.
Do not add any project views to the sheet. It will remain empty.
See [Adding a Sheet](#) on page 1032.
- 2 Assign the desired name and number to the sheet.
Use the name and number of the external sheet. See [Renaming a Sheet](#) on page 1037.

Revit Architecture updates the drawing list to include the name and number of the external drawing sheet.

Organizing a Drawing List

If you want the sheets in a drawing list to display in a particular order, you can create a custom Sheet Order parameter and add it to the drawing list properties.

The following procedure assumes that you have created a drawing list and added multiple sheets to the project. See [Creating a Drawing List](#) on page 1067 and [Adding a Sheet](#) on page 1032.

To organize a drawing list

- 1 Open the drawing list.
- 2 In the Project Browser, under Schedules/Quantities, right-click the drawing list name, and click Properties.
- 3 On the Instance Properties dialog, for Fields, click Edit.
- 4 Add a custom field named Sheet Order, as follows:
 - a On the Fields tab of the Drawing List Properties dialog, click Add Parameter.
 - b In the Parameter Properties dialog, under Parameter Type, select Project parameter.
 - c Under Parameter Data, for Name, enter **Sheet Order**.
 - d Click OK.

On the Drawing List Properties dialog, the Sheet Order field displays in the list of scheduled fields.

- 5 Use the Sheet Order field to sort the drawing list, as follows:
 - a Click the Sorting/Grouping tab.
 - b For Sort by, select Sheet Order. Make sure that Ascending is selected.
 - c Click OK.
 - d On the Instance Properties dialog, click OK.

The drawing list displays a column titled Sheet Order. In a later step, you will hide this column so it does not display in the drawing list. First, however, you must assign a sheet order to each sheet in the list.

- 6 For each sheet in the list, click in the Sheet Order column, and enter a number to indicate its order in the sheet sequence.
As you enter sheet order numbers, Revit Architecture re-sorts the list to place the rows in order.

Drawing List		
Sheet Number	Sheet Name	Sheet Order
A6	Interiors	
A7	RCP	
A8	Roof Plan	
T	Title Sheet	0
A1.1	Landscape Plan	1
A2	Plans/Schedules	2
A3	Elevations	3
A4	Sections	4
A5	Details	5

7 To hide the Sheet Order field, right-click the column in the drawing list, and click Hide Column(s).

Revit Architecture hides the Sheet Order column in the drawing list.

Drawing List	
Sheet Number	Sheet Name
A6	Interiors
A7	RCP
A8	Roof Plan
T	Title Sheet
A1.1	Landscape Plan
A2	Plans/Schedules
A3	Elevations
A4	Sections
A5	Details

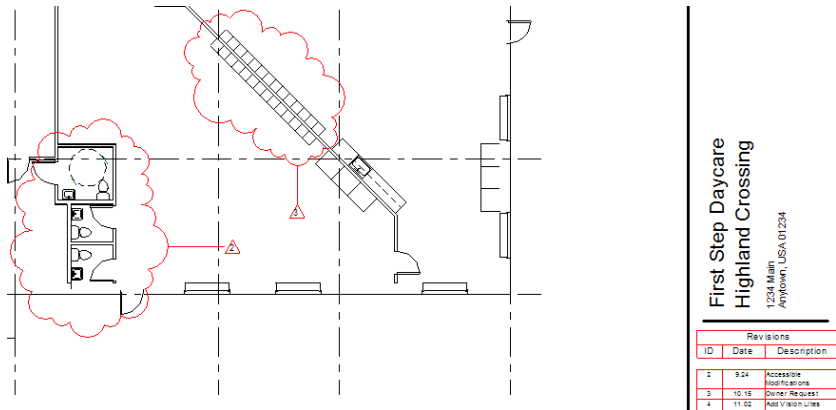
NOTE To redisplay the Sheet Order column, right-click in the drawing list, and click Unhide All Columns.

You can place the drawing list on a sheet and format it as desired. See [Adding a Schedule to a Sheet](#) on page 1063 and [Formatting a Schedule on a Sheet](#) on page 1063.

Revisions

When working on building projects, you must often make changes to meet client or regulatory requirements. These revisions need to be tracked for future reference. For example, you may want to check the revision history to identify when, why, and by whom a change was made. Revit Architecture provides tools that enable you to track revisions and include revision information on sheets in a construction document set.

Revisions on a sheet



Revision Workflow

Revision tracking is the process of recording changes made to a building model after sheets have been issued. In Revit Architecture, you display and track revisions using revision clouds, tags, and schedules.

Typically you manage the revision process as follows:


- 1 Enter information about the revision in the Sheet Issues/Revisions dialog.
See [Entering Revision Information](#) on page 1070.
- 2 Update the Revit project to implement the change.
- 3 In one or more project views, draw revision clouds to indicate the areas that changed.
See [Adding a Revision Cloud](#) on page 1075.
- 4 Assign a revision to each cloud.
See [Assigning a Revision to a Revision Cloud](#) on page 1076.
- 5 Tag the revision clouds to identify the assigned revisions.
See [Tagging a Revision Cloud](#) on page 1077.
- 6 Check sheets to make sure that the revision schedules show the desired information.
See [Specifying the Revisions to Include in a Revision Schedule](#) on page 1079.
- 7 Issue the revisions.
See [Issuing a Revision](#) on page 1080.

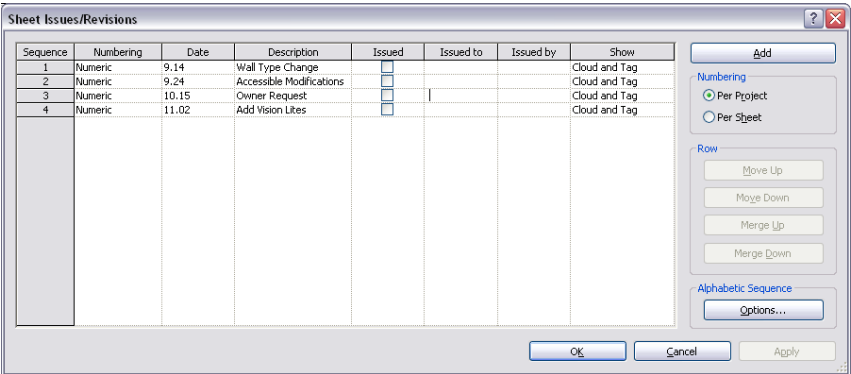
Entering Revision Information

When you revise the building model, enter information about the revision in the project. When you later add revision clouds to a drawing, you can assign the revision to one or more clouds.

NOTE Before entering revision information in a project, decide how revision clouds will be numbered on sheets. See [Revision Cloud Numbering by Project or by Sheet](#) on page 1072.

To enter revision information

- 1 In the project, click View tab ► Sheet Composition panel ►  (Sheet Issues/Revisions).
The Sheet Issues/Revisions dialog displays.



- 2 To add a new revision, click Add.

NOTE For your first revision, edit the values for the existing (default) revision row.

3 In the revision row, for Numbering, select Numeric, Alphabetic, or None.

See [Numbering for Revisions](#) on page 1073.

4 For Date, enter the date on which the revisions are made or will be sent for review.

5 For Description, enter the description of the revision to display in revision schedules on sheets.

6 If the revision has been issued, enter values for Issued to and Issued by, and then select Issued.

See [Issuing a Revision](#) on page 1080.

7 For Show, select one of the following values. (These values apply after you assign the revision to one or more clouds.)

■ **None:** Does not display the revision cloud and the revision tag in the drawing.

■ **Tag:** Displays the revision tag and draws the revision cloud, but does not display the cloud in the drawing. (To move or edit the cloud in the drawing, move the cursor over the cloud area to highlight and select the cloud.)

■ **Cloud and Tag:** Displays the revision cloud and the revision tag in the drawing. This option is the default.

8 Click OK.


Merging Revisions

You can merge (combine) revisions into a single entry. For some projects, you may want to merge all revisions from a particular stage of the project. All new revisions for the next project stage are then listed individually.

When you merge revisions, the target revision (the revision being merged to) remains. Information about the revision being merged is lost.

NOTE You cannot delete revisions in the Sheet Issues/Revisions dialog, but you can merge them.

To merge revisions

1 In the project, click View tab ► Sheet Composition panel ►  (Sheet Issues/Revisions).

2 In the Sheet Issues/Revisions dialog, click the sequence number for the revision to merge with another.

NOTE The information for the selected revision row (including the Date, Description, Issued to, and Issued by values) will be lost when you merge it with another revision.


3 To merge the selected revision with the one above or below it in the list, under Row, click Merge Up or Merge Down.

4 Click OK.

Changing the Order of Revisions

When you change the sequence of revisions on the Sheet Issues/Revisions dialog, the number assigned to each revision changes accordingly. If you use a mix of alphabetic and numeric numbering for revisions, the revision numbers change to reflect their new positions in the overall sequence.

To change the order of revisions

- 1 In the project, click View tab ► Sheet Composition panel ►  (Sheet Issues/Revisions).
- 2 In the Sheet Issues/Revisions dialog, click the sequence number for the revision to move.
- 3 Under Row, click Move Up or Move Down.
If needed, click Move Up or Move Down multiple times to move the selected revision to the desired location in the revision sequence.
- 4 Click OK.

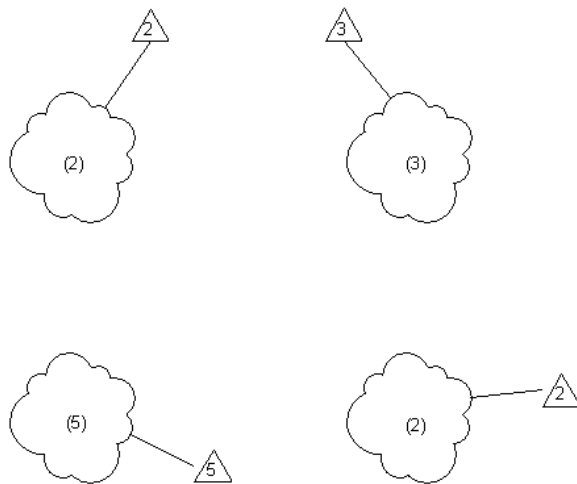
In views and sheets, the revision numbers in tags and revision schedules update to reflect the new sequence.

Revision Cloud Numbering by Project or by Sheet

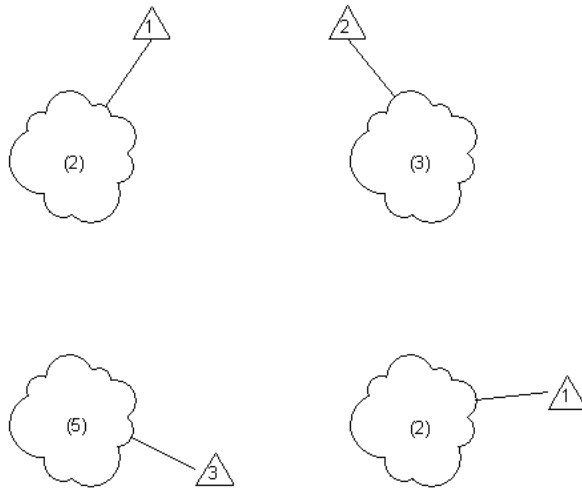
Before entering information about revisions, carefully consider how you want to number revision clouds on sheets: by project or by sheet. Use the Numbering setting in the Sheet Issues/Revisions dialog to control the display of revision numbers for clouds in tags and schedules. If you change this setting after creating revisions, revision numbers of all revision clouds may change.

- **Numbering Per Project:** (default) Revit Architecture numbers revisions according to the sequence of revisions in the Sheet Issues/Revisions dialog. For example, suppose you create clouds for revisions 2, 3, and 4. When you add those clouds to a sheet, the numbering in the tags and the revision schedule display 2, 3, and 4. You cannot modify the sequence number.
- **Numbering Per Sheet:** Revit Architecture numbers clouds relative to the sequence of other clouds on the sheet. For example, suppose you create revisions 5, 6, and 7, and tag revision clouds for them. When you add views (containing the revision clouds) to a sheet, the cloud created for revision 5 is numbered 1, the cloud created for revision 6 is numbered 2, and the cloud created for revision 7 is numbered 3.

The following diagram illustrates cloud numbering by project. The number in the cloud is the project-based revision number. The number in the tag is the revision number assigned to the cloud on the sheet.



The following diagram illustrates cloud numbering by sheet. The number in the cloud is the project-based revision number. The number in the tag is the revision number assigned to the cloud on the sheet.




Related topic

- [Numbering for Revisions](#) on page 1073

Specifying Revision Cloud Numbering by Project or by Sheet

NOTE If you change the Numbering setting after creating revisions, revision numbers of all revision clouds may change. Specify the desired setting before entering revision information for the project.

- 1 In the project, click View tab ► Sheet Composition panel ►  (Sheet Issues/Revisions).
- 2 In the Sheet Issues/Revisions dialog, for Numbering, select the revision numbering method for clouds on a sheet: Per Project or Per Sheet.
See [Revision Cloud Numbering by Project or by Sheet](#) on page 1072.
- 3 Click OK.

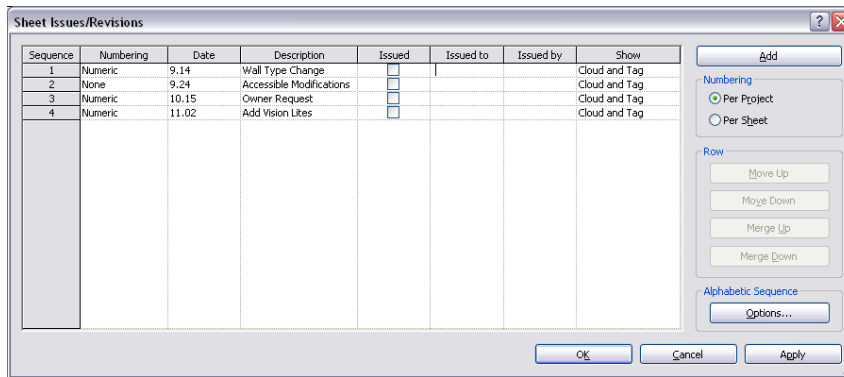
Numbering for Revisions

Revit Architecture provides flexibility in how it displays the sequence of revisions in a project. You can track revisions using the following numbering schemes:

- Numbers
- Letters or a user-defined sequence of letters or other characters
- No number or letter

Use the Sheet Issues/Revisions dialog to specify the numbering scheme to use for each revision. You can also specify the letters or other characters to use for a user-defined sequence.

You can start the project using one numbering scheme (such as numeric). Later in the project, you can use a different numbering scheme to indicate a different stage of the project. The Sequence number listed in the Sheet Issues/Revisions dialog maintains an overall, project-based sequence for all revisions, regardless of their individual numbering schemes.



Related topic

- [Revision Cloud Numbering by Project or by Sheet](#) on page 1072

Assigning a Numbering Scheme to a Revision

You can assign a [numbering scheme](#) to a revision when you first add it to the project. (See [Entering Revision Information](#) on page 1070.) You can also change the numbering scheme later.

To assign a numbering scheme to a revision

- 1 In the project, click View tab ► Sheet Composition panel ► (Sheet Issues/Revisions).
- 2 In the Sheet Issues/Revisions dialog, for the revision whose numbering scheme you want to change, click in the Numbering column.
- 3 From the list, select Numeric, Alphabetic, or None.
For more information, see [Defining an Alphabetic Sequence for Revisions](#) on page 1074 and [Revisions with No Numbering Scheme](#) on page 1075.
- 4 Click OK.

Defining an Alphabetic Sequence for Revisions

If you use an alphabetic sequence for [revision numbers](#), you can specify the characters and the order in which they occur. You can specify one alphabetic sequence per project.

To define an alphabetic sequence

- 1 In the project, click View tab ► Sheet Composition panel ► (Sheet Issues/Revisions).
- 2 In the Sheet Issues/Revisions dialog, under Alphabetic Sequence, click Options.
- 3 In the Sequence Options dialog, enter the characters to use for the sequence.
The sequence can include letters and other characters (such as *, &, and %). It cannot include spaces, numbers, or repeated characters.
If the project contains more revisions than the number of characters in the sequence, Revit Architecture uses double characters. For example, if you define the sequence abcdefghij, and a project has more than 10 revisions, Revit Architecture numbers the later revisions using aa, bb, cc, and so on.
- 4 Click OK.

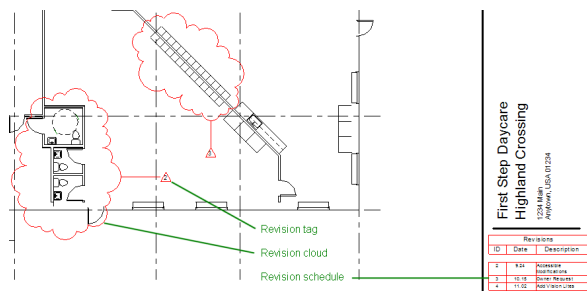
Revisions with No Numbering Scheme

In some cases, you may want a revision to use no numbering scheme. For example, an unnumbered revision can indicate a project milestone or a document issuance. When assigning a numbering scheme to the revision, select None. (See [Assigning a Numbering Scheme to a Revision](#) on page 1074.)

Revision Clouds

Use revision clouds to indicate design areas that have changed in a project. You can sketch revision clouds in all views except 3D views. The cloud is visible in the view where it resides and on sheets that include the view.

After entering revision information, you can assign a revision to one or more clouds. Use tags to identify the revisions assigned to clouds. On sheets, revision clouds and tags can display in their views, if desired. For each sheet, the revision schedule includes information for the revisions represented by the clouds that are displayed in the views on the sheet.



Related topics

- [Revision Workflow](#) on page 1070
- [Entering Revision Information](#) on page 1070

Adding a Revision Cloud

- 1 In the project, open a view in which you want to indicate changes.
You can sketch revision clouds in all views except 3D views.
- 2 Click **Annotate** tab ► **Detail** panel ► **Revision Cloud**.
Revit Architecture enters sketch mode.
- 3 Sketch a cloud, as follows:
 - a In the drawing area, place the cursor near the part of the view that has changed.
 - b Click and move the cursor in a clockwise direction to create a segment of the cloud.
 - c Click to stop that segment and start a new segment.
 - d Continue creating cloud segments until the cloud encompasses the changed area.
- 4 Sketch additional clouds, if needed.
- 5 Click **Create Revision Cloud Sketch** tab ► **Revision Cloud** panel ► **Finish Cloud**.

By default, Revit Architecture assigns to the clouds the latest revision assigned to any view on that view's sheet. (In the sheet view properties, the Current Revision parameter identifies this revision.) To assign a different revision, see [Assigning a Revision to a Revision Cloud](#) on page 1076.

Related topics

- [Revisions](#) on page 1069
- [Revision Clouds](#) on page 1075
- [Revision Workflow](#) on page 1070

Assigning a Revision to a Revision Cloud

When you add a revision cloud to a view, by default Revit Architecture assigns the most recent revision to the cloud. If needed, you can assign a different revision to the cloud. You can assign one revision to each cloud, or assign the same revision to multiple clouds.

To assign a revision to a cloud

- 1 In a project view, select the revision cloud.
- 2 On the Options Bar, for Revision, select the desired revision from the list.
If you have not yet entered information for the revision that you want to assign to the cloud, see [Entering Revision Information](#) on page 1070.

As an alternative, you can right-click a revision cloud, and click Element Properties. On the Instance Properties dialog, for Revision, select the desired revision from the list.

Modifying a Revision Cloud

You can change the boundaries of a revision cloud. You can also change the line weight, color, and style of one cloud or of all clouds in the project.

To change the boundaries and appearance of a revision cloud

- 1 In a project view, select the revision cloud.
- 2 To change its boundaries, do the following:
 - a Click Modify Revision Clouds tab ► Edit panel ► Edit Sketch.
Revit Architecture enters sketch mode.
 - b Select segments of the revision cloud, and drag the endpoints to adjust its boundaries.
 - c Click Modify Revision Clouds > Edit Sketch tab ► Revision Cloud panel ► Finish Cloud.
- 3 To change the appearance of the cloud, do the following:
 - a Right-click the cloud, and click Override Graphics in View ► By Element.
 - b Change the values for the Weight, Color, and Pattern of the cloud lines.
 - c Click OK.

To change the appearance of all revision clouds

- 1 In the project, click Manage tab ► Project Settings panel ► Settings drop-down ► Object Styles.
- 2 Click the Annotation Objects tab.
- 3 For Revision Clouds, change the values for Line Weight, Line Color, and Line Pattern.
- 4 Click OK.
These changes apply to all revision clouds in the project.

Tagging a Revision Cloud

A revision tag identifies the revision assigned to each cloud in a view. (You enter revision information on the Sheet Issues/Revisions dialog. See [Entering Revision Information](#) on page 1070.)

To tag revision clouds

- 1 If the revision tag family is not yet loaded into the project, load it.

A project created using the default project template includes the Revision Tag or M_Revision Tag family. To check whether another revision tag family is loaded, in the Project Browser, under Families ► Annotation Symbols, look for the revision tag family name. To load a revision tag family, see [Loading Families](#) on page 427 for instructions.

- 2 Open the view that contains revision clouds.

- 3 Click Annotate tab ► Tag panel ► Tag By Category.

- 4 In the drawing area, select the revision clouds to tag.

As you select each cloud, Revit Architecture displays a revision tag next to it. Numbers in the tags reflect the revisions assigned to the clouds. (See [Assigning a Revision to a Revision Cloud](#) on page 1076.) On sheets, these tag numbers can differ. (See [Revision Cloud Numbering by Project or by Sheet](#) on page 1072.)

- 5 If desired, adjust the positions of the tags and their leader lines, as follows:

- a Press Esc to exit the Tag by Category tool.
- b Select a revision tag.
You may need to zoom in to see the controls for the revision tag.
- c To reposition the tag, drag the blue arrows.
- d To adjust the elbow in its leader line, drag the blue dot.
- e To remove the leader line, on the Options Bar, clear Leader.
- f To assign the tag to a different revision cloud, click Modify Revision Cloud Tags tab ► Tag panel ► Pick New Host. In the drawing area, select the desired revision cloud for the tag.

For more information about applying a tag to an element, see [Tags](#) on page 1123.

Hiding a Revision Cloud

You can hide revision clouds in a view. The method you use to hide revision clouds can determine whether the revision information (for the hidden clouds) displays in the revision schedule of a sheet.

To hide revision clouds but include their revisions in a revision schedule, use either of the following methods:

- **Sheet Issues/Revisions dialog.** (See [Entering Revision Information](#) on page 1070.) Use the Show column to indicate whether revision clouds and tags display for each revision. This setting affects all views in the project.
- **Hide in view > Category.** In a view, select one or more revision clouds, right-click, and click Hide in view ► Category. This tool hides all clouds in the view.

To hide revision clouds and omit their revisions from a revision schedule, use either of the following methods. By default the revision schedule of the view's sheet does not include the revision information for these

clouds. However, you can force the sheet to list the revisions, if desired. See [Specifying the Revisions to Include in a Revision Schedule](#) on page 1079.

- **Crop region.** If all or part of a revision cloud is outside the model crop region of a view, the cloud does not display in the view. See [Crop Regions](#) on page 211.
- **Hide in view > Elements.** In a view, select one or more revision clouds, right-click, and click Hide in view ► Elements.

Revision Cloud Properties

The following table describes parameters for revision clouds. To see or change these parameters, right-click a revision cloud in a view, and click Element Properties.

Name	Description
Revision	The revision assigned to the cloud. To change the assigned revision, select a revision from the list. (See Entering Revision Information on page 1070 and Assigning a Revision to a Revision Cloud on page 1076.)
Revision Number	A number assigned to the cloud, which displays in a revision tag and a revision schedule on a sheet. Its value depends on the assigned revision and the cloud numbering method. (See Revision Cloud Numbering by Project or by Sheet on page 1072.) This value is read-only.
Revision Date	The date of the assigned revision, based on the Date column of the Sheet Issues/Revisions dialog. This value is read-only.
Issued to	For the assigned revision, the value of the Issued to column of the Sheet Issues/Revisions dialog. This value is read-only.
Issued by	For the assigned revision, the value of the Issued by column of the Sheet Issues/Revisions dialog. This value is read-only.
Mark	A unique identifier for the revision cloud.
Comments	A text field that you can use to store information about the revision cloud.

Revision Schedules on Sheets

Most title blocks for sheets include a revision schedule. When you place a view on a sheet and the view includes revision clouds, the revision schedule automatically displays information about those revisions. If desired, you can specify that other revisions (not represented by revision clouds in the view) are to display in the revision schedule,

To display a revision schedule on a sheet, use a title block that includes a revision schedule. When designing the revision schedule, you can specify its format, orientation on the page, information that it displays, and sort order. You control these attributes of the revision schedule by modifying the title block family. See [Revision Schedules on Title Blocks](#) on page 1049.

Revisions		
ID	Date	Description
1	9.14	Wall Type Change
2	9.24	Accessible Modifications
3	10.15	Owner Request
4	11.02	Add Vision Lites

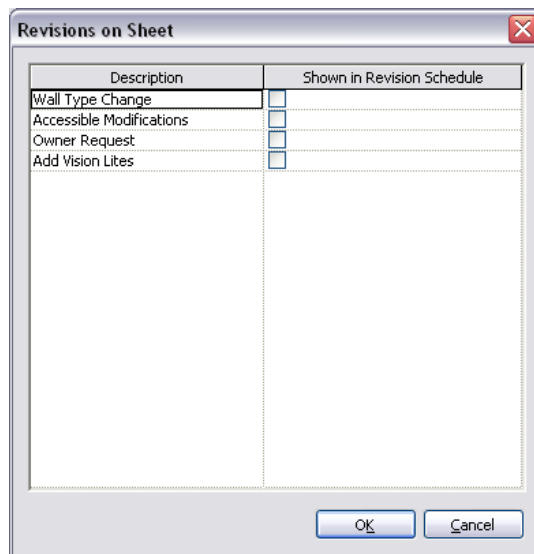
Specifying the Revisions to Include in a Revision Schedule

By default, the revision schedule on a sheet lists the revisions relating to revision clouds in the views of the sheet. Use the following procedure to list more revisions on the revision schedule.

This procedure assumes that you have created a project with views and sheets that include revision schedules, entered revision information, added revision clouds to views, and tagged the clouds.

To specify the revisions to include in a revision schedule

- 1 Open a sheet.
- 2 Zoom in on the revision schedule in the title block for the sheet.
- 3 Right-click in the drawing area, and click View Properties.
- 4 On the Instance Properties dialog for the [Sheets](#) on page 1030, for Revisions on Sheet, click Edit.
The Revisions on Sheet dialog lists all revisions entered in the Sheet Issues/Revisions dialog. Revisions assigned to clouds in views on the sheet are already selected, and they are read only.



- 5 Select Shown in Revision Schedule for each revision that you want to include in the revision schedule on this sheet.
- 6 Click OK twice.


The revision schedule on the sheet updates to include the selected revisions.

Issuing a Revision

After you have completed revisions to a project and added the revised views to a sheet, you can issue the revision. In Revit Architecture, marking a revision as Issued means the following:

- On the Sheet Issues/Revisions dialog, you can no longer change information for that revision.
- In project views, you can no longer assign the issued revision to additional (new) revision clouds.
- You cannot edit revision clouds to which the issued revision is assigned.

To issue a revision

- 1 In the project, click View tab ► Sheet Composition panel ►  (Sheet Issues/Revisions).
- 2 In the Sheet Issues/Revisions dialog, do the following:
 - a For Issued to, indicate the person or organization to whom the revisions will be issued.
 - b For Issued by, indicate the person or organization who will issue the revision.
 - c Check the other values for the revision row (such as Date and Description). Update them if needed.
 - d Select Issued.

Most of the revision row displays as read only. After selecting Issued, you cannot make further changes to the revision information.

NOTE If you must change any revision information after issuing the revision, clear Issued, make the changes, and then select Issued again.

- e Click OK.

- 3 Print or publish the revised sheets. See [Printing](#) on page 1080 or [Publish](#) on page 1381.

Printing

The Print tool prints the current window, a visible portion of the current window, or selected views and sheets. You can send the desired drawings to the printer, to a PRN or PLT file, or to a PDF file.


Printed output in Revit Architecture is What You See Is What You Get (WYSIWYG), with a few exceptions:

- The background color on the print job is always white.
- By default, reference planes, work planes, crop boundaries, unreferenced view tags, and scope boxes do not print. To include them in the print job, in the Print Setup dialog, clear the corresponding Hide options.
- The print job includes elements that have been hidden from a view using the Temporary Hide/Isolate tool.
- Line weights modified by the Thin Lines tool print at their default line weight.

Related topics


- [Exporting to CAD Formats](#) on page 1341
- [Exporting to Design Web Format](#) on page 1355
- [Publishing to Buzzsaw](#) on page 1384

Printing Tips

- Keyboard shortcut: Ctrl+P.
- Before printing, be sure that you have installed the most recent version of the printer driver. Consult with the printer manufacturer.
- To print to PDF, see [Printing to PDF](#) on page 1084.
- To print many views and sheets unattended, use Batch Print for Revit. See [Batch Printing](#) on page 1086.
- To generate DWF or DWFX files, click  ➤ Export ➤ DWF. See [Exporting to Design Web Format](#) on page 1355.
- If the print job is of substantial size, the status bar displays a Cancel button. The file size necessary to trigger this option depends on system speed and amount of memory.

Print Setup

You can specify various options for a print job in Revit Architecture.

- 1 Click  ➤ Print ➤ Print Setup.
Or, if the Print dialog is already open, click Setup.
- 2 In the Print Setup dialog, for Name, select the saved print settings to use, if any.
See [Saving Print Settings](#) on page 1082.
- 3 Under Paper, specify options for Size and Source.
- 4 Under Orientation, select Portrait or Landscape.
- 5 Under Paper Placement, specify where the view prints on the sheet.
If, for Offset from Corner, you select User Defined, enter X and Y offset values.
- 6 Under Hidden Line Views, choose an option to increase print performance for hidden line views in elevations, sections, and 3D views.
Vector processing times vary depending on the number of views processed and view complexity. Raster processing times depend on the dimensions of the view and amount of graphics. Vector processing typically produces much smaller print files than raster processing.
- 7 Under Zoom, specify whether to fit the drawing to the size of the page or zoom to a percentage of the original size.
- 8 Under Appearance, specify a value for Raster Quality.
This option controls the resolution of the raster data being sent to the print device. A higher quality results in a longer print time.
- 9 Under Appearance, for Colors, select an option:
 - **Black Lines:** All text, non-white lines, pattern lines, and edges print in black. All raster images and solid patterns print in grayscale. (This option is not available for publishing to DWF.)
 - **Grayscale:** All colors, text, images, and lines are printed in grayscale. (This option is not available for publishing to DWF.)
 - **Color:** All colors in the project are maintained and printed, provided the printer supports colors.


10 Under Options, specify additional print settings:

- When printing, you can hide the following elements: scope boxes, work planes, reference planes, and crop boundaries.
- Hide unreferenced view tags. Select this option if you do not want to print section, elevation, and callout tags that are not on sheets.
- View links print black by default, but you can choose to print them in blue.
- If views display some elements in halftone, you can replace the halftone drawings with thin lines by selecting Replace halftone with thin lines. (See [Halftone/Underlay](#) on page 497.)

11 Click OK.

Saving Print Settings

You can save print settings in a project, so that they are available for reuse. You can also change saved print settings, revert changes, and rename or delete print settings.

To access the Print Setup dialog, click  ► Print ► Print Setup.

To save print settings

- 1 In the Print Setup dialog, specify print options. See [Print Setup](#) on page 1081.
- 2 To save the print settings to a new name, click Save As.
- 3 Enter a name for the print settings, and click OK.
- 4 Click OK.

TIP You can transfer print settings to another project using Transfer Project Standards. Click Manage tab ► Project Settings panel ► Transfer Project Standards, and in the Select Items To Copy dialog, select Print Settings. See [Transferring Project Standards](#) on page 446.

To change a saved print setting

- 1 In the Print Setup dialog, for Name, select a saved print setting.
- 2 Make the desired print setting changes.
- 3 Click Save.

NOTE If you click OK before clicking Save, your changes are not saved to the selected print setting. The first time you click OK, however, you are prompted to save your changes to the modified print setting. If you click No, the changed settings are applied to the in-session print setting. Any future changes you make without saving are also applied to the in-session setting. These changes are lost when you exit the Revit Architecture session.

To revert print settings

- 1 In the Print Setup dialog, for Name, select a saved print setting.
- 2 Click Revert.
The settings revert back to their original saved state or in-session state.

To rename print settings

- 1 In the Print Setup dialog, for Name, select a saved print setting.
- 2 Click Rename.

3 Enter a new name for the settings, and click OK.

To delete print settings

1 In the Print Setup dialog, for Name, select a saved print setting.

2 Click Delete.

Print Preview

Use Print Preview to see a draft version of a view or sheet before printing it. Print Preview is not available if you are printing multiple sheets or views.

To see a print preview, click  ► Print ► Print Preview.

NOTE If the print job is of substantial size, the status bar displays a Cancel button. The file size necessary to trigger this option depends on system speed and amount of memory.

Printing Views and Sheets

Use the Print tool to print one or a few views and sheets. If you must print a large number of views and sheets, consider using the Revit Batch Print utility. See [Batch Printing](#) on page 1086.

To print construction documents

1 Click  ► Print.

2 In the Print dialog, for Name, select a printer.

3 (Optional) Click Properties to configure the printer.

4 (Optional) Select Print to File. You can save the print job as a PRN or PLT file.

5 Under Print Range, specify whether you are printing the current window, a visible portion of current window, or selected views/sheets. If you are printing selected views and sheets, click Select, select the views and sheets to print, and click OK.

When you are printing selected views and sheets to a file, Revit Architecture creates one file per view or sheet. If you want to create a single file that contains all selected views and sheets, print to PDF. See [Printing to PDF](#) on page 1084.

6 Under Options, specify the number of copies to print and whether to print a view/sheet set in reverse order. You can select Reverse Print Order for a multiple-page print job so that the last page is printed first.

7 To print a complete copy of the project before the first page of the next copy is printed, select Collate. To print all copies of the first page and then print all copies of each subsequent page, clear Collate.

8 To change print settings, under Settings, click Setup.

See [Print Setup](#) on page 1081.

9 To preview the print job before printing, click Preview.

While in print preview mode, you can zoom the image and flip through pages if the print job involves multiple pages. To exit print preview, click Close on the Options Bar. To return to the Print dialog, click Print.

10 When you are ready to print, click OK.

Selecting Views to Print

When you are printing project views or sheets, you can specify which views and sheets are to be included.

To select views or sheets

- 1 Under Print Range or Range, select Selected Views/Sheets, and click Select.
- 2 In the View/Sheet Set dialog, select the views and sheets to print or export.
- 3 To quickly select all sheets or views, click Check All. Click Clear All to clear all selections.
- 4 To save this view/sheet set for later reuse, click Save As, and enter a name.
- 5 Click OK. If you have not named the view/sheet set, you are prompted to name it.

NOTE You cannot transfer this view/sheet set to other projects.

To change a saved view/sheet set

- 1 Under Print Range or Range, select Selected Views/Sheets, and click Select.
- 2 In the View/Sheet Set dialog, for Name, select a view/sheet set name from the list.
- 3 Add or remove the desired views.
- 4 Click Save.

NOTE If you click OK before clicking Save, your changes are not saved to the selected view/sheet set. The first time you click OK, however, you are prompted to save your changes to the modified set. If you click No, the changed settings are applied to the in-session set. Any future changes you make without saving are also applied to the in-session set. These changes are lost when you exit the Revit Architecture session.

To revert view/sheet set settings

- 1 In the View/Sheet Set dialog, for Name, select a saved set.
- 2 Click Revert.

The settings are reverted back to their original saved state or in-session state.

To delete view/sheet sets

- 1 In the View/Sheet Set dialog, for Name, select a saved set.
- 2 Click Delete.

Printing to PDF

You can print construction documents to PDF (Portable Document Format). The resulting PDF files can easily be shared with other team members, viewed online, or printed. When printing multiple views and sheets to PDF, you can specify whether each view or sheet is saved in a separate PDF file, or one PDF file contains all selected views and sheets.

TIP You can also export construction documents to DWF. DWF files are smaller in size than PDF files, and they can be easily shared with colleagues for online review. See [Exporting to Design Web Format](#) on page 1355.

To print to PDF

- 1 Click  ➤ Print.

2 In the Print dialog, for Name, select your PDF print driver.

If the list does not include a PDF print driver, talk to your system administrator about installing one on your system. See [Changing Your System's PDF Print Settings](#) on page 1085.

3 Click Properties.

4 On the Properties dialog, define settings for the PDF print driver as desired.

5 To print only the sheet or view in the drawing area, do the following:

- a** Under Print Range, select Current Window to print the entire view or sheet that currently displays in the drawing area, or select Visible Portion of Current Window to print the part of the view or sheet that currently displays in the drawing area.
- b** Under File, for Name, specify the name and location of the resulting PDF file. If needed, click Browse and navigate to the target folder.

6 To print multiple views and sheets, do the following:

- a** Under Print Range, select Selected Views/Sheets.
- b** Click Select.
- c** In the View/Sheet Set dialog, select the views and sheets to print to PDF, and click OK.
- d** Under File, to generate a single PDF file that contains all of the selected views and sheets, select Combine Multiple Selected Views/Sheets into a Single File. To generate one PDF file for each selected view and sheet, select Create Separate Files.
- e** For Name, specify the name and location of the resulting PDF file. If needed, click Browse and navigate to the target folder.
If you are generating multiple PDF files, the specified file name is used as a prefix. It is appended with the names of the selected views and sheets.

7 If you are printing multiple pages and you want them to print in reverse order, under Options, select Reverse Print Order.

8 To change print settings, under Settings, click Setup.

See [Print Setup](#) on page 1081.

9 When you are ready to print, click OK.

10 Some PDF print drivers may display another dialog requesting a location and name for the PDF file. Provide the information requested and click OK.

Changing Your System's PDF Print Settings

In some cases, the default PDF print settings request a file name for each PDF file being created. If you are using Revit Architecture to create PDF files for several views or sheets, this default setting means that you must provide a file name for each PDF file as it is created.

To avoid the need to provide individual file names for PDFs, change your system's default PDF settings. The following procedure describes how to change this setting for Adobe® PDF. The steps may vary for other PDF drivers.

To change the default Adobe® PDF print settings

- 1** On the Windows desktop, click Start menu ► Settings ► Printers and Faxes.
- 2** In the Printers and Faxes window, right-click Adobe PDF, and click Properties.
- 3** In the Adobe PDF Properties dialog, General tab, click Printing Preferences.

- 4 In the Adobe PDF Printing Preferences dialog, Adobe PDF Settings tab, for Adobe PDF Output Folder, select My Documents*.pdf.
- 5 Clear View Adobe PDF results.
- 6 Click OK.

Batch Printing

Batch Print for Revit provides an easy way to print a large number of drawings (views and sheets) from a Revit project unattended.

After preparing the default printer and the Revit project, use Batch Print to send any number of drawings to the printer and to control the order in which they print. When you start the print job, Batch Print manages the printing of the drawings, requiring no further interaction from you. If desired, you can monitor the progress of the print job using a status dialog.

Batch Print is available to Revit subscription customers. To use this utility, do the following:

- 1 Download Batch Print from the Autodesk customer subscription Web page.
- 2 Install Batch Print.
- 3 Open a Revit project, and click Add-Ins tab ► External Tools drop-down ► Batch Print.
- 4 In the Batch Print dialog, click Help to learn how to use the utility.

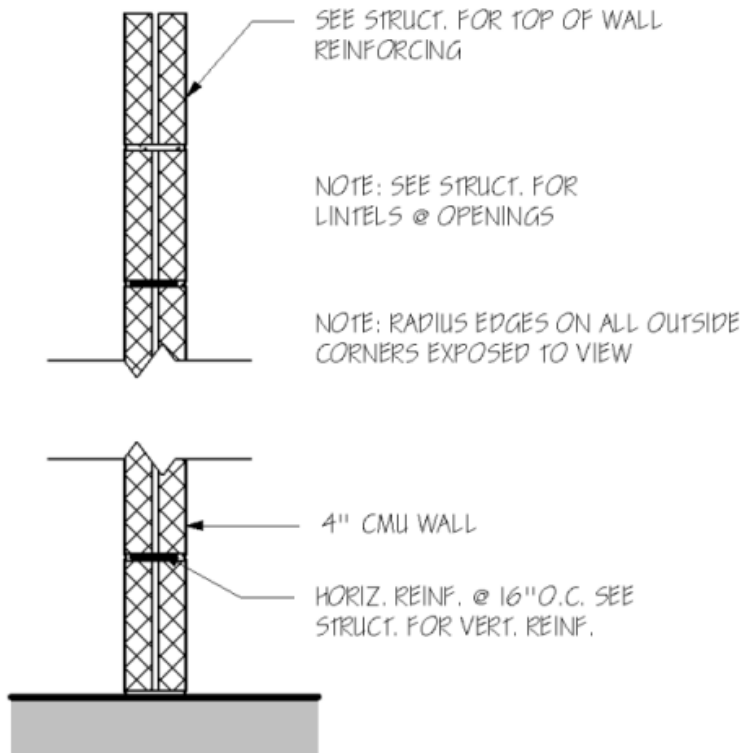
Annotating and Detailing

18

This topic provides information about annotation elements, drafting views, detail views, and detail components.

Text Notes

You can insert wrapping or non-wrapping text notes. Text notes are measured in paper space. For example, a 1/4" text note indicates that the text note will display as 1/4" high on a sheet. Text notes automatically scale with the view. For example, if you reduce the size of the view scale, the text automatically resizes.




Text notes without a leader snap to the text origins from nearby text notes or labels. Origin is a point that depends on the text alignment (left, right, center).

If you are placing a text note with a leader, then the last leader point snaps to all possible leader attachment points from nearby text notes.

Adding Text Notes

1 Click Annotate tab ► Text panel ► Text.

The cursor changes to the text tool .

2 Click Place Text tab ► Alignment panel ► Left, Center, or Right.

3 For Leader, select a leader line option:

- No Leader. Selected by default.
- One segment.
- Two segments.
- Curved. Curved leaders have an elbow control that you can drag to change the curve shape.

TIP When you place a text note with a leader, the last leader point snaps to all possible leader attachment points from nearby text notes.

4 Do one of the following:

- **For non-wrapping text.** Click once to place the note. Revit Architecture inserts a text box in which to type.
- **For wrapping text.** Place the cursor in the drawing area, then click and drag to form a text box.
- **For a text note with a one segment leader or an arc leader.** Click once to place the leader end. Move the cursor to draw the leader. Then click the cursor (for non-wrapping text) or drag it (for wrapping text).
- **For a text note with a two segment leader.** Click once to place the leader end. Move the cursor and click again to place the leader elbow. Move the cursor and click it (for non-wrapping text) or drag it (for wrapping text).

5 (Optional) Select attributes for the text on the Format panel: Bold, Italic, and Underline.

6 Enter the text in the text note box.

7 Click away from the text note to finish it.

The text note controls remain active so you can change the note's position and width.

Related topics

- [Text Notes](#) on page 1087
- [Modifying Text Notes](#) on page 1089
- [Specifying Text Note Styles](#) on page 500
- [Text Note Properties](#) on page 1091

Modifying Text Notes

You can make many modifications to text notes, including changing the font type and style, moving the text note, and changing the type of text note.

Changing the Text Note Type

To change the text note type on placement

- 1 Click Annotate tab ► Text panel ► Text.
- 2 Click Place Text tab ► Element panel, and select the desired type from the Type Selector drop-down.

To change the text note type in a project view

- 1 Select the text note in the drawing area.
- 2 Click Modify Text Notes tab ► Element panel, and select the desired type from the Type Selector drop-down.

Editing the Text Note

After writing the text note, you have several options available for editing the text note.

You can do the following after you select the text note in the drawing area:

- **Move it.** To move the text box without moving the arrowhead on the leader line, drag the cross-shaped control. To move a leader line, drag one of the blue sizing handles in the desired direction. If you want to create an elbow with the leader line, drag the text note elbow control.
- **Resize it.** Place the cursor on the drag controls to change the width of the note. If you resize the text box on a non-wrapping text note, the text note becomes wrapping.
- **Rotate it.** Place the cursor on the rotate control to rotate the note. See [Rotating Elements](#) on page 379.
- **Change text alignment.** Click Modify Text Notes tab ► Alignment panel ► Left, Center, or Right. Alternatively, you can click Modify Text Notes tab ► Element panel ► Element Properties, and in the Instance Properties dialog, edit the Horizontal Align property.
- **Change the typeface.** Click Modify Text Notes tab ► Element panel ► Element Properties drop-down ► Type Properties. In the Type Properties dialog, you can set the properties Italic, Bold, and Underline.
- **Edit the text.** Select the text note and then click on the text.
- **Change the background of the note.** Right-click the text note and click Element Properties. Click Edit Type. In the Type Properties dialog, set the Background value to either Opaque or Transparent.

Checking Text Note Spelling

The Spelling tool checks the spelling of text notes in a selection or in the current view or sheet. This tool does not check the spelling of other types of text, such as text in element properties.

To check the spelling of text notes with worksets, be sure that all the view and sheet worksets are editable. If you make a view editable by right-clicking it in the Project Browser and clicking Make Workset Editable, be sure that you have the view activated, not the Project Browser.


TIP If you have text notes in views on a sheet, and you want to check their spelling but the sheet workset is not editable, use the Make Workset Editable with All Views option on the shortcut menu.

Text notes in groups are ignored by the Spelling tool unless you are editing the group. The Spelling tool notifies you if any groups were skipped when it finishes. If you are editing a group of text notes, the Spelling tool tests only the notes in that group.

To check the spelling of text notes, do one of the following

- Click Annotate tab ► Text panel ► Spelling.
- Press *F7*.

To view or modify spelling settings

- 1 Click  ► Options.
- 2 In the Options dialog, click the Spelling tab.
See [Spelling Options](#) on page 520 for more information.

Adding a Special Character from the Windows® Character Map®

- 1 On the Windows Start menu, click Start ► Run.
- 2 In the Run dialog, enter **charmap**, and click OK.
The Character Map dialog displays.
- 3 Select a character and click Select.
- 4 Click Copy.
- 5 Return to Revit Architecture, and select a text note.
- 6 Click inside the text box to edit the text.
- 7 Click Modify Text Notes tab ► Clipboard panel ► Paste, or press *CTRL+V*.
The special character appears in the text box.

Adding or Removing Leader Lines from a Text Note

- 1 Select the text note.
- 2 To add leaders, click Modify Text Notes tab ► Leader panel, and click the desired tool:
 - Left Straight
 - Right Straight
 - Left Arc
 - Right Arc
- 3 Click as many times as desired to place leaders.

TIP You can convert a text note's leader to an arc leader: select the text note, click Modify Text Notes tab ► Element panel ► Element Properties, and select the Arc Leaders instance parameter.

- 4 To remove the leader line that you added most recently, click Modify Text Notes tab ► Leader panel ► Remove Last. Click as many times as desired. As you click, leader lines are removed in the order they were added.

Related topics

- [Specifying Arrowhead Styles](#) on page 500
- [Text Note Properties](#) on page 1091

Text Note Properties

Parameter names, values, and descriptions for text notes. Many values are modifiable.

Modifying Text Note Properties

- 1 In a project view, select a text note and click Modify Text Notes tab ► Element panel ► Element Properties.
- 2 In the Instance Properties dialog, edit text note instance properties.
See [Text Note Instance Properties](#) on page 1092.
- 3 Click Edit Type to change text note type properties.
See [Text Note Type Properties](#) on page 1091.

NOTE Changes made to type properties affect all text notes of that type in the project. To create a new text note type, click Duplicate.

- 4 Click OK.

Related topics

- [Specifying Text Note Styles](#) on page 500
- [Leader Arrowhead Properties](#) on page 1092

Text Note Type Properties

Name	Description
Graphics	
Color	Sets the color of the text and the leader line.
Line Weight	Sets the thickness of the line that surrounds the text when you select the text and the thickness of the leader line. You can change the definition of the line weight numbers using the Line Weights tool. See Line Weights on page 495.
Background	Sets the background for the text note. With Opaque, the background of the note itself covers material behind it. Transparent allows you to see material behind the note. This is useful with text notes placed in color-defined rooms.
Leader Arrowhead	Sets the arrowhead style for the leader as defined by the Arrowheads tool. See Specifying Arrowhead Styles on page 500.
Text	
Text Font	Sets the Microsoft® True Type fonts for the text note. The default font is Arial.

Name	Description
Text Size	Sets the size of the typeface.
Tab Size	Sets tab spacing in a text note. When you create a text note, you can press <i>TAB</i> anywhere in the text note, and a tab appears at the specified size.
Bold	Sets the text typeface to bold.
Italic	Sets the text typeface to italic.
Underline	Underlines the text.
Width Factor	1.0 is the default for regular text width. The font width is scaled proportionately to the Width Factor. Height is not affected.

Text Note Instance Properties

Name	Description
Graphics	
Arc Leaders	Converts a text note's leader to an arc leader.
Horizontal Align	Sets the justification of the text.
Keep Readable	Text in the note remains readable whenever you rotate it. It never displays upside-down.

Leader Arrowhead Properties

Parameter names, values, and descriptions for text note leader arrowheads. Many values are modifiable. Settings are global for the project.

To access properties for leader arrowhead types, click **Manage tab** ► **Project Settings panel** ► **Settings drop-down** ► **Arrowheads**.

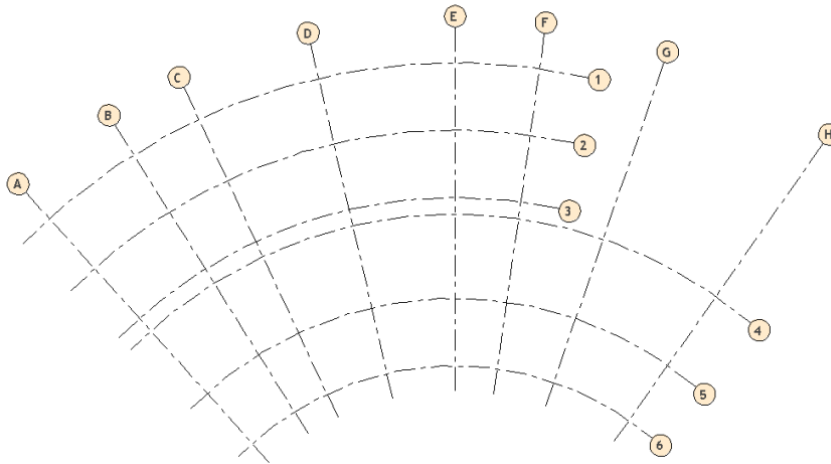
Arrowhead Properties

Name	Description
Arrow Style	Sets the arrowhead shape on the leader line.
Fill Tick	Fills the arrowhead.
Arrow Width Angle	Sets the width of the arrowhead. The larger the angle value, the wider the arrowhead.
Tick Size	Sets the overall size of the arrowhead.
Heavy End Pen Weight	If Arrow Style is set to Heavy End Tick Mark, this setting specifies the size of the mark or dot on the opposite end of the text note.

Grids

Use the Grid tool to place column grid lines in the building design. You can then add columns along the column grid lines. Grid lines are finite planes. You can drag their extents in elevation views so that they do not intersect level lines. This allows you to determine whether grid lines appear in each new plan view that you create for a project. See [Datum Extents and Visibility](#) on page 1108 and [Visibility of Arc Grids in Views](#) on page 1110.

Grids can be straight lines or arcs.



You can hide grid lines after you add them. For more information, see [Hiding Elements in a View](#) on page 208.


Related topic

- [Visibility of Arc Grids in Views](#) on page 1110

Adding Grids

1 Click Home tab ► Datum panel ► Grid.

2 Click Place Grid tab ► Draw panel, and select a sketch option.

Use  (Pick Lines) to snap the grid to an existing line, such as a wall.

For more information about sketch options, see [Sketching](#) on page 303.

3 Click when the grid is the correct length.

Revit Architecture automatically numbers each grid. To change the grid number, click the number, enter the new value, and press *ENTER*. You can use letters for grid line values. If you change the first grid number to a letter, all subsequent grid lines update appropriately.

As you draw grid lines, the heads and tails of the lines can align to one another. If grid lines are aligned and you select a line, a lock appears to indicate the alignment. If you move the grid extents, all aligned grid lines move with it.

Related topics

- [Grids](#) on page 1093

- [Modifying Grids](#) on page 1094
- [Grid Properties](#) on page 1099

Modifying Grids

You can modify the appearance of grids in many ways.

Changing the Grid Type

To change the grid type on placement

- 1 Click Home tab ► Datum panel ► Grid.
- 2 Click Place Grid tab ► Element panel, and select a different grid type from the Type Selector drop-down list.

To change the grid type in a project view

- 1 Select the grid line in the drawing area.
- 2 Click Modify Grids ► Element panel, and select a different grid type from the Type Selector drop-down.

Changing Grid Value

- 1 Click the grid header, then click the value in the grid header.
- 2 Enter a new value.

You can enter a number or a letter.

You can also change the value by selecting the grid line, right-clicking and selecting Element Properties. In the Instance Properties dialog, enter a different value for the Name property.


Offsetting a Grid Line from Its Bubble

There may be times when you sketch a grid line and want to offset its bubble from the rest of the grid line.

- 1 Sketch a grid line, or select an existing grid line.
The end of the line near the bubble has drag controls.

Selected grid with drag controls



- 2 To resize the grid line, select and move the end drag control near the bubble.
- 3 Click the Add Elbow drag control (), then drag the control to the desired location to move the bubble away from the grid line.

Bubble dragged from grid line

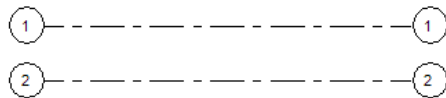


When you move the bubble end out of line, the effect appears only in that view. The segments created from dragging the bubble have a solid line style. You cannot change this style.

As you drag a control, the cursor snaps at points similar to the neighboring grids. The cursor also snaps as the segments form straight lines.

Showing and Hiding Grid Bubbles

You can control whether grid bubbles display at either end of a grid line. You can do this graphically for an individual grid line in a view, or for all grid lines of a particular type by changing type properties.

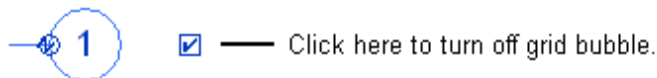


To show or hide individual grid bubbles

1 Open a view that displays grid lines.

2 Select a grid line.

Revit Architecture displays a check box near the grid bubble. You may need to zoom in to see it clearly.



3 Clear the check box to hide the bubble, or select it to show the bubble.

You can repeat this process to show or hide the bubble at the opposite end of the grid line.

To show or hide grid bubbles using type properties

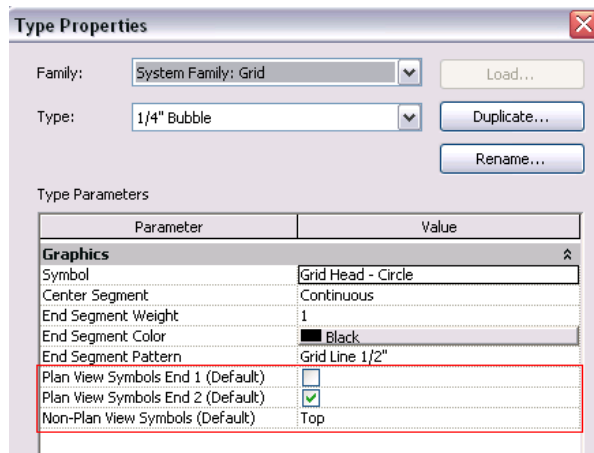
1 Open a view that displays grid lines.

2 Select a grid line, and click Modify Grids tab ► Element panel ► Element Properties drop-down ► Type Properties.

3 In the Type Properties dialog, do any of the following:

- To display grid bubbles at the start point of grid lines in a plan view, select Plan View Symbols End 1 (Default).
- To display grid bubbles at the endpoint of grid lines in a plan view, select Plan View Symbols End 2 (Default).

- In views other than plan views (such as elevations and sections), indicate where to display grid bubbles. For Non-Plan View Symbols (Default), select Top, Bottom, Both (top and bottom), or None.



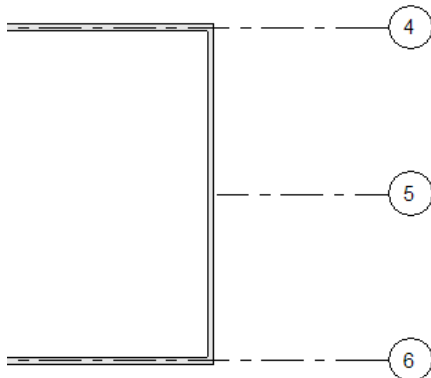
4 Click OK.

Revit Architecture updates all grid lines of this type in all views.

Adjusting the Center Segment of a Grid Line

You can adjust the length of the gap or center segment in an individual grid line. For example, you may want to adjust the gap so the grid line does not display through the middle of a model element. This feature is available when the grid line uses a grid type for which the Center Segment parameter is Custom or Gap. (See [Customizing Grid Lines](#) on page 1097.)

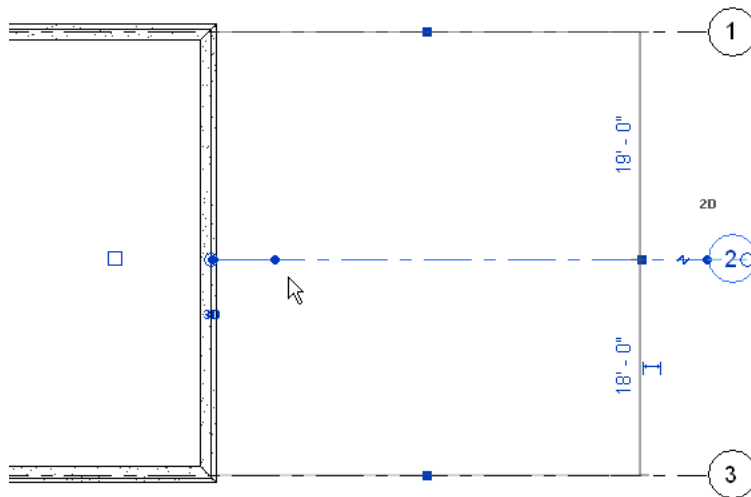
A grid line that has been adjusted to end at the wall



To adjust the center segment of a grid line

1 Select the grid line in the view.

Revit Architecture displays a blue dot on the grid line. You may need to zoom in to see it clearly.



NOTE If you do not see a blue dot indicating the segment boundary, move the 3D extent for the grid line outward until the dot is visible. In addition, check the setting of the Center Segment parameter. To do this, select the grid line, click Modify Grids tab ► Element panel ► Element Properties drop-down ► Type Properties. In the Type Properties dialog, change the value for Center Segment to None or Custom.

The default length of the end segments of a grid line is defined by the End Segments Length parameter of the grid type.

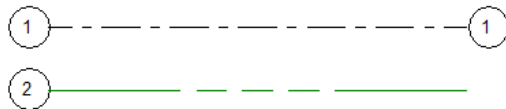
2 Drag the blue dot along the grid line to the desired position.

The end segment adjusts its length accordingly.

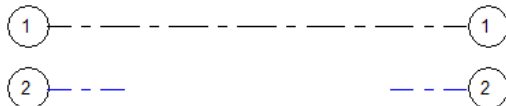
Customizing Grid Lines

You can customize grid types in the following ways:

- Change the line color, weight, and pattern of the entire grid line. (Modify the Bubble grid type, or create your own. See [Changing a Continuous Grid Line](#) on page 1098.)



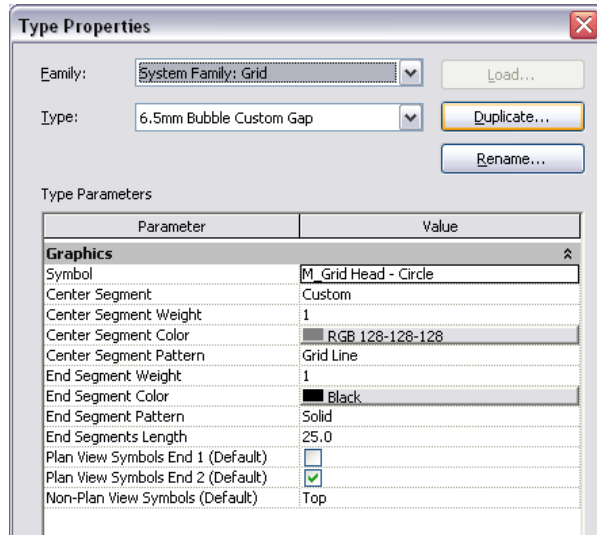
- Hide the center segment of the grid lines to create a gap, displaying only the end segments in views. (Modify the Bubble Gap grid type, or create your own. See [Creating a Grid Line with a Center Gap](#) on page 1098.)



- Display the center segment of the grid line using a different line color, weight, and pattern than the end segments. (Modify the Bubble Custom Gap grid type, or create your own. See [Creating a Grid Line with a Center Segment](#) on page 1099.)



To make these customizations, you modify a grid type. In views, all grid lines of that type reflect the changes.



Changing a Continuous Grid Line

- 1 Open a view that displays grid lines.
 - 2 Select a grid line, and click Modify Grids tab ► Element panel ► Element Properties drop-down ► Type Properties.
 - 3 In the Type Properties dialog, do the following:
 - For Center Segment, select Continuous.
 - For End Segment Weight, End Segment Color, and End Segment Pattern, specify the line weight, color, and pattern of the grid line.
 - Use the other parameters to indicate which grid bubble to use and where it should display. See [Grid Type Properties](#) on page 1100.
 - 4 Click OK.
- Revit Architecture updates all grid lines of this type in all views.

Creating a Grid Line with a Center Gap

- 1 Open a view that displays grid lines.
- 2 Select a grid line, and click Modify Grids tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 In the Type Properties dialog, do the following:
 - For Center Segment, select None.
 - For End Segment Weight, End Segment Color, and End Segment Pattern, specify the line weight, color, and pattern of the segments to display on each end of the grid line.

- For End Segments Length, enter the length of the segments (in paper space) to display on each end of the grid line.
- Use the other parameters to indicate which grid bubble to use and where it should display. See [Grid Type Properties](#) on page 1100.

4 Click OK.

Revit Architecture updates all grid lines of this type in all views.

Creating a Grid Line with a Center Segment

1 Open a view that displays grid lines.

2 Select a grid line, and click Modify Grids tab ► Element panel ► Element Properties drop-down ► Type Properties.

3 In the Type Properties dialog, do the following:

- For Center Segment, select Custom.
- For Center Segment Weight, Center Segment Color, and Center Segment Pattern, specify the line weight, color, and pattern of the center segment of the grid line.
- For End Segment Weight, End Segment Color, and End Segment Pattern, specify the line weight, color, and pattern of the end segments of the grid line.
- For End Segments Length, enter the length of the segments (in paper space) to display on each end of the grid line.
- Use the other parameters to indicate which grid bubble to use and where it should display. See [Grid Type Properties](#) on page 1100.

4 Click OK.

Revit Architecture updates all grid lines of this type in all views.

Grid Properties

You can change properties for individual grid lines or for grid types.

Modifying Grid Properties

1 In a project view, select a grid line and click Modify Grids tab ► Element panel ► Element Properties.

2 In the Instance Properties dialog, edit instance properties.

See [Grid Instance Properties](#) on page 1101.

3 To edit type properties, click Edit Type.

See [Grid Type Properties](#) on page 1100. Changes made to type properties affect all grid lines of that type in the project. You can click Duplicate to create a new grid line type.

4 Click OK.

Grid Type Properties

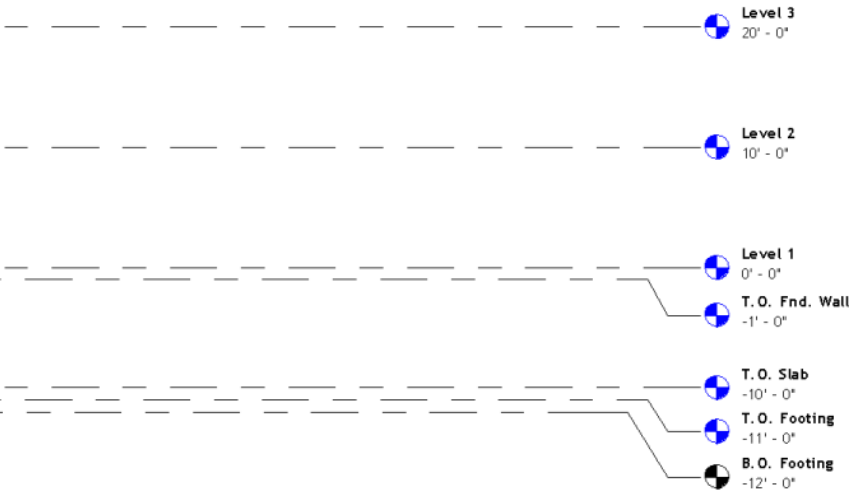
Name	Description
Graphics	
Symbol	The symbol to use for the ends of a grid line. The symbol can display a grid number in a bubble (Grid Head–Circle), a grid number but no bubble (Grid Head–No Bubble), or no grid bubble or number (none).
Center Segment	The type of center segment to display in the grid line. Select None, Continuous, or Custom. See Customizing Grid Lines on page 1097.
Center Segment Weight	If the Center Segment parameter is Custom, the line weight is used for the center segment.
Center Segment Color	If the Center Segment parameter is Custom, the line color is used for the center segment. Select a color defined in Revit Architecture, or define your own color. See Colors on page 525.
Center Segment Pattern	If the Center Segment parameter is Custom, the pattern is used for the center segment. The line pattern can be solid or a combination of dashes and dots.
End Segment Weight	The line weight to use for a continuous grid line, or if Center Segment is None or Custom, the line weight for the end segments.
End Segment Color	The line color to use for a continuous grid line, or if Center Segment is None or Custom, the line color for the end segments.
End Segment Pattern	The line style to use for a continuous grid line, or if Center Segment is None or Custom, the line style for the end segments.
End Segments Length	If the Center Segment parameter is None or Custom, the length of the end segments (in paper space).
Plan View Symbols End 1 (Default)	In a plan view, the default setting to display a bubble at the start point of a grid line. (That is, when you draw a grid line, the bubble displays at its start point.) If desired, you can show or hide bubbles for individual grid lines in views. See Showing and Hiding Grid Bubbles on page 1095.
Plan View Symbols End 2 (Default)	In a plan view, the default setting to display a bubble at the endpoint of a grid line. (That is, when you draw a grid line, the bubble displays at its endpoint.) If desired, you can show or hide bubbles for individual grid lines in views. See Showing and Hiding Grid Bubbles on page 1095.
Non-Plan View Symbols (Default)	In project views other than plan views (such as elevations and sections), the default location where bubbles display on the grid line: Top, Bottom, Both (top and bottom), or None. If desired, you can show or hide bubbles for individual grid lines in views. See Showing and Hiding Grid Bubbles on page 1095.
Identity Data	
Design Option	The design option in which the grid lines display. Read-only.

Grid Instance Properties

Name	Description
Graphics	
Center Mark Visible	For an arc grid line, displays its center mark.
Identity Data	
Name	A value for the grid line. This can be a numeric or alphanumeric value. The first instance defaults to 1.
Design Option	The design option in which the grid lines display. Read-only.
Extent	
Scope Box	The scope box applied to the grid. See Controlling Visibility of Datums Using Scope Boxes on page 1112.

Levels

Use the Level tool to define a vertical height or story within a building. You create a level for each known story or other needed reference of the building (for example, first floor, top of wall, or bottom of foundation). To add levels, you must be in a section or elevation view. When you add levels, you can create an associated plan view.



Levels are finite horizontal planes that act as a reference for level-hosted elements, such as roofs, floors, and ceilings. You can resize their extents so that they do not display in certain views. For more information, see [Datum Extents and Visibility](#) on page 1108.

When you start a new project using the default template in Revit Architecture, 2 levels display: level 1 and level 2.

You can hide level annotations after you add them. For more information, see [Hiding Elements in a View](#) on page 208.

Adding Levels

- 1 Open the section or elevation view to add levels to.
- 2 Click Home tab ► Datum panel ► Level.
- 3 Place the cursor in the drawing area and click.

NOTE As you place the cursor to create a level, if the cursor aligns to an existing level line, a temporary vertical dimension displays between the cursor and that level line.


- 4 Draw level lines by moving the cursor horizontally.

On the Options Bar, Make Plan View is selected by default. As a result, each level you create is a story level and has an associated floor plan view and a reflected ceiling plan view. If you click Plan View Types on the Options Bar, you can choose to create only the view types that you specify in the Plan View Types dialog. If you clear Make Plan View, the level is considered to be a non-story level or a reference level; no associated plan view is created. Walls and other level-based elements can use reference levels as their top or base constraint.

As you draw level lines, the heads and tails of the lines can align to one another. When you select a level line that is aligned with others, a lock appears to show the alignment. If you move the level line horizontally, all aligned level lines move with it.

- 5 Click when the level line is the correct length.

You can change the name of the level by clicking the number to select it. You can also change the height of the level by clicking the dimension.

Revit Architecture assigns the label (for example, Level 1) and the level symbol  to the new level. Use the Project Browser to rename the level, if desired. See [Project Browser](#) on page 93. If you rename the level, the associated name for the floor plan and the reflected ceiling plan update as well.

Related topics

- [Levels](#) on page 1101
- [Modifying Levels](#) on page 1102
- [Level Properties](#) on page 1104

Modifying Levels

You can modify the appearance of levels in many ways.

Changing the Level Type

To change the level type on placement

- 1 Click Home tab ► Datum panel ► Level.
- 2 Click Place Level tab ► Element panel, and select a different level type from the Type Selector drop-down list.

To change the level type in a section or elevation view

- 1 Select the level line in the drawing area.

- 2 Click Modify Levels tab ► Element panel, and select a different level type from the Type Selector drop-down list.

Editing Level Lines in an Elevation View

You can change level lines in the following ways:

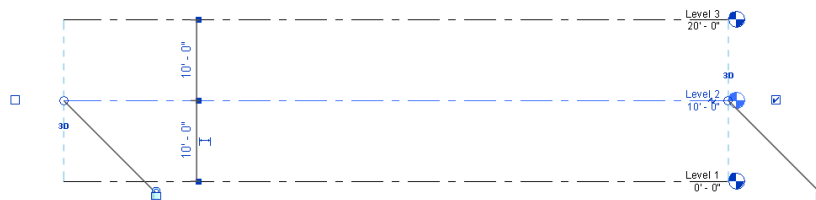
- Resize level lines. Select the level line, click on the blue sizing handles, and drag the cursor left or right.
- Raise or lower levels. Select the level line, and click the dimension value associated with it. Enter a new value for the dimension.
- Relabel the level. Select the level and click the label box. Enter a new label for the level.

Moving Levels

You can move level lines in the following ways:

- Select a level line. A temporary dimension displays between that level line and any level lines immediately above and below.

Selected level line shown with temporary dimensions above and below it



To move the selected level up or down, click the temporary dimension, type a new value, and press **ENTER**.

- Drag the selected level line up or down.
- To move multiple level lines, select the desired number of level lines and move them up or down.

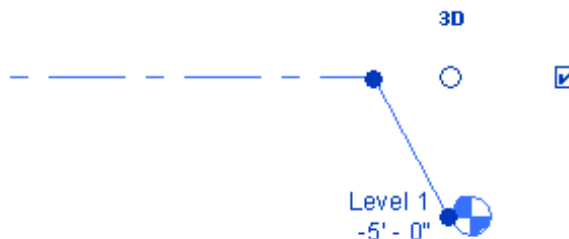
Offsetting a Level Line from Its Bubble


There may be times when you sketch a level line and want to offset its bubble from the rest of the level line.

- 1 Sketch a level line, or select an existing level line.

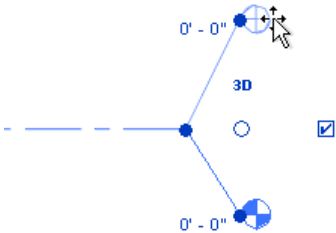
The end of the line near the bubble has drag controls.

Selected level with drag controls



- 2 Select and move the end drag control near the bubble to resize the level line.
- 3 Click the Add Elbow drag control (), then drag the control to the desired location to move the bubble away from the level line.

Bubble dragged from level line



When you move the bubble end out of line, the effect appears only in that view, no other views are affected. The segments created from dragging the bubble have a solid line style. You cannot change this style.

As you drag a control, the cursor snaps at points similar to the neighboring level lines. The cursor also snaps as the segments form straight lines.

Level Properties

Parameter names, values, and descriptions for levels. Most values are modifiable.

Modifying Level Properties

- 1 In a project view, select a level line, and click Modify Levels tab ► Element panel ► Element Properties.
- 2 In the Instance Properties dialog, edit instance properties.
- 3 To edit type properties, click Edit Type.
Changes made to type properties affect all level lines of that type in the project. You can click Duplicate to create a new level line type.
- 4 Click OK.

Level Type Properties

Name	Description
Constraints	
Elevation Base	If the elevation base value is set to Project, the elevation reported on a level is with respect to the project origin. If the base value is set to Shared, then the elevation reported is with respect to the shared origin. To change the shared origin, you can relocate the project. See Relocating and Mirroring a Project on page 1300.
Graphics	
Line Weight	Sets the line weight for the level type. You can change the definition of the line weight number using the Line Weights tool. See Line Weights on page 495.

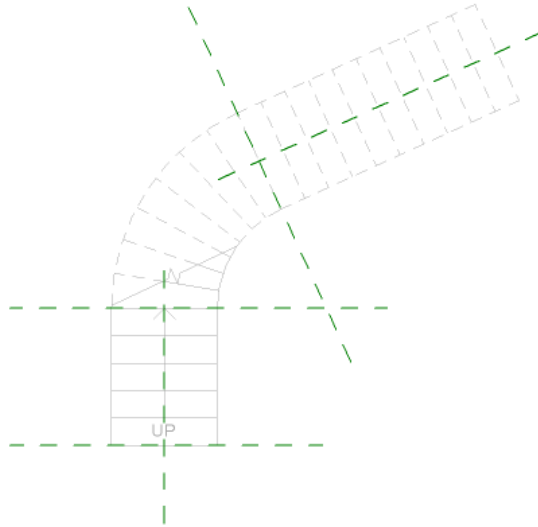
Name	Description
Color	Sets the color of the level line. You can choose from a list of colors defined in Revit Architecture, or define your own color.
Line Pattern	Sets the line pattern of level lines. The line pattern can be solid or a combination of dashes and dots. You can choose from a list of values defined in Revit Architecture, or define your own line pattern.
Symbol	Determines whether the head of a level line displays a level number in a bubble (Level Head–Circle), a level number but no bubble (Level Head–No Bubble), or no level number (<none>).
Symbol at End 1 Default	Places a bubble by default at the left end of the level line. When you select a level line, a check box appears next to the level bubble. Clear the check box to hide the bubble. Select it again to display the bubble.
Symbol at End 2 Default	Places a bubble by default at the right end of the level line.
Dimensions	
Automatic Room Computation Height	Computation height for the perimeter of a room is measured at a defined distance above the base level of the room. To use the default computation height (4' or 1200 mm above the base level of the room), select this option. Also see Computation Height on page 989.
Computation Height	To enable this parameter, clear Automatic Room Computation Height. Enter the distance above the base level to use when computing the room area and perimeter. If the room includes a sloped wall, consider using a computation height of 0 (zero). See Computation Height on page 989.
Identity Data	
Design Option	A read-only field that indicates the design option in which the level lines display.

Level Instance Properties

Name	Description
Constraints	
Elevation	The vertical height of the level.
Identity Data	
Name	A label for the level. You can assign any label or name you wish to this property.
Design Option	A read-only field that indicates the design option in which the level lines display.
Extents	
Scope Box	The scope box applied to the level. See Controlling Visibility of Datums Using Scope Boxes on page 1112.

Reference Planes

Use the Reference Plane tool to draw reference planes to use as a guideline in your design. Reference planes are an integral part of family creation. For detailed information about creating families, see [The Families Guide](#) on page 418. Reference planes appear in each new plan view that you create for a project. See [Datum Extents and Visibility](#) on page 1108.



Adding Reference Planes

- 1 Click Home tab ► Work Plane panel ► Ref Plane drop-down ► Draw Reference Plane or Pick Existing Line/Edge.
- 2 If you selected Draw Reference Plane, do the following:
 - a Place the cursor in the drawing area.
 - b Draw the reference planes by dragging the cursor.
 - c When you finish the plane (designated by a green, dashed line), click to end the line.
- 3 If you selected Pick Existing Line/Edge, do the following:
 - a On the Options Bar, specify an offset, if desired.
 - b Select the Lock option to lock the reference plane to the line or edge.
 - c Move the cursor near the line or edge to which you want to place the reference plane and click.

Related topics

- [Reference Planes](#) on page 1106
- [Naming Reference Planes](#) on page 1107
- [Reference Plane Properties](#) on page 1107
- [Datum Extents and Visibility](#) on page 1108

Naming Reference Planes

- 1 In the drawing area, select a reference plane, and click Modify Reference planes tab ► Element panel ► Element Properties.
- 2 In the Instance Properties dialog, for Name, enter a name for the reference plane.
- 3 Click OK.

Hiding the Annotation in the View

- 1 Select one or more annotation lines to hide, and right-click to display the shortcut menu.
- 2 To hide the selected annotations, click Hide in View ► Elements.
To hide the selected annotations and all other annotations of the same category in the current view, click Hide in View ► Category.

To redisplay the hidden annotation lines, see [Revealing and Unhiding Hidden Elements](#) on page 209.

Reference Plane Properties

Parameter names and descriptions for reference planes.

To modify reference plane properties, select a reference plane and click Modify Reference planes tab ► Element panel ► Element Properties.

Reference Plane Instance Properties

Name	Description
Construction	
Wall Closure	You can use a reference plane to define the point where walls wrap for doors and windows. Select this option to use the reference plane to define this point. This parameter is only available in the Family Editor. See The Families Guide on page 418.
Identity Data	
Name	The name of the reference plane.
Design Option	A read-only field that indicates the design option in which the reference plane displays.
Extents	
Scope Box	The scope box applied to the reference plane. See Controlling Visibility of Datums Using Scope Boxes on page 1112.
Other	
Is Reference	Specifies whether a reference plane, sketched during the creation of a family, is a reference in a project. This means that you can dimension to the family or align to it. If you set a reference plane as a reference for all family types, then you can consistently dimension to that family type when you place it in your project. For example,

Name	Description
	you create a door family with 24", 30", and 36" types. For each type, you specify a reference plane as left. Then you place the new 24" door type in your project and dimension it 5' from an exterior wall. Then you decide to replace that 24" door with a 30" door. When you swap out the doors, Revit Architecture retains the 5' dimension. The Is Reference names are arbitrary and are meant as a convenient method for maintaining consistency across family types. For more information, including information on strong and weak references, see The Families Guide on page 418.
Defines Origin	Specifies where the cursor rests on the object you are placing. For example, as you place a rectangular column, the cursor rests at the centerline of the column shape.

Datum Extents and Visibility

Datum planes, such as those for levels, grids, and reference planes are not visible in all views. If the datum does not intersect a view's plane (or does not intersect the plane in the correct way), then it will not be visible in that view.

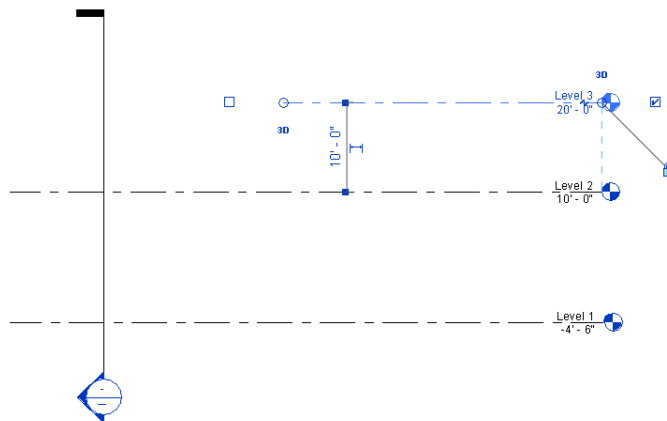
Datum planes are modifiable. You can resize their extents so that they are visible in some views, but not others. You can also change datum extents in one view and then propagate that change to any desired parallel views in which the datum is visible.

You can also use scope boxes to control visibility of datum.

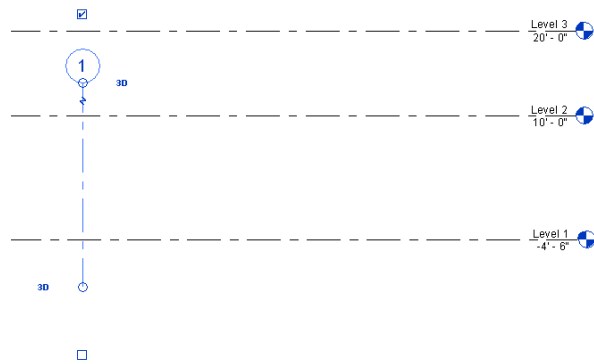
Example of Datum Visibility in Project Views

When you resize model (3D) datum extents, you can control in which view they are visible. If the datum planes do not intersect the view plane, they are not visible in the view.

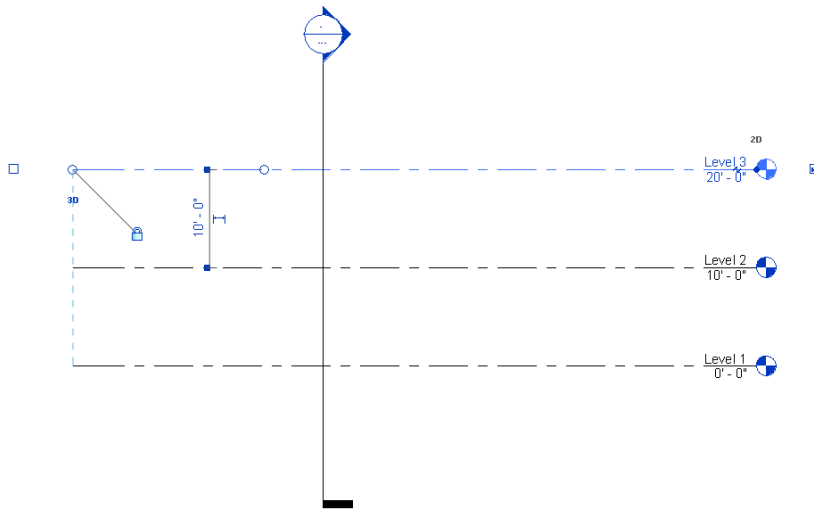
In the following example, the top level line is not visible in the section view, because its model (3D) extents do not intersect it.



In the next example, the grid is visible only in the first 2 plan views, because its model (3D) extents do not intersect the third level line.



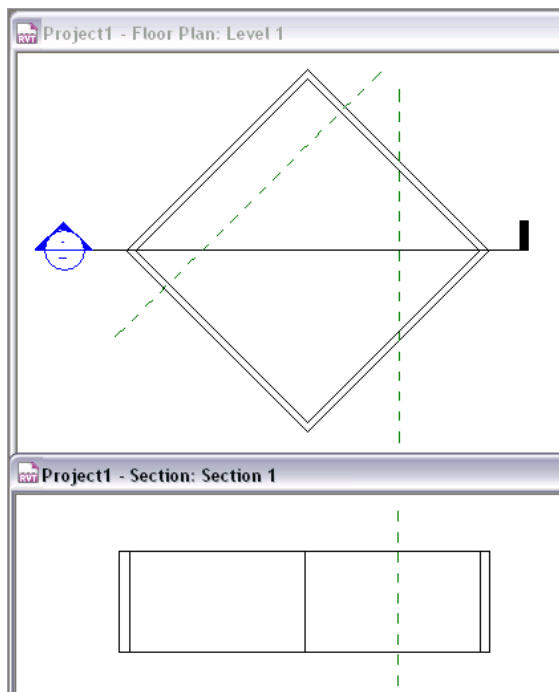
You may notice a datum intersecting a view plane but not displaying in the view. If you select the datum, you will notice that its view-specific extent intersects the view plane, but not its model extent, as the next figure shows. The open circle in the figure shows the 3D model extent, which is not intersecting the section. The filled circle is showing the 2D extent, which has intersected the section. As a result, Level 3 will not display in the section view.



Visibility of Non-Perpendicular Datums in Views

If a datum element (such as a reference plane) is not perpendicular to a view, then the datum element does not display in the view.

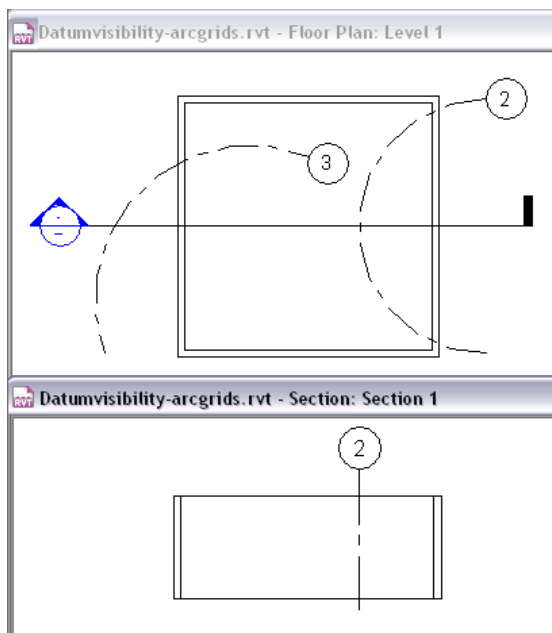
For example, the following floor plan shows 2 reference planes, indicated with dashed green lines. The reference plane on the left intersects the section line at an angle. The reference plane on the right is perpendicular to the section line. Because the angled reference plane is not perpendicular to the section line, the plane does not appear in the resulting section view. However, the perpendicular reference plane does display in the section view.



Visibility of Arc Grids in Views

In plan views (such as floor plans and ceiling plans), you can define grid lines that are arcs rather than straight lines. Arc grid lines will display in section views where the center of the arc intersects and is perpendicular to the section line.

For example, the following floor plan shows 2 arc grid lines. Grid Line 3 intersects the section line, but its center is not perpendicular to the section line. As a result, Grid Line 3 does not display in the section view. Grid Line 2 intersects the section line in the floor plan, and its center intersects the section line perpendicularly. Therefore, Grid Line 2 displays in the section view, indicating the center of the arc.



Resizing Datum Extent Controls

1 Select a datum.

Notice that there is a control titled 3D that displays at the ends of the datum. With the 3D designation, the datum is in Model Extent mode. This means that if you drag the control to resize the datum extent, it changes the extent of that datum in all other parallel views, provided those datums also have the 3D model extent control.

NOTE When you select a datum, it is selected in all views in which it is visible.

Model extent control



Resize datum in all views

2 Drag the hollow circle 3D control at either end of the datum to the desired location.

Resize datum in a specific view only

3 Click the 3D control. It changes to display 2D, and the control changes from an open circle to a filled circle. This means the datum is in view-specific mode. If you resize the datum, the change occurs in that view only.

View-specific extent control



NOTE When you drag the filled circle, the open circle remains. This shows where the model (3D) extent is. If you want to return to that extent, right-click the datum, and click Reset to 3D Extents.

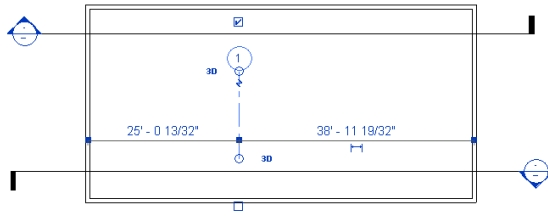
If you drag a datum extent outside the crop boundary of the view, the control on the extent is always in view-specific (2D) mode. You also cannot propagate its extents to other views.

If you move the 2D control of a datum on top of a 3D control, the 2D control becomes a 3D control.

Maximizing 3D Model Extents

A datum may be of a certain size, such that it is not visible in all views of the model. You can change the 3D model extents to intersect the boundary of the model, so that the datum will be visible in more views.

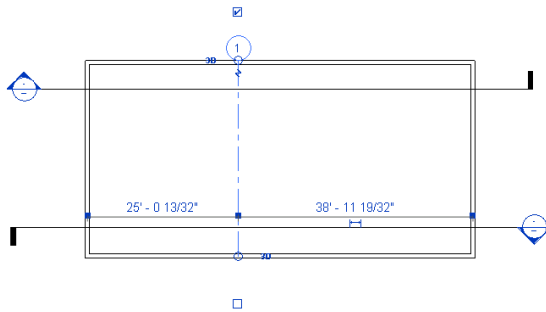
In the following example, the grid is not visible in the 2 section views of the model, because its 3D model extents do not intersect either section view plane.



To maximize 3D model extents

- 1 Select the datum, and right-click it.
- 2 From the shortcut menu, click Maximize 3D Extents.

The grid is resized to the boundary of the model.



Propagating 2D Datum Extents

When you have modified a 2D datum to the desired extent, you may have similar views in which you want it to display the same way. You can use Propagate Extents to accomplish this.

To propagate 2D datum extents

- 1 Select the datum.
- 2 Click Modify <datum> tab ► Datum panel ► Propagate Extents.
- 3 In the Propagate Datum Extents dialog, select the parallel views in which you want the datum to look the same, and click OK.

There is no permanent connection between the look of the datum in multiple views. If you modify the datum again, you must use Propagate Extents again. Propagate Extents does not affect Model (3D) extents.

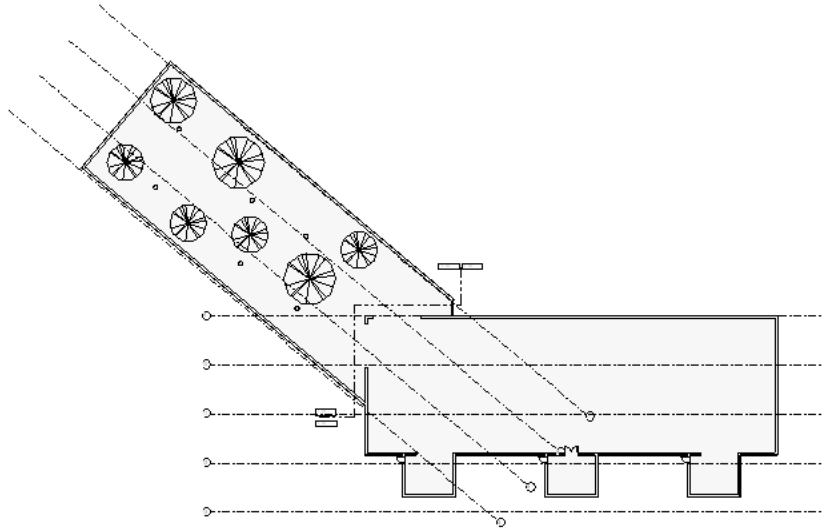
Controlling Visibility of Datums Using Scope Boxes

When you add datum elements (grids, levels, and reference lines) to a project, they can display in more views than desired. For example, when you add grid lines to a plan view, the grid lines display in all plan views of the model. However, you may want the grid lines to display in only certain views. This is exactly what a scope box is for: to specify the views in which the datum elements will display.

Scope boxes control the visibility of datum elements in views whose cutting plane intersects the scope box. Scope boxes are particularly useful to control the visibility of datums that are not parallel or orthogonal to a view.

For example, the following floor plan shows a science center with an aviary wing at an angle to the main building. The matchline indicates where this

floor plan is divided into dependent views, to show each part of the building on separate sheets. (See [Duplicate Dependent Views](#) on page 192.) However, on the dependent view for the aviary wing, you do not want to show the grid lines for the main building. On the dependent view for the main building, you do not want to show the grid lines for the aviary wing. You can accomplish this using scope boxes.



To use scope boxes to control datum elements

- 1 Create one or more scope boxes.
- 2 Apply a scope box to datum elements (grid lines, levels, or reference planes).
- 3 (Optional) Apply a scope box to desired views.



Creating a Scope Box

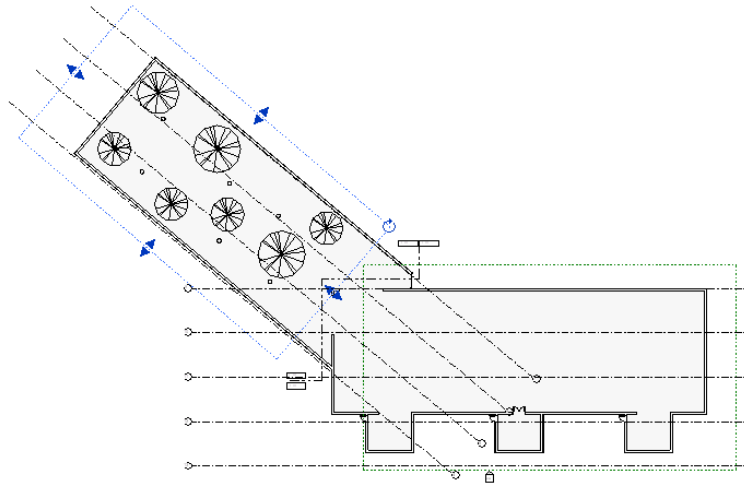
You create [scope boxes](#) in plan views only. After a scope box is created, you can change its size and position in a 3D view.

- 1 In a plan view, click View tab ► Create panel ► Scope Box.
- 2 On the Options Bar, enter a name and specify a height for the scope box, if desired.

TIP You can also change the name of the scope box after creating it. Select the scope box, click Modify Scope Boxes tab ► Element panel ► Element Properties. In the Instance Properties dialog, enter a value for the Name property.

- 3 To draw a scope box, click in the upper left-hand corner to start the box. Click in the lower right-hand corner to finish it.

The following floor plan shows 2 scope boxes: one around the main building, and another around the aviary wing. When you draw a scope box, it displays drag controls, which you can use to resize the scope box. You can also rotate the scope box using the rotate control  and the Rotate tool . (See [Rotating Elements](#) on page 379.)



4 If desired, open a 3D view to further adjust the size and position of the scope boxes.

After creating scope boxes, you need to do the following:

- [Apply each scope box to datum elements..](#)
- (Optional) [Apply each scope box to the desired views](#) on page 1112.

Applying a Scope Box to Datums

To control the visibility of datum elements in a [scope box](#), you must associate each datum element with the scope box.

1 Select the appropriate datum element (for example, a grid line), and click Modify <datum> tab ► Element panel ► Element Properties.

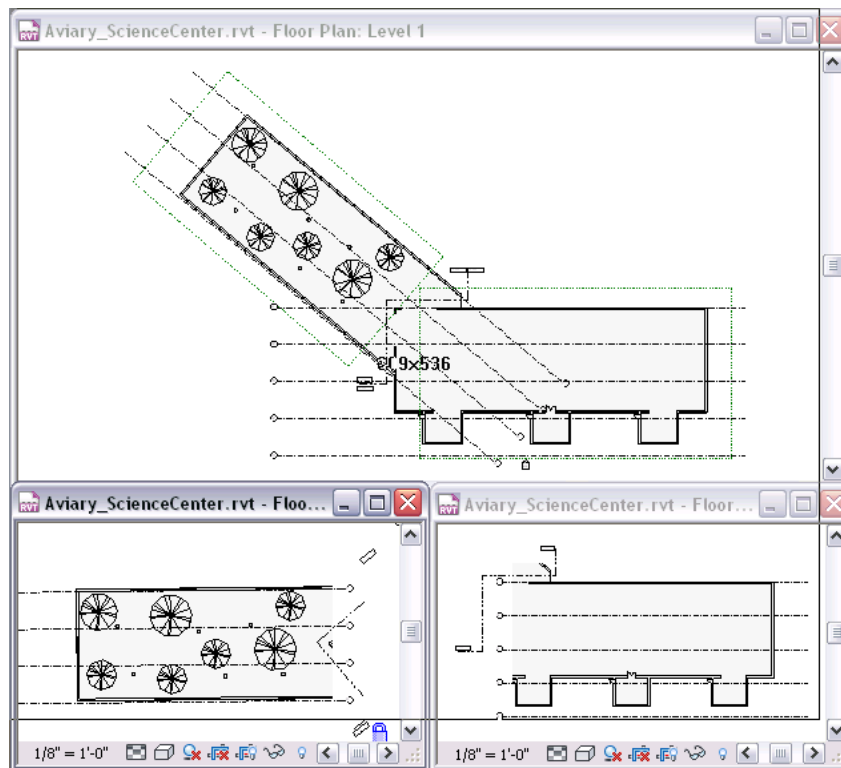
2 In the Instance Properties dialog, for Scope Box, select the desired scope box.

For example, for a project with 2 scope boxes named Scope Box 1 and Scope Box 2, select Scope Box 1 from the drop-down list.

3 Click OK.

The datum now displays only in views whose cutting plane intersects the selected scope box. If a view's cutting plane lies outside the scope, the associated datum does not display in the view.

For example, in the following illustration, the top view shows scope boxes around the main building and the aviary wing. Scope Box 1 was applied to grid lines for the main building, and Scope Box 2 was applied to grid lines for the aviary wing. As a result, the dependent views (bottom) show only the grid lines that apply to each part of the building.

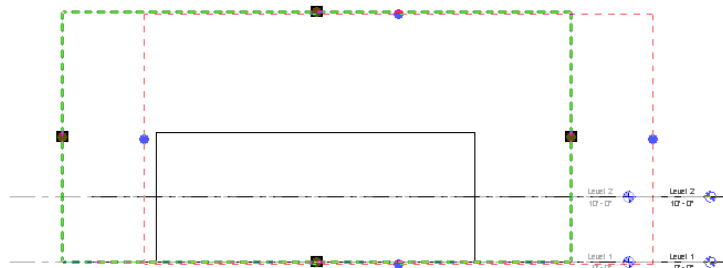


TIP If a section view's cutting plane intersects the scope box, the datums will appear in the section view.

Datums Resize with Scope Box

You can drag the extent of datums associated with [scope boxes](#) by selecting the scope box and dragging it; the associated datum moves with it.

Dragged scope box moves level lines associated with it



To revert the extents of a level datum back to its default, select the level, right-click, and click Reset to 3D Extents. The model (3D) extent cannot be moved from the edge of a scope box to which it is assigned, but the 2D extent can be modified in a view. This option returns the extent to the default position: slightly offset to the outside the scope box.

Controlling Visibility of Scope Boxes

Scope boxes are automatically visible in 3D views and any view whose cut plane intersects the scope. They can also be set to display in elevation views. You can set their visibility for other views by resizing them or changing their visibility property. Scope boxes do not print in construction documents.

Resizing a Scope Box

- 1 Open a plan or 3D view, and select the scope box.

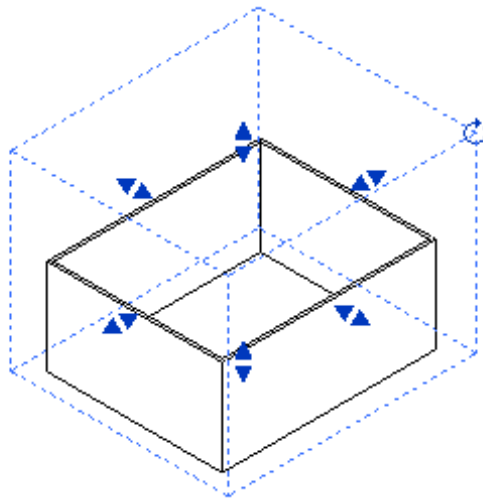
Handles appear on the scope box.

- 2 Drag the handles to resize the scope box.

As you resize the scope box, you control the views in which it displays. If a view plane no longer cuts through the scope box, the scope box is not visible in that view. Consequently, any datums associated with that scope box do not display in that view.

For example, suppose a building has 8 floors. You resize the scope box so that its top boundary extent is at Level 4. As a result, the scope box and associated datums will not display in the plan views for Levels 5 through 8. Conversely, if you resize the scope box to intersect those levels, the datums will display in those views.

Scope box in 3D with drag and rotation controls



Setting the Views Visible Property for a Scope Box

The Views Visible property sets the display of a **scope box** in various views, including elevation views.

- 1 Open a view in which you can see the scope box.
- 2 Select the scope box, and click Modify Scope Boxes tab ► Element panel ► Element Properties.
- 3 In the Instance Properties dialog, for the Views Visible property, click Edit.

The Scope Box Views Visible dialog lists all the view types and view names in the project. It shows in which views the scope box is visible. Revit Architecture calculates the visibility of the scope box when you create it and subsequently change its extents. The Automatic Visibility column shows the views in which the scope is automatically visible. The scope box is not automatically visible in exterior elevations, but you can override this behavior.

- 4 Locate the appropriate view row (for example, South Elevation), and find its value in the Override column. Click in the text box, and select Visible in the list.
- 5 Click OK.
The scope box is now visible in that view.

Hiding Scope Boxes in a View

A [scope box](#) may apply to a view, but you may not want the scope box to be visible in the view.

To hide one scope box in a view

In the drawing area, select the scope box you want to hide, and do either of the following:

- Click Modify Scope Boxes tab ► View Graphics panel ► Hide drop-down ► Elements.
- Right-click a scope box, and click Hide in view ► Elements.

The selected scope box is no longer visible in the view. (The scope box is still visible in other views.)

To hide all scope boxes in a view

Open the view in which one or more scope boxes display, select a scope box, and do either of the following:

- Click Modify Scope Boxes tab ► View Graphics panel ► Hide drop-down ► By Category.
- Right-click any scope box, and click Hide in View ► Category.

All scope boxes are no longer visible in the view.

To redisplay hidden scope boxes, see [Revealing and Unhiding Hidden Elements](#) on page 209.

Keynotes

A keynote parameter is available for all model elements (including detail components) and materials. You can tag each of these elements using a keynote tag family. The keynote value is derived from a separate text file that contains a list of keynotes.

If an element already contains a value for a keynote, it displays in a tag automatically. If not, you can select the keynote value directly. Revit Architecture provides 2 sample text files for keynoting. See [Keynote Workflow](#) on page 1118.

Keynotes assigned in a project are linked to their source keynote table. When the keynote table is changed, keynotes in the project will reflect the changes when the project is closed and reopened.

Differences Between Keynoting and Tagging a Material

The difference between keynoting and tagging a material is the information that is displayed in the tag and which tag family Revit Architecture uses. Revit Architecture has separate categories for keynotes and material tags.

Using keynotes

- If you click Annotate tab ► Tag panel ► Keynote drop-down ► Material, Revit Architecture looks for a tag family assigned to the keynote category. If the tag is not loaded in the project, you are prompted to load one.

- The keynote family displays one or both of the values available from the keynote table. See [Keynoting Settings](#) on page 1118.

Using tags

- If you click Annotate tab ► Tag panel ► Material, Revit Architecture uses a tag family assigned to the material category.
- The default tag displays the value stored for the Description parameter, if it is assigned.

Keynoting Settings

To access the Keynoting Settings dialog, click Annotate tab ► Tag panel drop-down ► Keynoting Settings.

Keynote Table

Full Path Displays the entire path of the keynote file.

Saved Path Displays the file name of the keynote file that is loaded.

View Opens the Keynotes dialog. This dialog does not permit editing the keynote table.

Path Type

Absolute Identifies a specific folder located on your local PC or a network server. The path could be stored in the Uniform Naming Convention (UNC) format such as \\servername\share\folder\keynote.txt.

Relative Finds the keynote file where the project file or central file is located. If the file is moved to a new location, Revit Architecture expects to find the keynote file in this new folder location as well.

At Library Locations Finds the keynote file where the stand-alone installation or network deployment specified.

Numbering Method

By keynote Determines the keynote value by the value stored in the keynote parameter or selected from the keynote table. This value displays in the keynote as well as filling in the keynote parameter.

By sheet Numbers keynotes according to their order of creation.

A value for the keynote parameter is still stored if one has been chosen.

A Keynote Legend displays the Keynote Number according to the order it was created instead. No number appears in the tag until the view bearing Keynote Tags is placed on a sheet view.

Keynote Workflow

The default keynoting data provided in Revit Architecture is based on the 1995 Construction Specification Institute (CSI) Master format system, which uses 16 divisions to organize construction process and materials. This is a widely used system in the United States. See [Keynote File Versions](#) on page 1123.

A more recent version of this system has not yet seen wide-spread adoption. This newer version is based upon 50 divisions and was introduced in 2004. Support for this new format can be accomplished by adding the additional divisions to the default keynote data files as needed. See [Adding Additional Categories](#) on page 1122.

This system is most effective when objects that are used throughout a project are already assigned their respective keynote values. When these values are not supplied, you can assign a value as you place a keynote tag. Materials, system and component families, and detail components can have keynote parameters entered in advance.

Placing a Keynote

- 1 Click Annotate tab ► Tag panel ► Keynote drop-down ► Element, Material, or User.
- 2 Click Place <type> Keynote tab ► Element panel, and select a keynote style from the Type Selector drop-down.
 - Keynote Tag: Keynote Number shows the keynote number in the drawing area.
 - Keynote Tag: Keynote Number - Boxed shows the keynote number with a box around it in the drawing area.
 - Keynote Tag: Keynote Text shows the keynote text in the drawing area.
- 3 On the Options Bar, select the keynote tag orientation (horizontal or vertical), and select the Leader check box to show or hide the keynote tag leader.
- 4 Click the relevant element or material to identify which element to tag. An arrowhead appears at this location.
- 5 Click the second point of the first segment for leader.
- 6 Click the final point for the end of the second segment of leader and location of keynote tag.

If the element or material already has a value entered for the parameter keynote, it appears in the tag automatically. If it does not, the Keynotes dialog opens, where you can select the keynote value.

To add or create your own keynote data, see [Adding Additional Categories](#) on page 1122.

Keynote Placement Tips

- For Revit Architecture to keynote a material, the element must be visible in the view, and the material must be displayed by setting the detail level to medium or fine.

For example, you will not be able to keynote the material of a door's panel whose visibility is set to not show in plan view. The same door family can have a keynote or tag attached to the door panel's material in an elevation view, because the solid geometry is visible in the view.
- If you are not able to keynote or tag an element in a particular view, check the settings of the family. Nested family components need to be shared in order to place or display a keynote value. For more information about nested families, see [The Families Guide](#) on page 418.

Expected Keynote Behavior

If a family is created using a keynote table that is different from the one the project is using and

- The same value exists in each keynote table, the project's keynote file values are used.
- There are different values in each keynote table, or there is no corresponding value for the keynote in the project, the keynote number will display, but the text for the keynote will not display.

To resolve these issues, you can select a new keynote value that is part of the project's keynote table, or add the keynote value to the keynote table. See [Adding Additional Categories](#) on page 1122.

Types of Keynotes

- **Element.** A keynote can be applied to an entire element, such as a wall, detail component, or door.

- **Material.** A keynote can be assigned to a material that has been painted on a surface, and to materials assigned to the component layers of an element. Keynotes are not supported for the insulation drafting tool or the detail components line and filled region.
- **User.** This option provides a way to use commonly used notes or phrases to address documentation issues. These additional user notes must be added to the provided keynote text files or included in one that you create. See [Adding Additional Categories](#) on page 1122.

Assigning Keynote Values

Assigning Keynote Values to Materials

Keynote selection can be applied to materials. Keynotes are assigned to materials on the Identity Tab of the Materials dialog. To access the Materials dialog, click Manage tab ► Project Settings panel ► Materials.

When materials are assigned a keynote value, the objects that use these materials inherit the keynote value accordingly.

A great deal of time can be saved if the materials of a project have their keynote values applied before you apply keynote tags to materials. See [Changing Material Identity Data](#) on page 487.

Assigning Keynote Values to Elements

All elements have a Keynote Type parameter. These can be supplied in advance using the Type Properties dialog (see [Element Properties](#) on page 120), or selected when the tag is placed.

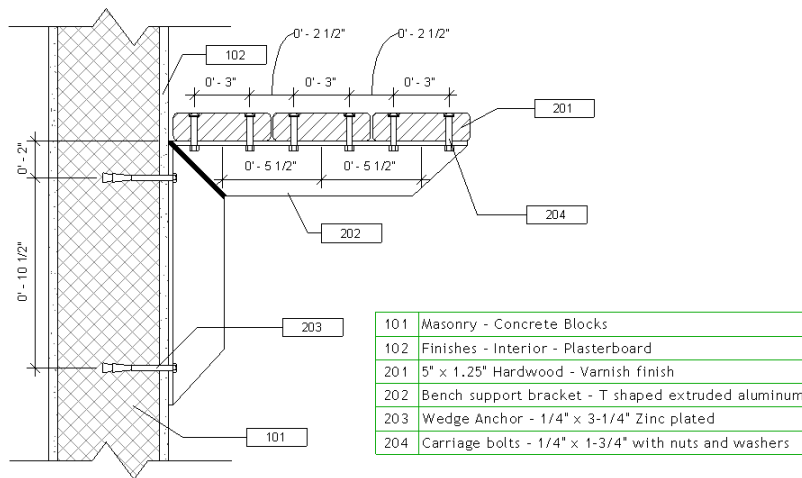
Assigning Keynote Values Using Tags

After you apply a keynote tag to an element, you can select the keynote tag and click over the keynote value or empty value to open the Keynotes dialog. Select the desired keynote for the element.

NOTE If you click OK, Revit Architecture uses the keynote value that is currently selected. If you click Cancel, the keynote value remains empty.

Keynote Legend

You can access the Keynote Legend tool by clicking View tab ► Create panel ► Legends drop-down ► Keynote Legend. There are 2 parameters predefined in the Scheduled fields list: Key Value and Keynote Text. The remaining tabs (Filter, Sorting/Grouping, Formatting, and Appearance) are all available as they are for other schedules. See [Specifying Schedule Properties](#) on page 176.



With careful use of keynote headings and filtering, it is possible to create keynote legends that group common types of keynotes together.

Keynote legends can be placed on multiple sheet views.

Filtering Keynotes by Sheet

The Filter by Sheet option causes the schedule to only display those keynotes that are visible in views on the sheet where the schedule is placed. Use the following procedure to select this option.

- 1 Open the keynote legend from the Legends category in the Project Browser.
- 2 Right-click the view, and click View Properties.
- 3 In the Instance Properties dialog, click Edit for the filter parameter.
- 4 In the Keynote Legend Properties dialog, click the Filter by Sheet check box, and click OK.

Filtering Keynotes by CSI Heading

To filter keynotes scheduled to one main category of keynotes

- 1 Open the keynote legend from the Legends category in the Project Browser.
- 2 Right-click the view, and click View Properties.
- 3 In the Instance Properties dialog, click Edit for the filter parameter.
- 4 In the Keynote Legend Properties dialog, for Filter By, click an option from the list.
For example, to filter by CSI Division 15, click Key Value.
- 5 Next to Filter By, a list of operators displays. The data must match or abide by the operator and value you enter for it to appear in the schedule.
For example, the value of the CSI Division 15's main heading is 15000. To display all keynote values that begin with 15, select the Begins With operator and enter the value 15 in the text box.

Adding Additional Categories

Keynotes are defined in a tab-delimited text file. The first portion of the text file is reserved for major headings/categories (the parent values). The remainder of the file is for sub-headings/categories (the child values). A tab-delimited file requires the use of the **TAB** key to create spaces between data entries.

Changes made to the keynote table are not available in the current project session of Revit Architecture. Changes are available when the project is closed and reopened.

You can use Microsoft® Excel or a similar spreadsheet application to manage the data, then export it to a tab-delimited file format.

Sample Keynote Text File

CSI Main Category/Heading (parent value)

11000 [tab] Division 11 - Equipment

CSI Master format sSb-Category/Heading [tab] Sub-Category/Heading Description [tab] CSI Masterformat Main Category/Heading Value (parent value)

11060 [tab] Theater and Stage Equipment [tab] 11000

11061 [tab] Acoustical Shells [tab] 11000

For sub-categories of sub-categories

11060.A1 [tab] Counter-Weight Rigging [tab] 11060

Sample User Keynote Text File

For User Keynotes you can place them in front of the CSI structure by using the following format:

Main/Heading/Parent Category

00000 [tab] Division 00 - User Notes

Sub-Category/Heading/Child

00001 [tab] User Note 1 [tab] 00000

00002 [tab] User Note 2 [tab] 00000

For sub-categories of sub-categories

00001.A1 [tab] User Note 1a [tab] 00001

Keynote File Locations

Keynote files for the default standalone installation reside in the following location:

C:\Documents and Settings\All Users\Application Data\Autodesk\Autodesk Revit Architecture 2010\Imperial Library

or

C:\Documents and Settings\All Users\Application Data\Autodesk\Autodesk Revit Architecture 2010\Metric Library

The file can be located on a network server so that it is available to all users. See [Keynoting Settings](#) on page 1118 for information on assigning file locations.

Keynote File Versions

The following files are provided and installed during deployment:

- RevitKeynotes_Imperial.txt
- RevitKeynotes_Metric.txt

Resolving Keynote File Errors

When the keynote file cannot be located, Revit Architecture displays the following message when any action that attempts to display the keynote selection dialog occurs:

Unable to Load Keynote data. Check keynote table locations in Keynoting Settings.

Use the following procedure to resolve the issue.

To specify the location of the keynote text file

- 1 Click Annotate tab ► Tag panel drop-down ► Keynoting Settings.
- 2 In the Keynoting Settings dialog, click Browse, and navigate to the appropriate keynote text file.

Keynote Tag Ends

For keynote tags that are associated with elements, the end of the leader is free to be relocated to another location and not connected to just the boundary of an element. Therefore, when placing a keynote, you can select the leader option Free End or Attached End.

Material tags are assigned Free End and cannot be assigned Attached End. A material keynote tag's leader end identifies the material as you move it over different materials. The keynote value automatically displays the appropriate keynote value, if one is assigned.

The leader end for tags associated with

- An element is attached to the boundary edge of the element.
- A material is attached to the center of the selected material.

Tags

Use the Tag tool to attach a tag to a selected element. A tag is an annotation for identifying elements on a drawing. Properties associated with a tag can display in schedules. The following image shows door tags, window tags, and room tags.



Every category in the family library has a premade tag. Some tags automatically load with the default Revit Architecture template, while others you need to load. If desired, you can make your own tag in the Family Editor. See [Creating an Annotation Symbol Family](#) on page 1132.

Related topics

- [Room Tags](#) on page 985
- [Areas and Area Tags](#) on page 1011


Tag Labels

When a tag is created, labels are added to display the text value of desired element parameters. See [Labels](#) on page 1156. These labels display the values for the object's corresponding parameters once the tag is loaded and placed in the project. For example, if the label is set to display "element type name", the tag displays the type name of each tagged element. Some parameters (such as type name) are automatically updated by Revit Architecture, while other parameters (such as comments) are user-defined.

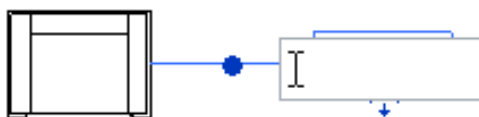
Editing the Label of a Placed Tag

Tags are edited in the Family Editor. Select the tag and click **Modify <element> Tags tab ► Family panel ► Edit Family** to open the Family Editor where you can edit the labels in this tag's family.

Editing Parameter Values Using the Tag Label

Edit the value of an element parameter from  (Element Properties), or, if a parameter in the tag's label is editable, the tag becomes a control when selected. Click the selected tag to edit the parameter value.

Sample in-place editing of a furniture tag



If the tag contains a multi-parameter label, click the selected tag to open the Change Parameter Values dialog and modify the associated parameters. See [Label Parameter Options](#) on page 1158.

Multiple Tags for Families

Families can have multiple tags. To load multiple tags for a family, see [Loading Tag Styles](#) on page 501.

Applying a Tag

Before attempting this procedure, load the necessary tags for elements that need a tag. For example, if you created a furniture tag, load that furniture tag for furniture. See [Loading Tag Styles](#) on page 501.

- 1 Click Annotate tab ► Tag panel ► Tag by Category. For generic annotation tags, drag the tag from the Project Browser onto the view.
- 2 To set the orientation of the tag, select Vertical or Horizontal on the Options Bar.
After you place the tag, you can change its orientation by selecting the tag and pressing *SPACEBAR*.
- 3 If you want the tag to have a leader line, on the Options Bar, select Leader.
- 4 If desired, enter a value for the length of the leader in the text box next to the Leader check box.
- 5 Highlight the element to tag, and click to place the tag.

Related topics

- [Tag All Not Tagged](#) on page 1126
- [Modifying Tags](#) on page 1128
- [Material Tags](#) on page 1128
- [Tag Properties](#) on page 1126

Changing a Tag Instance

- 1 Select the tag in the drawing area.
- 2 Click Modify <element> Tags tab ► Element panel, and select another tag from the Type Selector drop-down list.

NOTE Additional tags must already be loaded.

Aligning Tags

You can align tags with other similar tags by dragging them. For example, a room tag can align with another room tag, and a generic annotation can align with another generic annotation. As you drag a tag, dashed green lines display to show when the tag is aligned with another tag:



Tag Properties

Tags have properties that you can modify.

To modify tag properties

- 1 In the Project Browser, expand Families, Annotation Symbols. See [Project Browser](#) on page 93.
- 2 Expand the appropriate category (for example, wall tag), and right-click the type name.
- 3 Select Properties from the shortcut menu.
- 4 Set values for the properties in the Type Properties dialog.

Tag Type Properties

Name	Description
Leader Arrowhead	Sets the arrowhead shape on the leader line. The value is the name of the arrowhead style defined by the Arrowheads tool. See Specifying Arrowhead Styles on page 500.

Tag All Not Tagged

If some or all elements in a view do not have tags, you can apply tags to untagged elements in one operation.

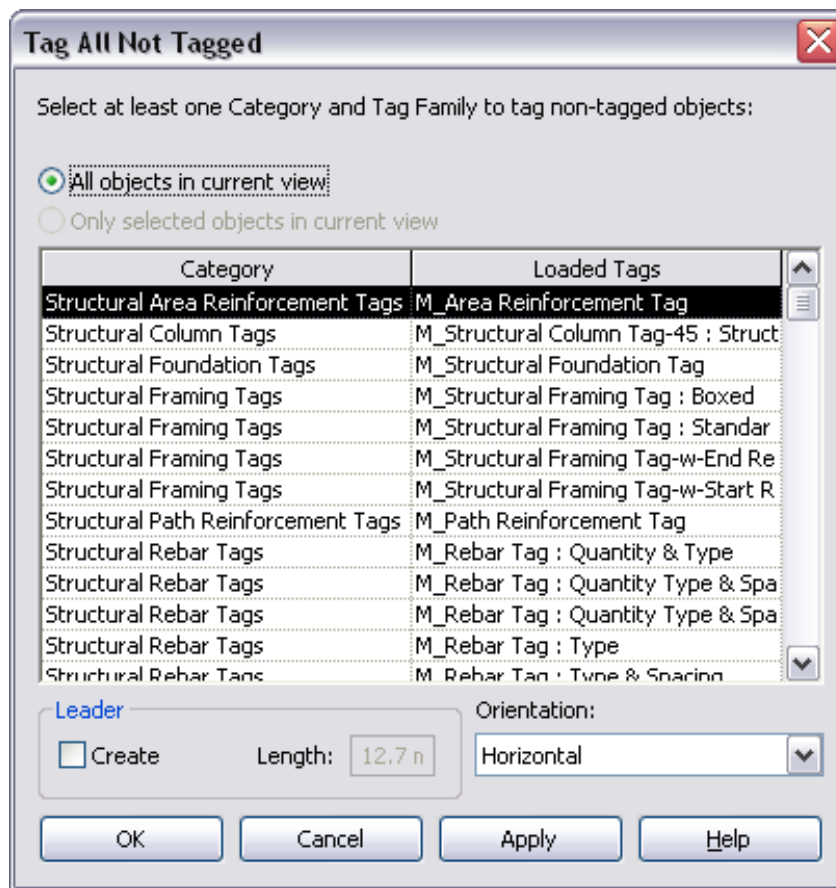
The Tag All Not Tagged tool applies to many types of elements, such as doors, windows, detail items and masses. It also applies to rooms and areas. Some elements, such as walls, must be tagged separately.

This function can be useful, for example, when you place and tag rooms in a floor plan view, and you want to see tags for the same rooms in a reflected ceiling plan (RCP) view.

NOTE The desired tag families must be loaded into the project before using the Tag All Not Tagged tool. See [Loading Tag Styles](#) on page 501.

To tag untagged elements

- 1 Open the view in which you want to tag elements.
- 2 (Optional) Select one or more elements to tag.
If you do not select elements, the Tag All Not Tagged tool will tag all elements in the view that are not already tagged.
- 3 Click Annotate tab ► Tag panel ► Tag All.
The Tag All Not Tagged dialog displays.



4 Specify the elements to tag.

- To tag all visible elements in the current view that do not have tags, select All objects in current view.
- To tag only those elements you have selected in the view, select Only selected objects in current view.

5 Select one or more tag categories.

By selecting multiple tag categories, you can tag different types of elements (such as detail items and generic models) in one operation. To select multiple categories, while pressing *SHIFT* or *CTRL*, select the desired categories.

6 To attach a leader to each tag, do the following:

- Under Leader, select Create.
- For Length, enter a default leader length.

7 For Orientation, select Horizontal or Vertical.

8 Click OK.

NOTE If the visibility of the tag category or its object type is turned off, a message displays. Click OK to allow Revit Architecture to turn on visibility before that category is tagged.

Revit Architecture tags elements of the selected family categories.

Related topics

- [Modifying Tags](#) on page 1128
- [Material Tags](#) on page 1128
- [Tag Properties](#) on page 1126

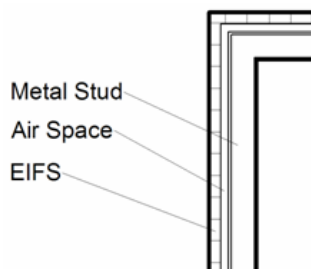
Material Tags

Use a material tag to identify the type of material used for an element or a layer of an element. Revit Architecture stores this information in the Description field of the Identity tab of the Materials dialog. (See [Changing Material Identity Data](#) on page 487.)

Before using this procedure, load the necessary material tags for those elements that need a tag. You can also keynote materials, see [Differences Between Keynoting and Tagging a Material](#) on page 1117.

- 1 Click Annotate tab ► Tag panel ► Material.
- 2 To set the orientation of the tag, select Vertical or Horizontal on the Options Bar.
After you place the tag, you can change its orientation by selecting the tag and pressing *SPACEBAR*.
- 3 If you want the tag to have a leader line, on the Options Bar, select Leader.
- 4 Highlight the material to tag within the component, and click to place the tag.
You can move the end of the leader to a new material, and the new material will display in the material tag.

NOTE You can highlight the material before you select it by moving the mouse over the material. The material must be displayed by setting the detail level to medium or fine. If the material is not visible, the tag will not display properly.



If the material tag displays a question mark (?), the Description field of the Identity tab for the element's material is blank. You can double-click the question mark and enter a description of the material. Revit Architecture automatically completes the Description field with this value.

Related topics

- [Modifying Tags](#) on page 1128
- [Tags](#) on page 1123

Modifying Tags

You can modify the appearance of tags through their element properties. You can change tag properties before or after placing a tag.

To change tag properties, use one of the following methods:

- Select the tag, and click **Modify <element> Tags tab ► Element panel ► Element Properties**.
- In the Project Browser, double-click the tag type name.
- Right-click the tag, and click **Element Properties**.
The shortcut menu also offers several choices for manipulating the tag, such as changing the zoom scale.

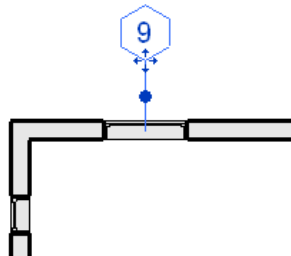
Changing the Tag Leader

If you want to...	Then...
change the length of the leader	select the tag, then drag a sizing handle.
add an arrowhead to the leader line	in the Project Browser, select the tag, then right-click and select Properties . In the Type Properties dialog, select a value for Leader Arrowhead .
change the color, weight, and pattern of the leader	click Manage tab ► Project Settings panel ► Settings drop-down ► Object Styles . In the Object Styles dialog, click the Annotation Objects tab, scroll to the appropriate tag, and specify values for Line Weight , Line Color , and Line Pattern .

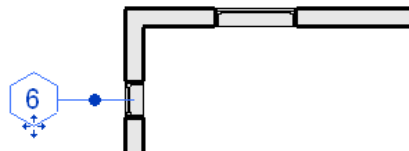
Rehosting a Tag

If needed, you can change the element to which a tag applies. The new element must belong to the same category as the original element for the tag.

- 1 In the project view, select the tag to rehost.



- 2 Click **Modify Tags tab ► Tag panel ► Pick New Host**.
- 3 Select the element to host the tag.
- 4 Drag the tag to move it near the new host element.
Adjust the tag leader and elbow, if needed.



Information displayed in the tag may change to reflect the newly assigned host element.

Sequential Tag Numbering

As you place rooms, doors, and windows in a project, you can use tags that sequentially number the elements. The tags automatically number based on parameters that you specify for each element. Values can be alphabetical, numerical, or alphanumeric sequences.

Creating Sequential Room Number Tags

To number rooms, you enter a unique value for the Room Number parameter.

To create sequential room number tags

- 1 Place a room.
- 2 Click Modify, select the room (not the room tag), and click Modify Rooms tab ► Element panel ► Element Properties.

Alternatively, you can right-click the room, and click Element Properties.

To select the room, move the cursor near the center of the room until a large X appears. This X indicates the room boundaries. When you click the X, the room is highlighted in transparent blue, indicating that it is selected.

- 3 In the Instance Properties dialog, enter a value for Number.

NOTE If you want to number rooms sequentially by floor, enter the number to begin with (such as 101, 201, 301, and so on) that corresponds to the current floor plan view. As you place subsequent rooms on that level, the room numbers follow in sequence (202, 203, 204, and so on).

- 4 Click OK.
- 5 Click Home tab ► Room & Area panel ► Room, to create additional rooms and room tags.

All subsequent rooms are numbered sequentially.

Creating Sequential Door or Window Tags

To number window and door tags, you enter a unique value for the Mark parameter.

- 1 Place a door or window.
- 2 Click Modify, select the element, and click Modify <element> tab ► Element panel ► Element Properties.

Alternatively, you can right-click the element, and click Element Properties.

- 3 In the Instance Properties dialog, enter a value for Mark.
- 4 Click OK.
- 5 Place more instances of the element as desired.

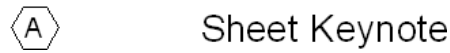
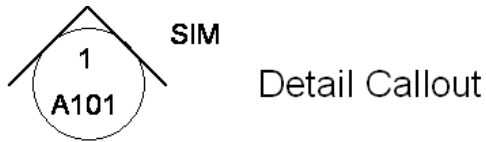
All subsequent instances are numbered sequentially.

NOTE All doors and windows number sequentially regardless of type. For example, you place a French door and then a single-flush door into a plan view. The French door is number 1; the single-flush door is number 2.

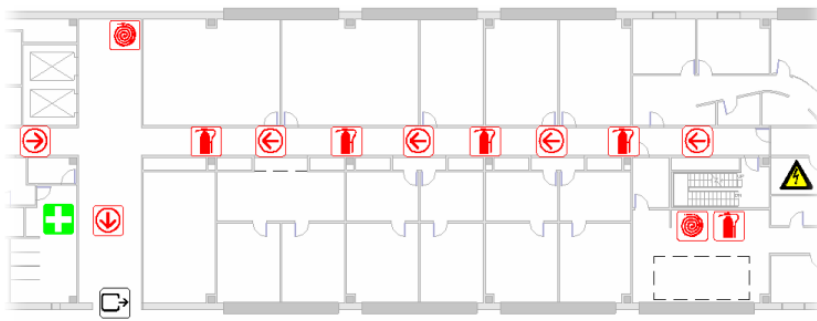
Symbols

A symbol is a graphic representation of an annotation element or other object. Symbols are sometimes referred to as tags. For example, the following symbol legend identifies the annotation symbols that are used

in a set of construction documents. Revit Architecture also uses symbols for moment frames, cantilever connections, and other elements.



Use the Symbol tool to place 2D annotation drawing symbols into the project.



Placing Symbols

1 If necessary, create the symbol family in the Family Editor, and load it into the project. To create the symbol family, use the Generic Annotation template. For more information, see [The Families Guide](#) on page 418.

As you create a symbol family, you notice that you can only see it in one view. Like other annotations, it is view-specific.

2 Click Annotate tab ► Detail panel ► Symbol.

3 Place the cursor in the drawing area where you want the symbol to appear.

4 Click to place it.

Modifying Symbols

You can modify the appearance of symbols through their properties. Properties are modifiable before or after you place the symbol. See [Symbols](#) on page 1130.

To edit element properties, do one of the following:

- Select the symbol, and click Modify Generic Annotations tab ► Element panel ► Element Properties drop-down ► Instance Properties or Type Properties.
- Right-click the symbol, and click Element Properties.

Read about element properties before modifying symbols. See [Element Properties](#) on page 120.

Annotation Symbols


An annotation symbol is a tag or symbol applied to a family to uniquely identify that family in a project. The tag can also include properties that appear on schedules. See [Creating a Schedule or Quantity](#) on page 173.

You create annotation symbols by selecting the family category with which you want to associate the symbol, sketching the symbol, and applying values to its properties. Some annotation families are for tag purposes. Others are generic annotations used for varying purposes.

Before reading this topic, you should familiarize yourself with families. See [The Families Guide](#) on page 418.

Creating an Annotation Symbol Family

The following procedure is a general procedure for creating an annotation symbol. Your steps may differ based on design intent.

- 1 Click  ► New ► Annotation Symbol.
- 2 In the New Annotation Symbol dialog, select the Annotation Symbol template for the project, and click OK.
The templates are all very similar. Some may already have predefined properties and values. Revit Architecture opens the Family Editor.
- 3 Click Create tab ► Family Properties panel ► Category and Parameters.
See [Family Category and Parameters](#) on page 433.
- 4 In the dialog, select a category, such as generic annotations.
- 5 Set the Family Parameters, and click OK.

NOTE Parameter options vary depending on family category.

- 6 Click Create tab ► Annotate panel ► Label.
- 7 Click Place Label tab ► Element panel, and select the label type from the Type Selector drop-down list.
- 8 Select the vertical and horizontal justification.
- 9 In the drawing area, click to position the label.
For example, in a generic model tag template, place the cursor at the intersection of the 2 reference planes.
- 10 In the Edit Label dialog, under Parameters, select the parameter you want in the label. If necessary, you can add a new parameter.
If you select a numerical or dimension value, you can specify the formatting of the value.
- 11 Click OK.

- 12 To modify the placement of the label, select Modify, select the label, and drag it to the new location.

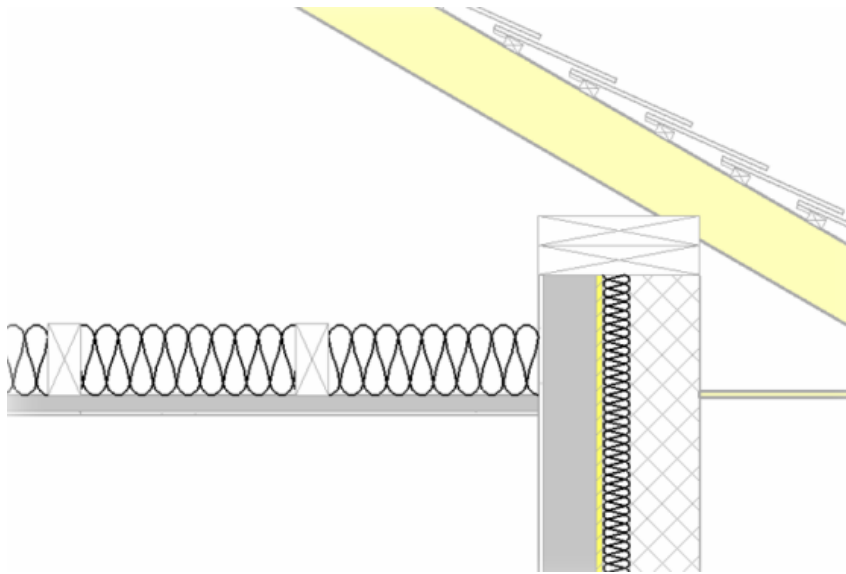
Specify sample text

- 13 Select the label, and click Modify Label tab ► Label panel ► Edit Label.
- 14 In the Edit Label dialog, edit the Sample Value for the Description parameter, and click OK.
- 15 Sketch the shape of the tag symbol, such as a circle. Click Create tab ► Detail panel ► Line, and then select a sketching tool. See [Sketching](#) on page 303.
- 16 Save the annotation. See [Saving Revit Files](#) on page 114.

NOTE Generic annotations have multiple leader options when loaded into a project.

Insulation

The Insulation tool places a batt insulation graphic for detail views.



Adding Insulation

- 1 Click Annotate tab ► Detail panel ► Insulation.
- 2 Sketch the insulation in a detail view.

Insulation is sketched similar to lines. You can set an offset from the cursor, and you can pick a line on which to sketch the insulation. See [Model Lines](#) on page 805.

Increasing the Insulation Size

- 1 Select the insulation.
- 2 On the Options Bar, enter a value for Width, or click Modify Insulation Batting Lines tab ► Element panel ► Element Properties, and in the Instance Properties dialog specify a value for Insulation Width.

Resizing the Insulation Length

- 1 Select the insulation.
- 2 Click and drag one of the blue dot controls that appear on the ends of the insulation. See [Controls and Shape Handles](#) on page 349.

Resizing the Bulge Between Insulation Lines

- 1 Select the insulation.
- 2 Click Modify Insulation Batting Lines tab ► Element panel ► Element Properties, and in the Instance Properties dialog specify a value for the Insulation Bulge to Width Ratio (1/x).
A smaller value increases the bulge, while a larger value decreases it.

Detailing

Revit Architecture is a building information modeler. You construct a project as a digital representation of the physical objects in the real world. However, not every component needs to be modeled in 3D. Architects create standard details to represent how materials in the larger project are constructed. Details bridge the gap between architectural design and building reality, conveying information to the builders and contractors on how a design should be built. Details are vital additions to a project, because they show how materials should interconnect.

Types of Views for Detailing

There are 2 main types of views you can create for detailing: detail views and drafting views. A detail view contains elements from the building information model. A drafting view is a sheet of paper that is not directly associated with the building information model.

Detail Views

A detail view is a view of the model that appears as a callout or section in other views. This type of view typically represents the model at finer scales of detail than in the parent view. It is used to add more information to specific parts of the model.

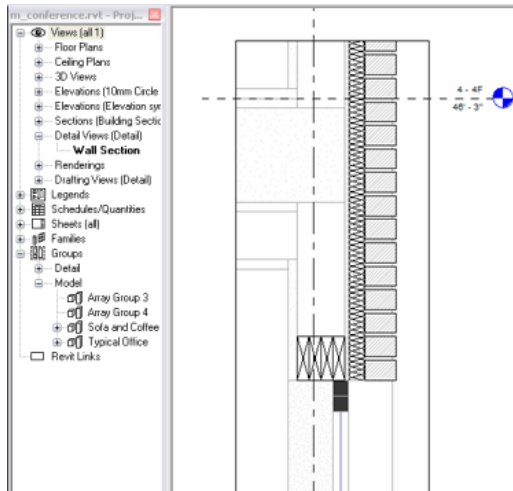
Visibility of a detail view tag depends on the scale of the parent view and whether the crop boundary of the detail view intersects or is entirely within that of the parent view. The detail view parameter Hide at Scales Coarser Than establishes a scale at which details are either shown or hidden in other views. For example, if a detail tag is set to hide at scales coarser than 1/4"=1'0", then a view with a scale set to 1/8" = 1'-0" would not show the detail tag.

A detail view can be created as a section or a callout. It can have both section and callout annotations assigned to it. That is, a detail view made as a callout can also show up as a section in views that intersect the callout view extents. For example, you may call out a detail view of a wall intersection. This same callout can appear as a section view with annotations within the overall building section view. For annotations to display in the overall building section view, you must select the Intersecting Views option for the Show In instance parameter. You set this parameter in the Instance Properties dialog. (Right-click the detail view in the Project Browser, and click Properties to open this dialog.)

All detail views, regardless of whether you draw them as a callout or section, show up in the Project Browser as a detail view.

Sample Detail View

The following image shows a sample of a Wall Section Detail with model geometry as the underlay and additional 2D detail components added.



Creating a Detail View

You can create a callout from a plan, section, or elevation view and then add detail components while using the model geometry as a base. When you create a callout or section detail, you can reference another detail or drafting view in the project.

The following is a general procedure for creating a callout or section detail from a Revit Architecture view. Your design intentions may differ. You can also use this procedure for imported drawings. See [Import/Link](#) on page 1386.

1 Do one of the following to activate the view creation tool:

- Click View tab ► Create panel ► Callout.
- Click View tab ► Create panel ► Section.

2 Click Callout or Section tab ► Element panel, and select Detail View: Detail as the view type from the Type Selector drop-down.

3 On the Options Bar, select an appropriate detail scale.

4 To reference another detail or drafting view, on the Options Bar, click Reference other view, and select a view from the list.

5 Choose 2 points on the plan view to define where the section is cutting.

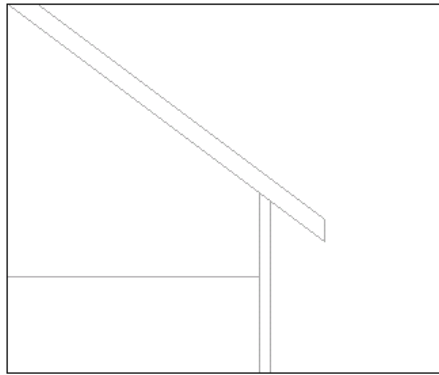
NOTE If this is a callout view, select the area to include in the callout view.

6 Click View tab ► Graphics panel ► View Properties.

7 In the Instance Properties dialog, for Display Model, select As underlay, and click OK.

Model elements in the callout view display using underlay settings, allowing you to visually see the difference between the model geometry and added detail components. (See [Halftone/Underlay](#) on page 497.)

Sample callout with halftone roof, ceiling, and wall for background



8 Click Annotate tab ► Detail panel ► Detail Line.

9 Sketch along lines of the underlay elements or use them as part of your detail.

As you sketch lines, the cursor snaps to the model geometry in that view.

10 Sketch lines that provide applicable construction details.

11 If desired, create filled regions.

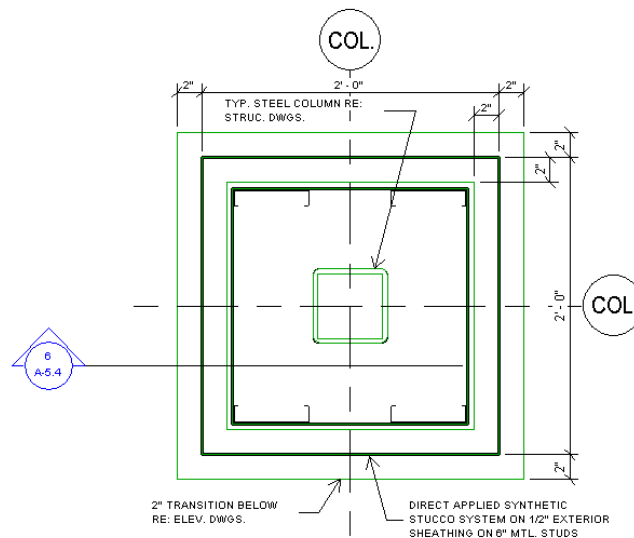
You might create a region to show concrete, grass, or sealant. As you sketch the lines for the region, you can change the line style by clicking Create Filled Region Boundary tab ► Draw panel ► Properties. In the Instance Properties dialog, select a different value for the Subcategory property. For example, you might want the region boundary to have invisible lines.

12 Add detail components to the detail.

See [Creating a Detail Component Family](#) on page 1143.

13 If desired, add text notes, dimensions, and symbols.

Sample details created with Revit Architecture detailing tools



Detail View Properties

Detail View Type Properties

Each detail view has type properties for section tags, callout tags, and reference labels. You can define the appearance of section tags and callout tags. The Reference Label parameter defines the text displayed next to the detail tag when the detail is a reference detail.

Detail View Instance Properties

This table lists parameters specific to detail views.

Name	Description
Show in	Indicates whether the detail view tag displays in intersecting views or just in the parent view. If you create a detail view as a callout, then the callout appears as a section in intersecting views.
Hide at scales coarser than	Depending on the value of this parameter, the detail view tag does not display in any view whose view scale is coarser than the value specified.

For descriptions on additional view properties, see [View Properties](#) on page 259.

Reusing Details From Callouts

Duplicating a Detail View

To copy the model geometry from an existing view into a new view, right-click the existing view in the Project Browser, and click Duplicate View ► Duplicate.

If you right-click, and click Duplicate View ► Duplicate with Detailing, both the model geometry and the detail geometry are copied into the new view. Detail geometry includes detail components, detail lines, repeating details, detail groups, and filled regions.

NOTE Hidden view-specific elements will not be created in the new view. Hidden model elements and datum will be created in the new view and will remain hidden. For more information on element visibility, see [Visibility and Graphic Display in Project Views](#) on page 198.

See also:

- [Duplicate Dependent Views](#) on page 192

Referencing a Callout View

When you create a detail callout from a section, plan, or elevation view, on the Options Bar, click Reference Other View to reference any detail or drafting view from the Project Browser. In this way, you can link the view to a particular area of the building information model.

NOTE The Reference Other View option appears when you activate the section or callout view creation tool. Before defining the callout or section, select this option and select the view to reference. See [Creating a Detail View](#) on page 1135.

The View Name instance parameter (in the Instance Properties dialog) shows the name of the view, or if the detail is referencing another view, the name of the referenced view.

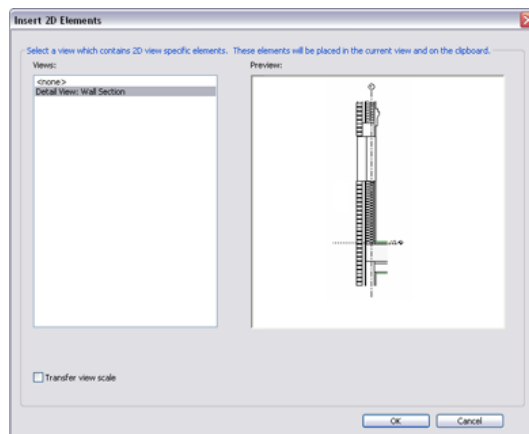
Saving Views to an External Project

Use the following procedure to save a view to an external Revit Architecture project. This operation will save the view and all elements (model elements and view-specific elements) visible in that view to a new project file.

- 1 Select a view in the Project Browser.
- 2 Right-click the view name, and click Save to New File.
- 3 Enter a new name for the Revit Architecture file.

Inserting Detail Components from a Saved Detail View

- 1 Click Insert tab ► Import panel ► Insert from File drop-down ► Insert 2D Elements from File.
- 2 In the Open dialog, select a project that was saved as a detail view and click Open.
- 3 In the Insert 2D Elements dialog, select a view that contains the 2D elements you wish to insert.



This copies the 2D Detail Components (repeating details, detail lines, insulation, and filled regions) to the new detail view. Although model geometry is not copied, Revit Architecture tries to map the detail components to the new host geometry in the current project. You will probably need to change and edit some of the 2D geometry, but this will give you a head start on your current detail.

The following view-specific elements will not be inserted:

- Edit cut profile elements
- Elements that cannot be grouped (for example, callout elements that create callout views)
- Elements that reference stair railing elements
- Elements that reference toposurface elements
- Elements that reference in-place families
- Elements that reference any elements in this list (for example, dimensions)

Drafting Views

During the course of a project, you may want to create details in a view that are not directly associated with the model. Rather than create a callout and then add details to it, you may want to create detail conditions where the model is not needed (for example, a carpet-transition detail which shows where carpet switches to tile, or roof-drain details not based on a callout on the roof).

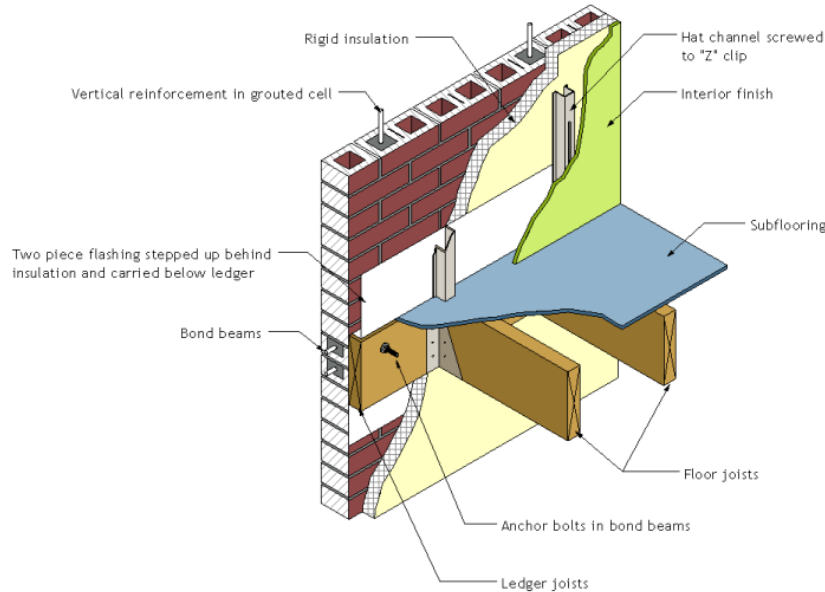
You create this unassociated, view-specific detail in a drafting view. The drafting view is not associated with the model. In a drafting view, you create details at differing view scales (coarse, medium, or fine) and use 2D detailing tools: detail lines, detail regions, detail components, insulation, reference planes, dimensions, symbols, and text. These are the exact same tools used in creating a detail view. However, drafting views do not display any model elements. When you create a drafting view in a project, it is saved with the project.

When using drafting views, consider the following:

- Similar to other views, drafting views are listed in the Project Browser under Drafting Views. See [Project Browser](#) on page 93.
- All of the detailing tools used in detail views are available to you in drafting views. See [Detailing Tools](#) on page 1146.
- Any callouts placed in a drafting view must be reference callouts. See [Reference Callouts](#) on page 154.
- Although not associated with the model, you can still drag the drafting views from the browser onto a drawing sheet. See [Adding Views to a Sheet](#) on page 1033.

Sample Drafting View

The following is a sample drafting view created using the 2D detailing tools in Revit Architecture. This is not a 3D view.



Creating a Drafting View

- 1 Click View tab ► Create panel ► Drafting View.
- 2 In the New Drafting View dialog, enter a value for Name, and select a value for Scale.

If you select Custom, enter a value for Scale value 1.

3 Click OK.

The drafting view opens in the drawing area.

4 In the Project Browser, expand Drafting Views to see the newly created drafting view listed.

5 To create the drafting view, use the detailing tools on the Annotate tab.

The detailing tools include Detail Lines, Insulation, Masking Region, Filled Region, Text, Symbol, and Dimension. See [Detailing Tools](#) on page 1146.

Sketching a Detail in a Drafting View

You can sketch a detail in a drafting view with the tools provided with Revit Architecture.

1 Click View tab ► Create panel ► Drafting View.

2 Enter a name and appropriate scale for the new drafting view.

3 Use Detail Lines, Repeating Details, Detail Components, Masking Regions, and Filled Regions to construct the geometry in this view. See [Detailing Tools](#) on page 1146.

Also see [Drafting Views](#) on page 1139 and [Sketching](#) on page 303.

Importing a View From Another CAD Program

You can import a view from another CAD program and create a detail from that view.

1 Click View tab ► Create panel ► Drafting View.

2 Enter a name and appropriate scale for the new drafting view.

3 Click Insert tab ► Import panel ► Import CAD.

4 Select the detail and CAD format.

5 Select the Current View Only option if you are in a detail view.

NOTE This is automatically selected if you are in a drafting view.

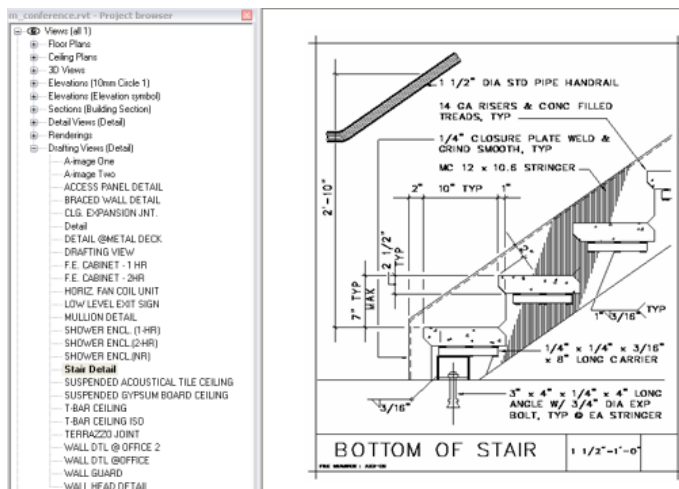
6 Click Open to place the CAD detail.

7 Drag and drop this view on a sheet, if desired.

8 Reference to this view when placing a callout or section, if desired.

Sample of an Imported Drafting View

The following image shows a sample of imported CAD detail to a drafting view.



Drafting View Display and Filled Regions

The behavior of filled regions changes in drafting views, depending on the display setting.

By default, drafting views display in hidden line. See [Hidden Line Model Graphics Style](#) on page 252. You can change the display to wireframe if desired. See [Wireframe Model Graphics Style](#) on page 251.

When the drafting view is in hidden line, filled regions with fill patterns hide all elements behind them. For example, if the filled region has a diagonal crosshatch pattern, and the view is in hidden line, you cannot see an element between the openings of the pattern.

If you change the display to wireframe, elements are visible behind openings in the pattern.

Drafting View Properties

Each drafting view has type properties for section tags, callout tags, and reference labels. You can define the look of section tags and callout tags. When the drafting view is a reference view, the Reference Label parameter sets the text displayed next to the view tag.

Reusing Drafting Views

Referencing a Drafting View

When you create a detail callout from a section, plan, or elevation view, you can click Reference Other View on the Options Bar to reference any detail or drafting view from the Project Browser. In this way, you can link the view to a particular area of the building information model.

NOTE The Reference Other View option appears when you activate the section or callout view creation tool. Before defining the callout or section, select this option and select the view to reference. See [Creating a Detail View](#) on page 1135.

You can link or import standard details from your CAD library into a drafting view. Then you can create a callout in a section, plan, or elevation view that references or points to this drafting view. View tags and annotations will display correctly.

Saving Drafting Views to an External Project

Use the following procedure to save drafting views to an external Revit Architecture project for use in another Revit Architecture project. You can also use this procedure to save sheet views and schedule views to an external project. For information on sheet views and schedule views, see [Sheets](#) on page 1030 and [Schedule Views](#) on page 172.

- 1 Select a drafting view in the Project Browser.
- 2 Right-click the view name, and click Save to New File.
- 3 Enter a new name for the project.
This creates a new Revit Architecture project file that contains the selected view and the contents of that view.

Inserting a Drafting View from Another Project

- 1 Click Insert tab ► Import panel ► Insert from File drop-down ► Insert Views from File.
- 2 In the Open dialog, select a project file, and click Open.
The Insert Views dialog opens, which displays views that are saved in the project.
- 3 From the list, select an option for views to display.
- 4 Select the views to insert, and click OK.
Revit Architecture creates a new drafting view with all the 2D components and text. If you have duplicate type names, the type name and properties from the current project are used, and a warning message displays.

Related topics

- [Inserting Schedule Views from Another Project](#) on page 191
- [Inserting Detail Components from a Saved Detail View](#) on page 1138
- [Saving Views to an External Project](#) on page 1138

Creating Details

After you have created a view for detailing, you can use additional resources provided with Revit Architecture to create details and complete the view for inclusion in construction documents. For information on creating views for detailing, see [Types of Views for Detailing](#) on page 1134.

Detailing Library

You can add additional detail components by loading them from the family library, or you can create or edit existing ones in the Family Editor. Click on the Detail Components folder, and then select the appropriate CSI (Construction Specifications Institute) section to see specific components under that section.

Revit Architecture contains over 500 Detail Component Families. They are organized by the 16 CSI divisions.

Inserting a Detail Component

The Detail Component tool places a detail component into a detail or drafting view. A detail component is visible in that view only. You can keynote detail components. See [Keynotes](#) on page 1117.

To insert a detail component

- 1 Click Annotate tab ► Detail panel ► Component drop-down ► Detail Component.
- 2 Click Place Detail Component tab ► Element panel, and select the appropriate detail component to place from the Type Selector drop-down.
- 3 Press *SPACEBAR* to rotate the detail component through its different snap points to other elements.
- 4 Place the detail component in the detail view.

You can add additional detail components by loading them from the family library, or you can create or edit existing ones in the Family Editor. Revit Architecture contains over 500 Detail Component Families. They are organized by the 16 CSI (Construction Specifications Institute) divisions.

Detail components can be tagged using detail item tags. To load tags into the project, click Insert tab ► Load from Library panel ► Load Family.

Creating a Detail Component Family

A detail component family consists of components added to detail or drafting views, and they are visible only in those views. They scale with the model, rather than the sheet. Detail components could include a 2X4, a metal stud, or a shim.

Before reading this topic, familiarize yourself with families. See [The Families Guide](#) on page 418.

The following procedure is a general procedure for creating a detail component family. Your steps may differ depending on your design intent.

- 1 In the Family Editor, sketch reference planes for placing the detail component.
- 2 Use tools on the Create tab to create the shape of the detail component. A detail component is displayed in a symbolic form and is not shown in 3D. Click the Line tool to sketch the symbol.

TIP You can change the sorting order of objects in the family by using the detail component draw order tools. For more information, see [Sorting the Draw Order of Detail Components](#) on page 1156.

- 3 For lines, select the line and click Modify Lines tab ► Visibility panel ► Visibility Settings, and select the views in which the object will be visible.

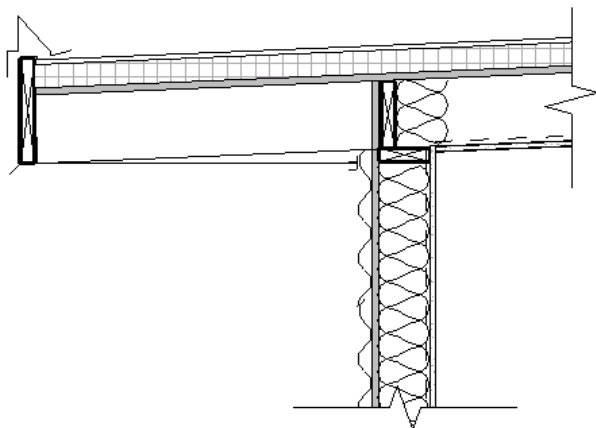
For filled regions, select the filled region and click Modify Detail Items tab ► Detail panel ► Visibility Settings, and select the views in which the object will be visible.

- 4 Save the detail component. See [Saving Revit Files](#) on page 114.

Creating a 2D Line-Based Detail Component Family

Detail components are pre-drawn line-based 2D elements that you can add to detail or drafting views. They are visible only in those views. They scale with the model, rather than the sheet.

For example, in the following drafting view, the studs, insulation, and siding are detail components.



Revit Architecture allows you to create a 2D detail component based on a line. By selecting the start and end of the line, you can place the detail. Suppose you want to place a plywood fill pattern in a section. By selecting the start and end points of the detail component, you can place the detail with the thickness and fill pattern that was created in the 2D detail component. For example, if the plywood is drawn at 1/2" in the 2D detail component, this procedure would place a piece of plywood along the length of the drawn line at 1/2". If you wanted to adjust the thickness of the plywood, you would first have to edit the 2D detail component.

Before reading this topic, familiarize yourself with families. See [The Families Guide](#) on page 418.

The following is the general procedure for creating a 2D line-based detail component family. Your steps may differ depending on your design intent.

- 1 Create a new family using the Detail Component line-based template.
- 2 Use tools on the Create tab to create the shape of the detail component. A detail component is displayed in a symbolic form and is not shown in 3D. Click the Line tool to sketch the symbol. Create the component between the 2 reference planes to have elements contract or expand based on the length.

TIP You can change the sorting order of objects in the family by using the detail component draw order tools. For more information, see [Sorting the Draw Order of Detail Components](#) on page 1156.

- 3 For lines, select the line and click Modify Lines tab ► Visibility panel ► Visibility Settings, and select the views in which the object will be visible.
For filled regions, select the filled region and click Modify Detail Items tab ► Detail panel ► Visibility Settings, and select the views in which the object will be visible.
- 4 Save the detail component. See [Saving Revit Files](#) on page 114.

Repeating Detail

With the Repeating Detail tool, you sketch a path defined by 2 points. The path is then filled in with a pattern of detail components. The pattern is a family type called a repeating detail. You can control the appearance of the family through its type properties. The type properties include the detail component family that is applied to the repeating detail, and the spacing of the individual detail components that compose the repeating detail. A repeating detail is essentially an array of a detail component. Like other detailing tools, a repeating detail is visible only in the view in which it is drawn.

Repeating details are primarily useful in plan and section views.

To create a repeating detail

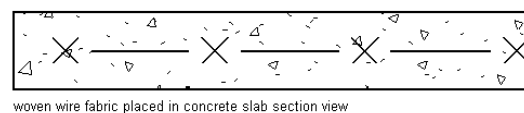
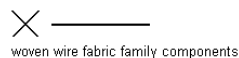
- 1 Click Annotate tab ► Detail panel ► Component drop-down ► Repeating Detail.
- 2 Sketch the repeating detail, and then click Modify.
- 3 Click Modify Detail Items tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 4 In the Type Properties dialog, click Duplicate, and enter a name for the repeating detail type.
- 5 Select a detail component for the Detail parameter.

If desired, load more detail components from the standard Revit Architecture library, or create your own. See [Loading Families](#) on page 427 for more information about loading a detail component family. See [Creating a Detail Component Family](#) on page 1143 for more information about creating a detail component family.

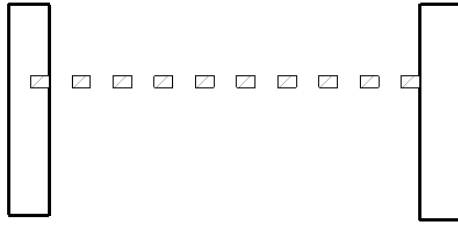
- 6 Set the Layout for the repeating detail:
 - Fill Available Space indicates that the detail component is repeated along the length of the path, such that the spacing is equal to the width of the component.
 - Fixed Distance indicates that the detail component is spaced at the exact value specified for the Spacing parameter, starting from the beginning of the path. See the description for Spacing below.
 - Fixed Number indicates that a defined number of detail components are placed along the path, while the spacing is adjusted to maintain this number. After setting this type parameter, you need to define the Number parameter in the family's instance properties.
 - Maximum Spacing indicates that the detail component is spaced at an even interval along the length of the path and at a distance up to the value specified for Spacing. The actual spacing used may be less to ensure a complete component at either end of the path.
- 7 Select the Inside parameter to confine the spacing of the detail components to within the length of the path.

If you do not select this parameter, the first and last detail components are placed according to the defined origin of the detail component family. This means that the first and last detail components can extend beyond the length of the path.
- 8 If you set Layout to Fixed Distance or Maximum Spacing, the Spacing parameter becomes enabled. Enter a value for this parameter.
- 9 If desired, indicate how you want the detail component to be rotated in the pattern.
- 10 Click OK to close the Type Properties dialog.
- 11 If you set the Layout parameter to Fixed Number, click Element Properties, and in the Instance Properties dialog, enter a value for Number parameter, and then click OK.
- 12 From the Type Selector, select the repeating detail that you created.
- 13 Sketch the repeating detail component in the family by clicking once for a start point, dragging the mouse, and clicking again for an end point.

The following image shows the addition of a welded wire fabric family to a concrete slab in section view.



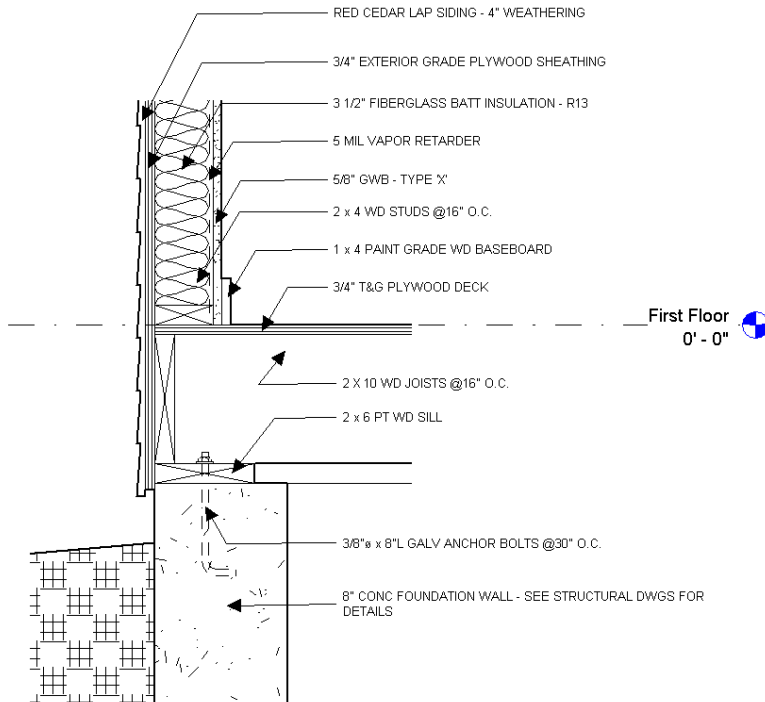
The following image shows a repeating pattern placed between 2 walls. The pattern has a fixed number of 10 and a length of 6 feet.



Detailing Tools

- **Callouts.** Create a callout first to get a close-up view of a plan or elevation view. All detail annotations are added to the callout view. See [Callout Views](#) on page 146.
- **Detail Lines.** Use detail lines to add information or sketch over existing elements. See [Detail Lines](#) on page 1154.
- **Dimensions.** Apply specific dimensions to the detail. See [Placing Permanent Dimensions](#) on page 265.
- **Text Notes.** Use text notes to specify construction methods. See [Text Notes](#) on page 1087.
- **Detail Components.** Create and load custom detail components to place in the detail. Detail components might be actual construction components, such as structural steel, jambs, or metal studs. See [Creating a Detail Component Family](#) on page 1143.
- **Symbols.** Place a symbol, such as a direction arrow or a break mark symbol to indicate omitted information. See [Symbols](#) on page 1130.
- **Masking Region:** Create masking regions to obscure elements in a view. See [Masking Regions](#) on page 1147.
- **Filled Region.** Create detail filled regions and give them a fill pattern to represent various surfaces, including concrete or compacted earth. You draw regions on the default work plane. It is not necessary to select a work plane for them. You can apply a fill pattern to the region. To do this, select the region and click Modify Detail Items tab ► Element panel ► Element Properties drop-down ► Type Properties. Set a value for the Fill Pattern property. The different fill patterns are defined by the Fill Patterns tool. See [Filled Region](#) on page 1153 and [Fill Patterns](#) on page 459.
- **Insulation.** Place insulation in a wall detail that shows all the material for the wall. For example, an exterior wall might include a layer of gypsum, insulation, metal studs, sheathing, air space, and brick. See [Insulation](#) on page 1133.

Foundation detail sketched with Revit Architecture detailing tools



Masking Regions

Masking regions provide a way to obscure elements in a view. Masking regions may be useful in scenarios like the following:

- You need to obscure elements in a project.
- You are creating a detail family or a model family and need the background of the element to mask the model and other detail components when it is loaded into a project.
- You need to create a model family (from imported 2D DWG files) that obscures other elements when placed in a view.

You can create 2D and 3D masking regions. 2D masking regions can be created in a project and in the Family Editor when you are creating a 2D family (annotation, detail, or title block). 3D masking regions can be created in the Family Editor when you are creating a model family.

Masking regions do not participate in shading; they are always drawn the background color of the drawing area. Masking regions cannot be applied to element subcategories.

Exporting Masking Regions to DWG

When you export a project or family that contains a masking region, any lines that intersect the masking region terminate at the masking region so that graphical intent is maintained in the DWG file.

Adding a Masking Region in a Project

- 1 Click Annotate tab ► Detail panel ► Region drop-down ► Masking Region.

- 2 Click Create Filled Region Boundary tab ► Element panel, and select the boundary line style from the Line Style drop-down list.
- 3 Sketch the masking region (or regions). Masking region sketches must be closed loops.
For more information on sketching, see [Sketching](#) on page 303.
- 4 When finished, click Finish Region.

After you add a masking region, you can sort the draw order. For more information, see [Sorting the Draw Order of Detail Components](#) on page 1156.

Adding a Masking Region to a Detail Family

- 1 In the Family Editor, click Create tab ► Detail panel ► Masking Region.
- 2 Click Create Filled Region Boundary tab ► Element panel, and select the boundary line style from the Line Style drop-down.
- 3 Click Element panel ► Region Properties.
- 4 In the Instance Properties dialog, specify properties for the masking region:
 - **Visible.** Specify if the masking region is visible when the family is loaded into a project and placed in the drawing area.
 - **Visibility/Graphics Overrides.** Specify the detail levels at which the masking region is visible (coarse, medium, or fine).
- 5 Sketch the masking region (or regions). Masking region sketches must be closed loops.
For more information on sketching, see [Sketching](#) on page 303.
- 6 When finished, click Finish Region.

The following is a sample detail family with a masking region applied. You can view this detail family by opening the Nominal Cut Lumber-Section family in the following directory:

Imperial (or Metric) Library\Detail Components\Div 06 - Wood and Plastic\06100 - Rough Carpentry\06110 - Wood Framing

After you add a masking region, you can sort the draw order. For more information, see [Sorting the Draw Order of Detail Components](#) on page 1156.

Masking Regions in Model Families

When you add a masking region to a model family, several parameters allow you to control the visibility of the masking region and where the masking region is drawn. You can specify the following properties for masking regions in model families:

- If the masking region is visible when the family is loaded into a project and placed in the drawing area.
- The detail levels at which the masking region is visible (coarse, medium, or fine).
- Where the masking region is drawn. This is controlled by the Draw in Foreground parameter. When this parameter is selected, the masking region is drawn at the detail plane of the view (the plane that is closest to you as you look at the view). When this option is not selected, the masking region is drawn on the work plane on which it was sketched.

Controlling Where Masking Regions are Drawn in Model Families

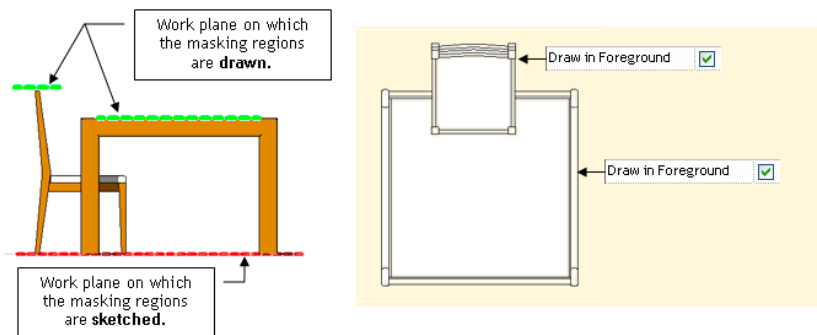
Where a masking region is drawn depends on where it is sketched in the family and the status of the Draw in Foreground parameter. It is also important to consider other families with which the family may interact

as you determine where you want the masking region drawn. The following scenarios illustrate sample families and the placement of their masking regions.

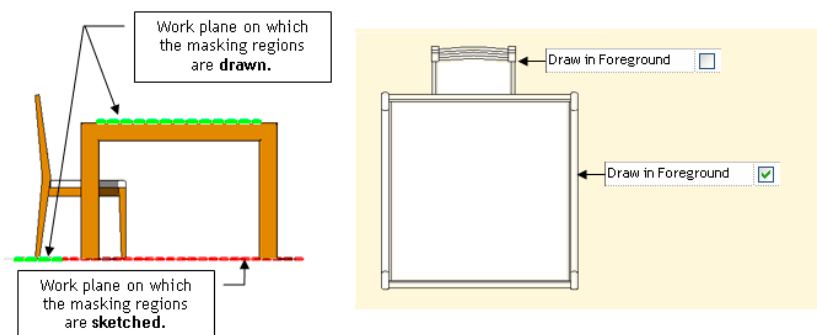
NOTE The Draw in Foreground parameter is available only in the Family Editor when you are creating or modifying a 3D family.

Scenario 1

The following images show a chair family and a table family, both with their masking region (red, dashed line) sketched on the reference level. In the first image, the Draw in Foreground parameter is selected for both the table and the chair. The chair masks the table, because the chair back is higher than the table.

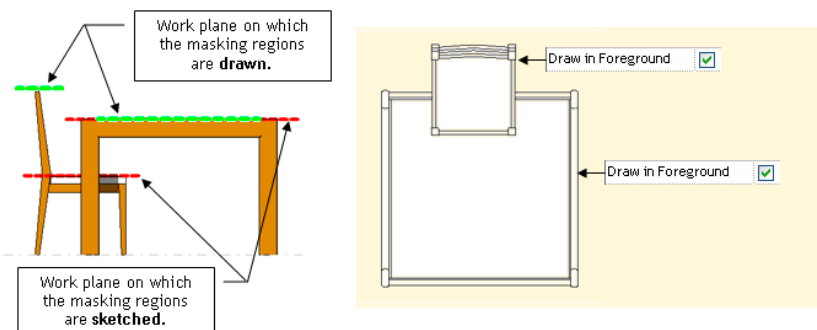


In the second image, the Draw in Foreground parameter is cleared for the chair so that the masking region is drawn where it was sketched. The Draw in Foreground parameter is still selected for the table. Therefore, the table masks the chair.

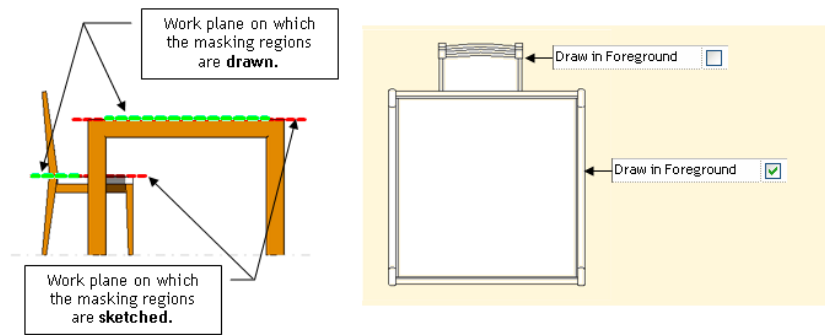


Scenario 2

The following images also show the same chair and table families, but the masking regions are sketched on different work planes. In the first image, the Draw in Foreground parameter is selected for both the table and the chair. Again, the chair masks the table, because the chair back is higher than the table.

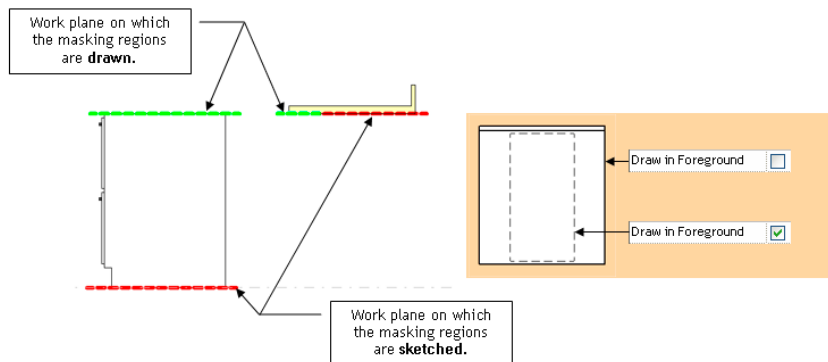


In the second image, the Draw in Foreground parameter is cleared for the chair and selected for the table. Therefore, the table masks the chair.



Scenario 3

The following image shows a cabinet family and a counter top family. The goal is for both the counter top and the cabinet to display in plan view when the counter top is placed on top of the cabinet. Both families have masking regions (as shown by the red, dashed lines). In order to accomplish the goal, clear the Draw in Foreground parameter for the counter top family, and select the Drawn in Foreground parameter for the cabinet family.



NOTE You can change the work plane of a masking region after you sketch it. See [Changing the Work Plane of an Element](#) on page 318.

Adding a Masking Region to a 2D Element in a Model Family

If you create a model family that only contains 2D elements (for example, a 2D toilet fixture) and you want to apply a masking region to the 2D element, you must include an invisible line to represent the Z dimension, which is where the masking region is drawn. The invisible line must be drawn above the level and must be a minimal length (such as 1/8") so that the masking region does not obscure any other elements in the view.

Adding a Masking Region to a Model Family

- 1 In the Family Editor, click Create tab ► Detail panel ► Masking Region.
- 2 Click Create Filled Region Boundary tab ► Element panel, and select the boundary line style from the Line Style drop-down list.
- 3 Click Element panel ► Region Properties.
- 4 In the Instance Properties dialog, specify properties for the masking region:
 - **Draw in Foreground.** Specify where you want the masking region drawn. When this parameter is selected, the masking region is drawn at the detail plane of the view (the plane that is

closest to you as you look at the view). When this option is not selected, the masking region is drawn on the work plane on which it was sketched. For more information on using the Draw in Foreground parameter, see [Masking Regions in Model Families](#) on page 1148.

- **Visible.** Specify whether the masking region is visible when the family is loaded into a project and placed in the drawing area.
- **Visibility/Graphics Overrides.** Specify the detail levels at which the masking region is visible (coarse, medium, or fine).


5 Sketch the masking region (or regions). Masking region sketches must be closed loops.

For more information on sketching, see [Sketching](#) on page 303.


IMPORTANT If your model family only contains 2D elements (for example, a 2D toilet fixture) and you want to apply a masking region to the 2D element, you must include an invisible line to represent the Z dimension, which is where the masking region is drawn. The invisible line must be drawn above the level and must be a minimal length (such as 1/8") so that the masking region does not obscure any other elements in the view.

6 When finished, click Finish Region.

Creating a Model Family with Masking Regions from 2D DWG Files

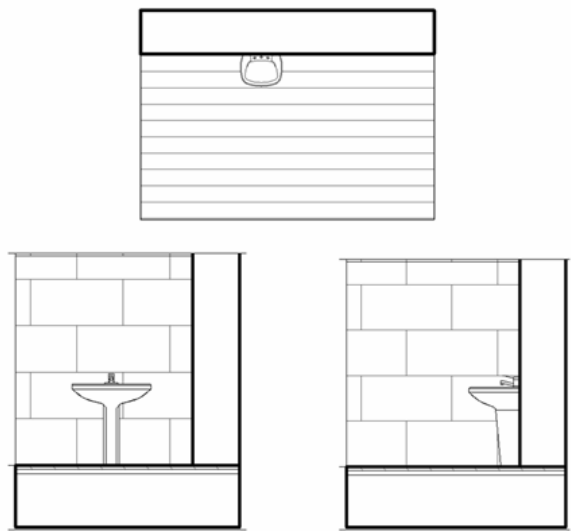
- 1 Click  ► New ► Family.
- 2 In the New Family dialog, select a default family template (for example, Plumbing Fixture wall based.rft), and click Open.
- 3 Open the view to import the DWG file into.
For example, if you have a DWG file for a plan representation, open the plan view.
- 4 Click Insert tab ► Import panel ► Import CAD.
- 5 In the Import CAD Formats dialog, navigate to the DWG file.
If you only want the representation to be visible in plan view, select the Current View Only option. Also, if you are unsure of the original coordinates of the DWG file, for Positioning, select Manual - Center.
- 6 Click Open.
- 7 Click in the drawing area to place the import symbol.
- 8 Modify the position of the import symbol as necessary, and lock the symbol to the necessary reference planes.
- 9 Click Create tab ► Detail panel ► Masking Region.
- 10 Sketch the masking region.

IMPORTANT When a model family only contains 2D elements and you are adding a masking region to a 2D element, you must include an invisible line to represent the Z dimension, which is where the masking region is drawn. The invisible line must be drawn above the level and must be a minimal length (such as 1/8") so that the masking region does not obscure any other elements in the view.

- 11 Add any other 2D view representations (for example, front elevation and side elevation) and masking regions, as necessary.
- 12 When finished, click  on the Quick Access toolbar to save the family.
- 13 If you need to load the family into a project, click Create tab ► Family Editor panel ► Load into Project.

If you have only one project open, the family loads into that project. If you have multiple projects open, the Load into Projects dialog opens where you can select the projects to load the family into.

When you load the family into a project and place it in the drawing area, it obscures surface patterns in orthogonal views.



Masking Region Properties

Properties for Masking Regions in Projects

Name	Description
Dimensions	
Area	The area of the masking region. This is a read-only value.
Identity Data	
Comments	Comments for the masking region.

Properties for Masking Regions in 2D and 3D Families

Name	Description
Constraints	
Draw in Fore-ground	Draws the masking region on the closest work plane in the view. This property is only available in the Family Editor when you are creating or modifying a 3D family. For more information, see Masking Regions in Model Families on page 1148.
Work Plane	The work plane of the masking region. This is a read-only value and is only available in the Family Editor.
Graphics	

Name	Description
Visible	Determines whether the masking region is visible when the family is loaded into a project, and then placed in the drawing area. This property is only available when you are creating or modifying a masking region in the Family Editor.
Visibility/Graphics Overrides	Select the detail level at which you want the masking region to display in a project: Coarse, Medium, or Fine. Detail levels are dependent on the view scale. This property is only available in the Family Editor.
Dimensions	
Area	The area of the masking region. This is a read-only value.
Identity Data	
Comments	Comments for the masking region.

Filled Region

The Filled Region tool creates a 2-dimensional, view-specific graphic with a boundary line style and fill pattern within the closed boundary. The filled region is parallel to the view's sketch plane. The tool is useful for defining a filled area in a detail view or for adding a filled region to an annotation family.

Filled regions contain a fill pattern. Fill patterns are of 2 types: Drafting or Model. Drafting fill patterns are based on the scale of the view. Model fill patterns are based on the actual dimensions in the building model.

The following procedure is a general method for creating a filled region. Steps may vary depending on your design intent.

- 1 Click Annotate tab ► Detail panel ► Region.
- 2 Click Create Filled Region Boundary tab ► Element panel, and select a boundary line style from the Line Styles drop-down.
- 3 Sketch the region using the sketch tools on the Draw panel.
For example, you might sketch a square region. For more information about the sketching tools, see [Sketching](#) on page 303.
- 4 To give the region a fill pattern, click Element panel ► Region Properties. In the Instance Properties dialog, click Edit Type and then select a fill for the Fill Pattern property.
- 5 To set different line styles for the region lines, select the lines, click Draw panel ► Properties, and change the value for the Subcategory property.
- 6 Click Finish Region to complete your sketch.

Changing Filled Region Properties

- 1 Select the completed detail filled region.
- 2 Click Modify Detail Items tab ► Element panel ► Element Properties drop-down ► Type Properties.

TIP You can also open properties through the Project Browser. In the browser under Families, expand Detail Items. Expand Filled Region. Right-click the region type name (for example, Filled Region 1) and click Properties.

- 3 You can set Fill pattern, Background, Line Weight Number, and Color for the region. With Background, you can set it to opaque or transparent.

Resizing the Filled Region

- 1 In the drawing area, select the filled region.
This displays shape handles on the region.
- 2 Click to select the shape handle.
- 3 Drag the handles to resize the region.

Viewing the Area of a Filled Region

- 1 Select the filled region in the drawing area.
- 2 Click Modify Detail Items tab ► Element panel ► Element Properties.
- 3 In the Instance Properties dialog, view the Area instance parameter.

The area value is the area of the region's closed perimeter loop, less the area of any closed loops within the perimeter. The area property is reported in the project units (for example, square meters or square feet). The area property is read-only and cannot be scheduled or tagged.

Fill Pattern Category

A filled region created for a detail view is part of the Detail Items category. Revit Architecture lists the region in the Project Browser under Families ► Detail Items ► Filled Region. If you create a filled region as part of an annotation family, Revit Architecture identifies it as a Filled Region, but does not store it in the Project Browser.

Detail Lines

The Detail Line tool creates detail lines for detailing drawings. Detail lines are visible only in the view in which they are drawn. Often they are drawn over the model view.

NOTE If you want to sketch lines that exist in 3D space and display in all views, see [Model Lines](#) on page 805.

The Detail Line tool has the same line styles as the Line tool, but detail lines are view-specific, like detail components and other annotations.

Detail lines are drawn in the view's sketch plane. They can be used to detail a view with part of the model visible, such as in a wall section or callout. Or detail lines can be used in a drafting view to draft lines with no reference to the model. Some examples of detail lines in a drafting view are signage or typical details that have no reference to the model.

You can also use detail lines for tracing over underlay elements. See [View Properties](#) on page 259 for more information on setting elements as underlays.

Before using this tool, you should read [Creating Details](#) on page 1142.

- 1 Click Annotate tab ► Detail panel ► Detail Line.
- 2 Sketch lines as appropriate.

Detail Editing

Detail Component Positioning

Every detail component, detail line, and filled region has a graphic draw order within the overall detail. Think of it as a stack of papers on your desk that overlap each other. You can send the detail component to the back of the detail. This is like taking the top paper and placing it at the bottom of the pile. You can also send the detail component back one step at a time. Think of this as taking the top piece paper and placing it behind the next piece of paper in the stack. Of course, you can do the reverse as well. You can bring the detail to the top of the stack or bring it forward one step at a time.

NOTE Detail components always appear on top of model geometry. You cannot send a detail component behind model geometry. The current positioning only works with detail components, insulation, detail lines, detail groups, repeating details, and filled regions.

For more information on graphic draw order, see [Sorting the Draw Order of Detail Components](#) on page 1156.

Show Hidden Lines

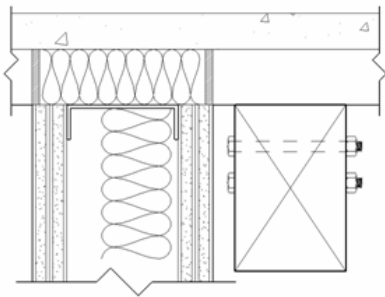
After you put detail components in the correct graphic draw order, you can use the Show Hidden Lines tool to obscure the lines behind a detail component.

- 1 Select Modify tab ► Edit Linework panel ► Show Hidden.
- 2 Select the elements that you want to show hidden lines through. Lines from obscured elements will show through these elements.
- 3 Select one or more elements for which you want hidden lines displayed. Obscured edges and lines for these elements will appear as hidden lines.

NOTE The object must be in the correct order. You cannot hide the lines of a bolt that is on top of a 4x6 stud. The bolt must first be sent behind the 4x6 stud to be obscured. To show the bolt as hidden lines, select the 4x6 stud, and then select the bolt. See [Remove Hidden Lines](#) on page 1155.

Remove Hidden Lines

The Remove Hidden Lines tool reverses the effects of the Show Hidden Lines tool. The following example illustrates the results after selecting Modify tab ► Edit Linework panel ► Show Hidden drop-down ► Remove Hidden Lines, and then selecting the 4x6 stud and the bolt. This procedure removes the hidden lines, and the 4x6 stud completely obscures the bolt.



Sorting the Draw Order of Detail Components





You can sort the draw order of detail components in a view. Draw order options are available when you select detail components in the view.

This functionality is also available in the Family Editor (for detail components in the Detail and Profile families), and for raster images.

To specify element draw order

1 In the drawing area, select a detail component.

The following tools become available on the Modify <element> tab ► Arrange panel.


-  (**Bring to Front**). Immediately places the detail component in front of all detail components in the view.
-  (**Send to Back**). Immediately places the detail component behind all detail components in the view.
-  (**Bring Forward**). Moves the detail component one step closer to the front of all other detail components.
-  (**Send Backward**). Moves the detail component one step closer to the back of all other detail components.

2 Click the desired option to move the component.

Saving Views

You can save 2D views to create a detail library for later use in other projects. This allows for reuse and saves duplication of work. You can save views that contain only view-specific elements, such as drafting views.


To save 2D views, do either of the following:

- To save a single view, in the Project Browser, right-click the view and click Save to New File. Navigate to the desired location, enter a file name, and click Save.
- To save several views from the project, select  ► Save As ► Library ► View. In the Save Views dialog, select the views to save, and click OK. Navigate to the desired location, enter a file name, and click Save.

For more information, see [Reusing Details From Callouts](#) on page 1137 and [Reusing Drafting Views](#) on page 1141.

Labels

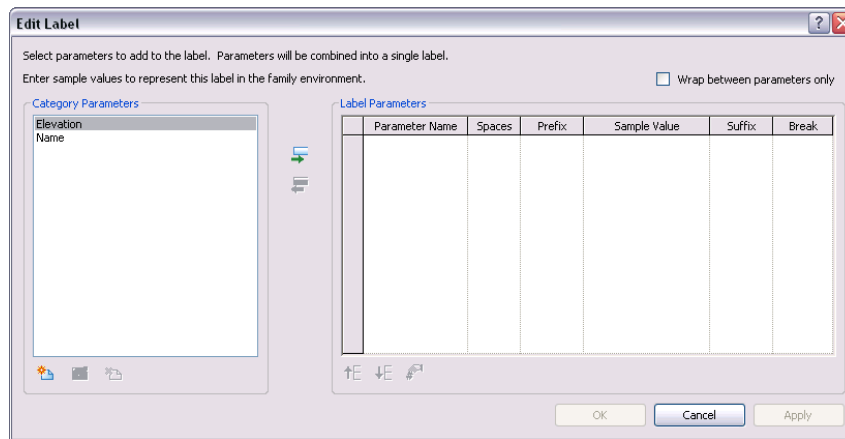
A label is a text placeholder added to tags or titleblocks. You create a label as part of a tag or titleblock family while in the Family Editor. When you place the tag or titleblock in the project, you place substitution text for the label, and the text appears as part of the family.

- 1 Click  ► New ► Annotation Symbol or Title Block.
- 2 In the displayed dialog, select the appropriate template for the family you are creating.
- 3 In the Family Editor, click Create tab ► Annotate panel ► Label.

- 4 Click Place Label tab ► Element panel, and select the label type from the Type Selector drop-down.
- 5 On the Alignment panel, select the vertical and horizontal justification.
- 6 In the drawing area, click to position the tag. For example, in a generic model tag template, place the cursor at the intersection of the two reference planes. The Edit Label dialog opens.
- 7 Edit the label parameters. See [Editing Multi-parameter Labels](#) on page 1157.

Editing Multi-parameter Labels



You assign single or multiple parameters to labels with the Edit Label dialog.





The Category Parameters window contains the label parameters related to the tag type. The Label Parameters window contains the Category Parameters that display in the label. Typically, this is a single parameter, but you can detail more complex, concatenated labels.

Building a Label




You add and remove parameters by moving them between the windows:

- Highlight a parameter in the Category Parameters window and click  (Add Parameter) to move it into the Label Parameters window.
- Highlight a parameter in the Label Parameters window and click  (Remove Parameter) to move it into the Category Parameters window.

Labels display their parameters from the first to the last (top to bottom) as listed in the Label Parameters window. You reorder the label by highlighting a parameter and shift its position using  (Move Parameter Up) and  (Move Parameter Down).

Shared Label Parameters

You can configure the label with shared external parameters of other families. You configure shared parameters before moving them over to the Label Parameters window. The Category Parameters controls aid in this integration:

-  **Add Parameter.** Click this button to enter the Parameter Properties dialog. See [Adding Shared Parameters to Families](#) on page 454.
For Generic Annotation families, you can use the Add Parameter button to introduce new Family Parameters to the Generic Annotation family. See [Creating Parameters](#) on page 431 and [Custom Parameters](#) on page 450.
-  **Edit Parameter.** Click this button to enter the Parameter Properties dialog to edit a selected parameter. See [Viewing, Moving, and Deleting Shared Parameters](#) on page 454.
-  **Delete Parameter.** Click this button to delete a selected family parameter.
To delete a shared parameter, see [Viewing, Moving, and Deleting Shared Parameters](#) on page 454.

NOTE Deleted shared parameters are removed from all sharing labels.

Label Parameter Options

The columns in the Label Parameters window display annotation options for the label. The parameter names are listed in order in the first column.

Spaces. You increase or decrease the spacing between parameters in the label by entering a representative number of spaces (zero or greater). This option disables if the Break option is selected.

Prefix. You can add a prefix to the parameter value by adding a text string in this option.

Sample Value. You can change how the place holding text appears in the parameter.

Suffix. You can add a suffix to the parameter value by adding a text string in this column.


Break. You force a line break immediately after the parameter by checking this box. Otherwise, the text wraps within the label boundary.

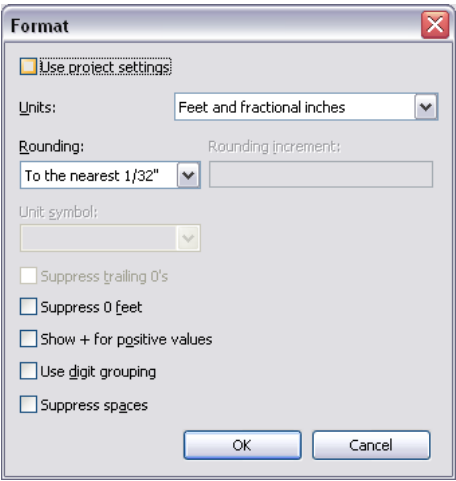
Wrap between parameters only. You force text wrapping in the label to break at the end of parameters by checking this box. If not selected, text wraps at the first word reaching the boundary.

Unadjusted label text	Wrapping label text	Breaking label text
Family: W-Wide Flange Name: W18X40 Material: Steel	Family: W-Wide Flange Name: W18X40 Material: Steel	Family: W-Wide Flange Name: W18X40 Material: Steel

Edit Label Unit Formats

If you create a label with a length, area, volume, angle, number, currency, or slope parameter, you can format the appearance of the parameter.

- 1 In the Edit Label dialog, choose a length or area parameter, such as Room area.
- 2 Click  . The Format dialog displays.



The Use project settings option is selected by default. This means that the value displays according to the Units setting in the project. See [Project Units](#) on page 502.

- 3 Clear Use project settings.
- 4 From the Units menu, select an appropriate unit.
- 5 From the Rounding menu, select a decimal place value. If you choose Custom from the menu, enter a value in the Rounding increment text box.
- 6 If applicable, select a Unit suffix from the menu.
- 7 Select Suppress 0 feet to hide leading zeros on dimensions, such as 0' 6". This option is available only for feet and fractional inches.
- 8 Click OK.

Label Type Properties

You can modify the Type Properties of labels.

Name	Description
Graphics	
Color	Sets the color of the text and the leader line.
Line weight	Sets the thickness of the line that surrounds the text when you select the text and the thickness of the leader line. You can change the definition of the line weight numbers using the Line Weights tool. See Line Weights on page 495.
Background	Sets the background for the text note. With Opaque, the background of the note itself covers material behind it. Transparent allows you to see material behind the note. This is useful with text notes placed in color-defined rooms.
Text	
Text Font	Sets the Microsoft® True Type fonts for the text note. The default font is Arial.
Text Size	Sets the size of the typeface.

Name	Description
Tab Size	Sets tab spacing in a text note. When you create a text note, you can press TAB anywhere in the text note, and a tab appears at the specified size.
Bold	Sets the text typeface to bold.
Italic	Sets the text typeface to italic.
Underline	Underlines the text.
Width Factor	1.0 is the default for regular text width. The font width scales proportionately to the Width Factor. Height is not affected.

Label Instance Properties

You can modify the Instance Properties of labels.


Name	Description
Graphics	
Sample Text	Read-only field that displays the Sample Value from the Edit Label dialog.
Label	Launches the Edit Label dialog.
Wrap between parameters only	Forces text wrapping to break at the end of parameters. If not selected, text wraps at the first word reaching the label boundary.
Vertical Align	Orients text at the Top, Middle, or Bottom of the label boundary.
Horizontal Align	Justifies text to the Left, Center, or Right of the label boundary.
Keep Readable	Text in the label remains readable whenever you rotate it. It never displays upside-down.
Visible	Sets whether the label is visible in a project.

Applying the Label to a Tag in a Project

- 1 In a project, click Insert tab ► Load from Library panel ► Load Family.
- 2 Navigate to the family you want to load, and click Open. If prompted to replace a family of the same type, click Yes.
- 3 If you created a window, door, or room tag, place one of those components to see the new tag you created.
- 4 If the element does not already have a tag associated with it, place the element, then click Home tab ► Room and Area panel ► Tag, or Annotate tab ► Tag panel ► Tag by Category, to place a tag with the element.
- 5 Select the element that you placed, for example, a window and click Modify <element> tab ► Element panel ► Element Properties.
- 6 Locate the parameter that you chose when creating the label in either the Instance or Type properties. For example, if you defined the label to include the Manufacturer parameter, click Edit Type to open the Type properties.

- 7 Enter a value for the parameter and click OK twice.
The label value displays in the tag.

Applying the Label to a Titleblock in a Project

- 1 In a project, click Insert tab ► Load from Library panel ► Load Family.
- 2 Create a sheet using the titleblock. See [Sheets](#) on page 1030.
The new sheet view opens with the label you created in the titleblock family.
- 3 Select the label and click  (Element Properties).
- 4 From the Instance properties list, locate the parameter you defined for the family and enter a value for it.
- 5 Click OK.

Rendering

19

You can use Revit Architecture to generate a photorealistic image of a building model so you can present the design to clients or share it with team members. Revit Architecture renders 3D views with various effects and content, such as lighting, plants, decals, and people.

As an alternative, you can export a 3D view, and use another software application to render the image. See [Exporting to 3ds Max](#) on page 1373.



Rendering Workflow

In Revit Architecture, the process of rendering a 3D view is as follows. (The first 4 steps can be performed in any order.)

- 1 Create a 3D view of the building model.
See [3D Views](#) on page 156.

- 2 Specify render appearances for materials, and apply materials to model elements.
See [Materials](#) on page 468.
- 3 Define lighting for the building model.
 - If the rendered image will use artificial lights, add them to the building model. See [Lights](#) on page 1164.
 - If the rendered image will use natural light, define sun and shadow settings. See [Defining the Sunlight Source for Shadows](#) on page 253.
- 4 (Optional) Add the following to the building model:
 - [Plants](#)
 - [People, cars, and other entourage](#)
 - [Decals](#)
- 5 Define render settings.
See [Defining Render Settings](#) on page 1221.
- 6 Render the image.
See [Creating the Rendered Image](#) on page 1229.
- 7 Save the rendered image.
See [Saving the Rendered Image as a Project View](#) on page 1231 or [Exporting the Rendered Image to a File](#) on page 1231.

Lights

When designing a building, you can place artificial lights on its exterior and interior to address lighting needs and plan the visual impact of lights. You can define lighting fixtures and their light sources, placing them in the building model for best effect. When you render a 3D view, you can specify whether the artificial lights, natural light, or both, will display in the rendered image.

Related topic

- [Defining the Sunlight Source for Shadows](#) on page 253

Lights Overview

Lighting is an important factor in conveying the design intent. When rendering a 3D view of a building model, you can use natural light, artificial light, or both to illuminate the building.

For natural light, you specify the direction of the sunlight, or the location, date, and time of day to achieve a realistic representation of sunlight on the building. For artificial light, you add lighting fixtures to the building model, organizing them into light groups if desired. Before rendering, you can turn on or off individual lighting fixtures or light groups to achieve the desired effect. The resulting rendered image shows the effects of lighting on the design.



Lighting Fixtures

In Revit Architecture, a lighting fixture is a model element that emits light from one or more light sources. A lighting fixture is defined by a Revit lighting fixture family. (See [Revit Families](#) on page 415.)

Revit Architecture provides several lighting fixture families for wall lights, ceiling lights, table lamps, floor lamps, exterior lighting, and other types of lighting fixtures. You can use the Family Editor to design your own lighting fixtures. You can also download additional lighting fixture families from the Revit Web Content Library and other sources.



Related topics

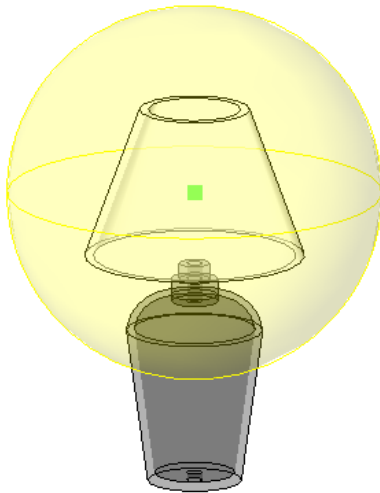
- [Creating and Modifying Lighting Fixtures](#) on page 1169
- [Using Lighting Fixtures in a Building Model](#) on page 1190

Light Sources

A light source is the part of a lighting fixture that emits light (such as a light bulb). In general, each lighting fixture family has one light source. To create a lighting fixture that uses multiple light sources (such as a chandelier or a set of track lights), create a nested family.

For each light source, you can specify the shape of the light element (point, line, rectangle, or circle), and the light distribution (spherical, hemispherical, spot, or [photometric web](#)). You can also define photometric characteristics, such as Light Loss Factor, Initial Intensity, and Initial Color Control. In a project, you can adjust the position and brightness of each light source to achieve the desired lighting effects.

A table lamp and its light source



Related topics

- [Creating Lighting Fixtures with Multiple Light Sources](#) on page 1170
- [Defining a Light Source](#) on page 1180
- [Controlling the Brightness of a Light Source](#) on page 1196
- [Adjust Light Sources Before Rendering](#) on page 1168
- [Displaying Light Sources in a View](#) on page 1192

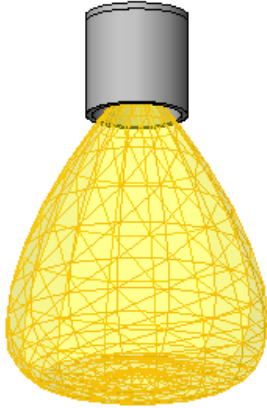
Photometrics and IES Files

In Revit Architecture, photometrics are parameters for creating realistic lighting fixture families. Photometrics help to define the visible light that displays in a rendered image of a building model.

The photometrics that are available for a particular lighting fixture depend on its light source definition. They include parameters such as Light Loss Factor, Initial Intensity, and Initial Color Control.

When you specify that the light distribution of a light source is [Photometric Web](#), you can specify an IES file. An IES file is a text file provided by a lighting manufacturer. It describes the intensity of a light source at points on a spherical grid. It also describes the geometry of how the light comes out of the lighting fixture (the photometric web).

A photometric web for a light source



Revit Architecture uses the IES file to make a photometric web to represent the light source. In general, IES files result in more accurate lighting results in rendered images. For information about the IES file format, go to <http://www.iesna.org>. See [Specifying an IES File for a Light Source](#) on page 1178.

Lighting Best Practices

To get the most accurate results in shaded views and rendered images, use the following best practices.

Related topic:

- [Render Performance and Lighting](#) on page 1234

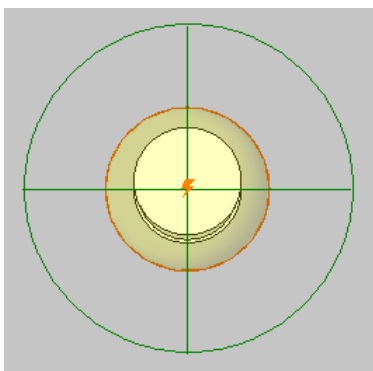
Use IES Files

When specifying photometric properties for a lighting fixture, set the [light distribution](#) to Photometric Web, and use the manufacturer's [IES file](#), if one is available. Because an IES file provides a more accurate representation of the light source, you get better results in a rendered image.

To obtain an IES file, go to the website of the lighting manufacturer, and search for **ies**. Locate the IES file for the desired lighting product, and save it to your computer. See [Specifying an IES File for a Light Source](#) on page 1178.

Leave Connectors in Place

When displayed in the Family Editor, some lighting fixtures include a connector. In the drawing area, a connector typically displays a green outline with an orange lighting bolt at the origin.



These connectors are used in Revit MEP. They allow electrical engineers to connect the lighting fixtures to circuits in an electrical plan.

If you are not working with an electrical engineer, you can delete these connectors from their lighting fixture families, or hide them in views. (See [Hiding Elements in a View](#) on page 208.) Otherwise, leave the connectors in place.

Related topic

■ [Connectors](#) on page 435

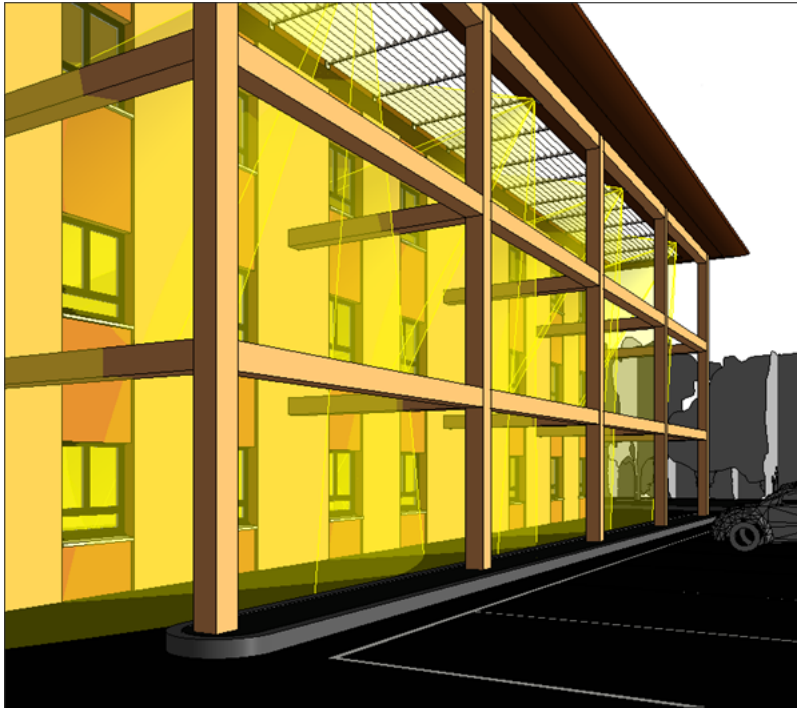
Adjust Light Sources Before Rendering

A common goal of rendering an image is to check the effect of lighting on the building model. For example, suppose you want to evenly illuminate the facade of a building. After placing lighting fixtures, you want to make sure that the lights provide the desired result.



However, the rendering process can be resource-intensive. Before rendering, therefore, do as much as possible to plan the placement of lighting fixtures for maximum effect. In Revit Architecture, you can use 2D and

3D views to plan the appropriate spacing, angle, and setback of lighting fixtures in the building model. For the view's model graphics style, use Shading or Shading with Edges to see how the light hits a wall or other surface.



Related topics

- [Displaying Light Sources in a View](#) on page 1192
- [Aiming a Spotlight](#) on page 1193
- [Controlling the Brightness of a Light Source](#) on page 1196

Creating and Modifying Lighting Fixtures

In Revit Architecture, lighting fixtures are model elements that are defined by Revit families. Revit Architecture provides several lighting fixture families, which you can use in projects or as the basis for custom lighting fixtures. To create or modify a lighting fixture family, use the Family Editor.

Related topics

- [Lighting Fixtures](#) on page 1165
- [Using Lighting Fixtures in a Building Model](#) on page 1190
- [Revit Families](#) on page 415

Creating a Lighting Fixture with One Light Source



1 Click  ► New ► Family.

2 In the New Family - Select Template File dialog, select a light fixture template.

The names of all lighting fixture templates include the words Lighting Fixture. Be sure to select the appropriate template for the type of lighting fixture that you want to create. For example, to create a ceiling-based fixture for metric projects, use Metric Lighting Fixture ceiling based.rft.

Revit Architecture opens the Family Editor. The template defines reference planes and a light source. For ceiling-based and wall-based fixtures, the template includes a ceiling or wall to host the fixture. See [Family Editor](#) on page 416.

3 Define the geometry of the light source for the lighting fixture.

See [Defining the Geometry of a Light Source](#) on page 1180.

4 Sketch solid geometry for the lighting fixture.

See [Creating Solid and Void Geometry](#) on page 320.

TIP If you want the surface of the light bulb to display in a rendered image, create geometry for it. Then apply a material to it, and, for its render appearance, select Glass Light Bulb On from the Render Appearance Library. This render appearance models the surface of a light bulb that is turned on. It is white, shiny, and emits the appropriate amount of light.

5 Click Family Properties panel ► Types.

6 In the Family Types dialog, specify values for the parameters.

See [Parameters for Lighting Fixtures and Light Sources](#) on page 1182.

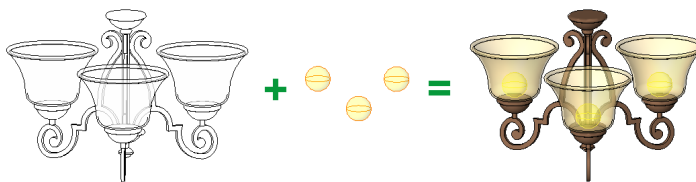
7 Click OK.

8 Click Load into Project to load the light fixture into the current project, or save the fixture and exit the Family Editor.

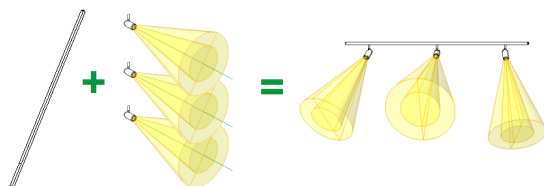
Creating Lighting Fixtures with Multiple Light Sources

To create a lighting fixture that uses multiple light sources (such as a chandelier or a set of track lights), create a nested family. The host family represents the hardware that supports the light sources (for example, the hardware for a chandelier, or the track for a set of track lights). Then you create another lighting fixture family that defines the light source (for example, the candles in a chandelier, or the can lights for a set of track lights). This family is nested into the host family. For more information about nested families, see [The Families Guide](#) on page 418

A nested chandelier family



A nested track light family



The nested family (that defines the light sources) can be shared or not shared, depending on whether you want to be able to schedule the light sources and control their photometric parameters individually. See [Sharing a Lighting Fixture Family](#) on page 1171.

Sharing a Lighting Fixture Family

The nested family that defines the light sources in a chandelier or set of track lights can be shared or not shared. Sharing the nested family affects how the lighting fixture is scheduled, and how parameters for the family can be changed, as follows. (For information about creating a nested family of shared components, see [The Families Guide](#) on page 418.)

Nested family is...	Impact on scheduling	Impact on changing family parameters
Shared	Individual light sources can be listed separately in a lighting fixture schedule. For example, for a set of track lights, can lights can be listed individually, grouped, or totalled.	If needed, each light source in the fixture can have different settings. For example, you can change the initial intensity of each can light in a set of track lights.
Not shared	In a lighting fixture schedule, the entire fixture (and its light sources) are listed as one item. For example, for a chandelier, the individual candles cannot be listed individually, grouped, or totalled.	You can change settings for the entire lighting fixture as a whole, but you cannot change settings for individual light sources. For example, you can change the initial intensity for the entire chandelier, but not for its individual candles.

To share a lighting fixture family

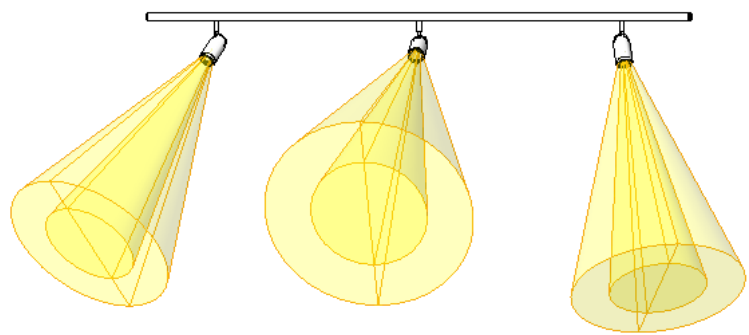
- 1 Open the lighting fixture family in the Family Editor.
- 2 Click Family Properties panel ► Category and Parameters.
- 3 Under Family Parameters, select Shared.
- 4 Click OK.

To make a lighting fixture family not shared

- 1 Open the lighting fixture family in the Family Editor.
- 2 Click Family Properties panel ► Category and Parameters.
- 3 Under Family Parameters, clear Shared.
- 4 Click OK.

Creating Track Lights

The following procedure describes a general method for creating a set of track lights. You can also use this procedure to create a lighting fixture family that has multiple light sources that you want to schedule individually or to control lighting parameters individually. The specific steps required will vary, depending on your needs and design intent.



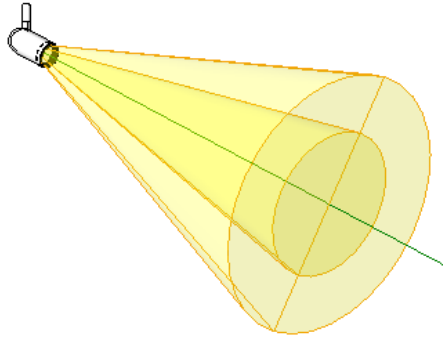
To create a set of track lights

1 Create a lighting fixture family to represent the light source.

For example, create a family that describes a can light in a set of track lights. Create the geometry for the can fixture, and define its light source.

See [Creating a Lighting Fixture with One Light Source](#) on page 1169.

In the following steps, this family is referred to as the light source family.

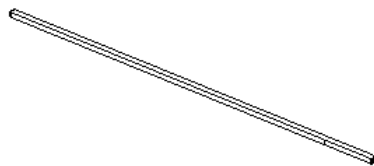


2 For the light source family, turn on the Light Source and Shared parameters, as follows:

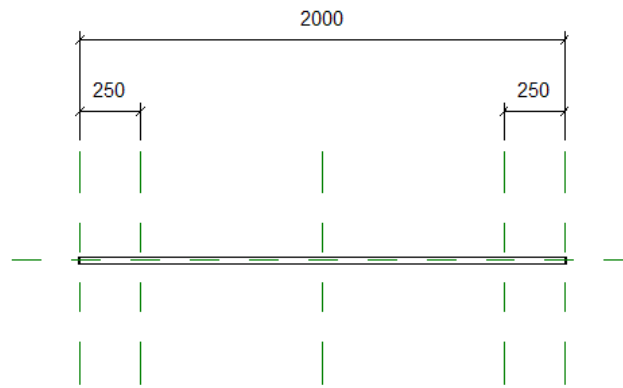
- a Click Family Properties panel ► Category and Parameters.
- b In the Family Category and Parameters dialog, under Family Parameters, select Light Source. Turning on the light source allows you to specify photometric parameters for it.
- c Select Shared.
Sharing the light source family ensures that a lighting fixture schedule can display information for individual lights, and that you can adjust lighting parameters for individual lights. (See [Sharing a Lighting Fixture Family](#) on page 1171.)
- d Click OK.
- e Save the light source family.

3 Create the host lighting fixture family, as follows:

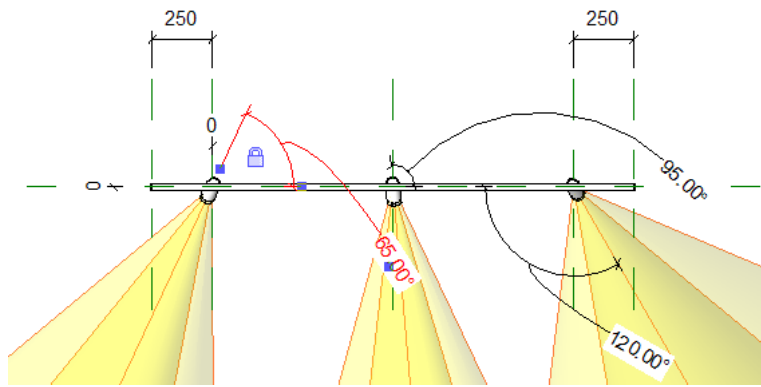
- a Create the geometry for the lighting fixture.
For example, for a set of track lights, create the track on which the can lights will be mounted. See [Creating a Lighting Fixture with One Light Source](#) on page 1169.



- b Create reference planes that can be used to position the light sources and lock them to the lighting fixture (the track).
See [Reference Planes](#) on page 1106.



- 4 For the host lighting fixture family, turn off the Light Source and Shared parameters, as follows:
 - a Click Family Properties panel ► Category and Parameters.
 - b In the Family Category and Parameters dialog, under Family Parameters, clear Light Source. When you turn off the light source for the host lighting fixture family, photometric parameters are not available for it. Instead, you define the photometric parameters in the light source family (for example, for the can lights).
 - c Clear Shared.
 - d Click OK.
 - e Save the lighting fixture family.
- 5 Load the light source family (the can lights) into the host lighting fixture family (the track). See [Modifying Families in a Project \(or Nested Family\)](#) on page 430.
- 6 Place one or more instances of the light source family into the host lighting fixture family, as follows:
 - a If needed, open the host lighting fixture family in the Family Editor.
 - b Click Home tab ► Build panel ► Component drop-down ► Place a Component.
 - c Click Place Component tab ► Element panel, and select the light source family from the Type Selector drop-down.
 - d Click in the drawing area to place instances of the light source (the can light) in the lighting fixture (the track).
Use the reference planes to position the light sources correctly.
 - e Lock the light sources to the reference planes.
See [Using Pins to Lock Elements in Place](#) on page 382.



7 Save changes to the host lighting fixture family.

Now you can place instances of the lighting fixture (the track light set containing multiple can lights) in the building model. See [Using Lighting Fixtures in a Building Model](#) on page 1190.

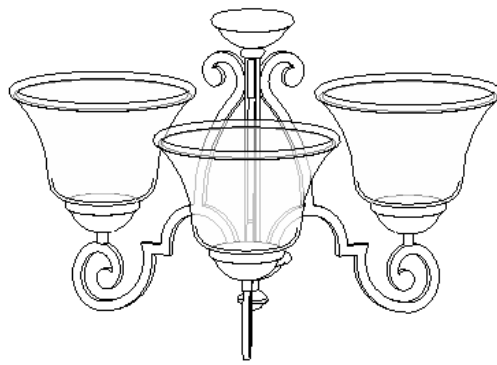
Creating a Chandelier

The following procedure describes a general method for creating a chandelier. You can also use this procedure to create a lighting fixture family that has multiple light sources, and for which you do not want to schedule the light sources or control their lighting parameters individually. The specific steps required will vary, depending on your needs and design intent.



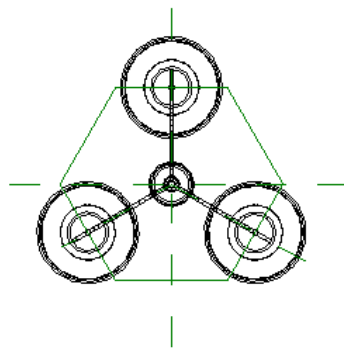
To create a chandelier

- 1** Create the host chandelier family, as follows:
 - a** Create the geometry (hardware) for the chandelier.
See [Creating a Lighting Fixture with One Light Source](#) on page 1169.



- b** Create reference planes that can be used to position the candles in place and lock them to the chandelier.

See [Reference Planes](#) on page 1106.



- 2** For the host chandelier family, define parameters as follows:

- a** Click Family Properties panel ► Category and Parameters.
- b** In the Family Category and Parameters dialog, under Family Parameters, select Light Source.
- c** Clear Shared.
- d** Click OK.

- 3** In the host chandelier family, create one candle (light source) as follows:

- a** Create geometry for the candle.
- b** Put the candle in the desired position on the chandelier, and lock it in place.
- c** Define the geometry of the light source.
See [Defining the Geometry of a Light Source](#) on page 1180.
- d** Define its parameters.
See [Defining Parameters for Lighting Fixtures and Light Sources](#) on page 1182.
- e** In the drawing area, move the light source symbol to align it with the candle as appropriate, and lock it in place.

- 4** Create a lighting fixture family to represent a candle of the chandelier, as follows:

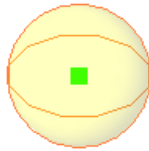
NOTE You will nest this family into the host chandelier family, and place multiple instances of this family (that is, multiple candles) in the chandelier. So this family should represent a single light source or candle.

- a In this family, create the geometry of the candle. If desired, you can copy and paste the candle geometry that you created in the host chandelier family.

NOTE In the sample chandelier shown previously, the candle does not have any geometry. Instead, it defines the light source only.

- b Define family parameters: Click Family Properties panel ► Category and Parameters. Under Family Parameters, select Light Source, clear Shared, and click OK.
- c Define the geometry of the light source.
See [Defining the Geometry of a Light Source](#) on page 1180.

**Geometry of the
light source for the
chandelier candle**



- d Define parameters for the light source.
See [Defining Parameters for Lighting Fixtures and Light Sources](#) on page 1182.
- e Save the light source family.

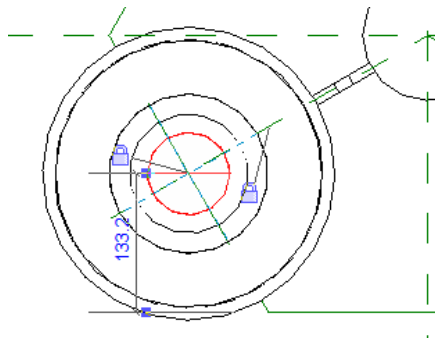
In the following steps, this family is referred to as the candle family.

5 Load the candle family into the host chandelier family.

See [Modifying Families in a Project \(or Nested Family\)](#) on page 430.

6 Place one or more instances of the candle family into the host chandelier family, as follows:


- a Open the host chandelier family in the Family Editor.
- b Click Home tab ► Build panel ► Component drop-down ► Place a Component.
- c Click Place Component tab ► Element panel, and select the candle family from the Type Selector drop-down.
- d Click in the drawing area to place instances of the light source (candles) in the chandelier. Use the reference planes to position the candles correctly.
- e Lock the candles to the reference planes.
See [Using Pins to Lock Elements in Place](#) on page 382.




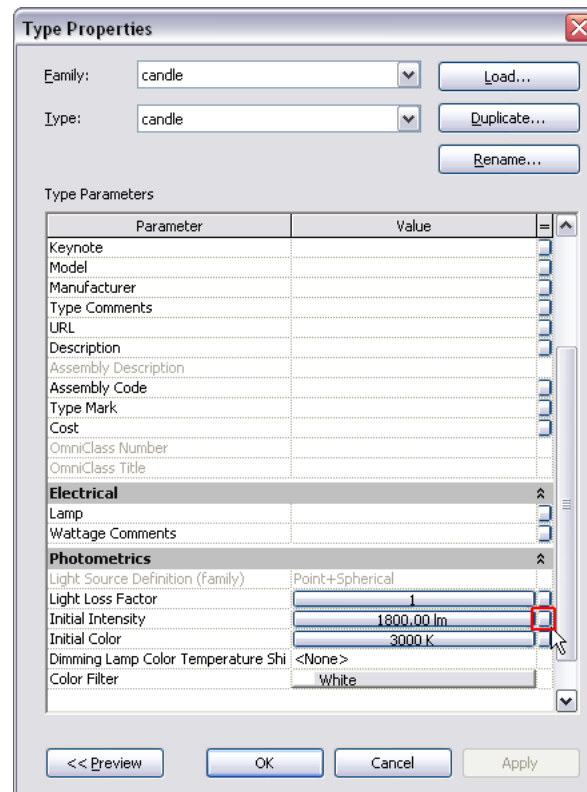
7 Link the Initial Intensity parameter of the candle family to the Initial Intensity parameter of the host chandelier family.

When you link these parameters and add a chandelier to a building model, in the project you can adjust the Initial Intensity parameter (or other linked parameters) for the chandelier as a whole. You cannot change the Initial Intensity of individual candles in a chandelier.

- a In the host chandelier family, select one of the candles from the candle family.
- b Click Modify <Element> tab ► Element panel ► Element Properties drop-down ► Type Properties.

The Type Properties dialog displays a column with an equal sign in the column heading . A gray button displays in this column for each type parameter that you can link to other parameters.

- c Click the gray button in the  column for the Initial Intensity parameter (or any other parameter that you want to be able to change for the chandelier in a project).



- d In the Associate Family Parameter dialog, select Initial Intensity (or the parameter that corresponds to the type parameter that you selected), and click OK.

8 Save changes to the host chandelier family.

Now you can place instances of the chandelier family in the building model. See [Using Lighting Fixtures in a Building Model](#) on page 1190.

Specifying an IES File for a Light Source

An IES file is a text file that describes the intensity of a light source at points on a spherical grid. It provides more photorealistic lighting effects in rendered images than other types of light distribution. See [Photometrics and IES Files](#) on page 1166.

Specifying an IES file for a light source is a 2-step process. First, in the light source definition, you must specify Photometric Web for its light distribution. (To perform this step, you edit the lighting fixture family.) Second, you must specify the particular IES file to use. (You can perform this step when editing the lighting fixture family, or when modifying type parameters for particular lighting fixture in a project.)

To specify an IES file for a light source

1 Obtain the desired IES file.


You can obtain an IES file directly from the manufacturer, or use an IES file provided by Revit Architecture. The Revit IES files reside in the following location, by default:

C:\Program Files\<product name and version>\Data\Electrical Components\IES

2 Specify Photometric Web light distribution, as follows:

- a Open the lighting fixture family in the Family Editor.
See [Modifying a Lighting Fixture Family](#) on page 1179.
- b In the drawing area, select the light source.
- c Click Modify Light Source tab ► Lighting panel ► Light Source Definition.
- d In the Light Source Definition dialog, for Emit from Shape, select the desired shape.

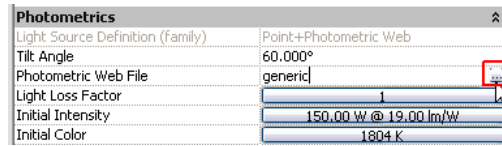


- e For Light distribution, select  (Photometric Web).
- f Click OK.
- g Save changes to the lighting fixture family.

3 Specify the IES file to use, as follows:

- a If you want the IES file to define light distribution for the entire lighting fixture family, keep the lighting fixture family open in the Family Editor. Click Family Properties panel ► Types. For Name, select the family type to modify.
- b If you want the IES file to define light distribution for selected instances of the lighting fixture family, open a project that uses it, and select a lighting fixture in the project. Click Modify Lighting Fixtures tab ► Element panel ► Element Properties drop-down ► Type Properties. Click Duplicate, specify a name for the new family type, and click OK.
- c In the list of parameters, scroll down to Photometrics.
- d For Photometric Web File, click in the Value column.

- e Click  (Browse).



NOTE The Browse button displays after you click in the field.

- f Navigate to the desired IES file, select it, and click Open.
- g Click OK.
- h Save changes to the project or the lighting fixture family.


In the drawing area, the shape of the light source reflects the specified IES file. (To see the light source in a project view, you must make light sources visible. See [Displaying Light Sources in a View](#) on page 1192.)

Modifying a Lighting Fixture Family

Use the Family Editor to modify a lighting fixture family to change the design of the fixture or to define its light source.

To modify a lighting fixture family


- 1 Open a lighting fixture family for editing, using one of the following methods:

- Open a project that contains instances of the lighting fixture. In the Project Browser, expand Families ► Lighting Fixtures. Right-click the name of the lighting fixture family to modify, and click Edit.
- In the Revit window, click  ► Open ► Family. Navigate to the location of the lighting fixture family (RFA) file. Select the file, and click Open.

The Family Editor opens, displaying the lighting fixture family in the drawing area.

- 2 Modify the lighting fixture family as desired.

- To change the hardware of the lighting fixture, edit its geometry.
See [Family Editor](#) on page 416.
- To change the light source definition, select the light source in the drawing area. Click Modify Light Source tab ► Lighting panel ► Light Source Definition. Select the desired Emit from Shape and Light distribution values, and click OK.
See [Defining the Geometry of a Light Source](#) on page 1180.
- To change parameters for the lighting fixture (including photometrics), click Family Properties panel ► Types. For Name, select the family type to modify. Change the parameters, and click OK.
See [Parameters for Lighting Fixtures and Light Sources](#) on page 1182.

- 3 To save changes to the lighting fixture, click  ► Save.

- 4 Load the lighting fixture into a project.

See [Loading Families](#) on page 427.

Defining a Light Source

The light source is the part of a lighting fixture that emits light. (See [Light Sources](#) on page 1166.) To ensure that a lighting fixture emits light and to define the type of light, use the following procedure.

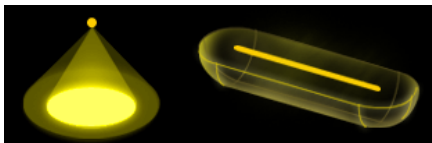
The following procedure assumes that the lighting fixture family is [open for editing](#) in the Family Editor.

To define a light source

- 1 For the lighting fixture family, turn on the Light Source parameter, as follows. (This parameter is usually turned on by default.)
 - a Click Family Properties panel ► Category and Parameters.
 - b In the Family Category and Parameters dialog, under Family Parameters, select Light Source.
 - c Click OK.
- 2 Define the geometry of the light source (that is, the shape of the light that emits from the fixture).
See [Defining the Geometry of a Light Source](#) on page 1180.
- 3 Define parameters for the light source.
See [Parameters for Lighting Fixtures and Light Sources](#) on page 1182.

Defining the Geometry of a Light Source

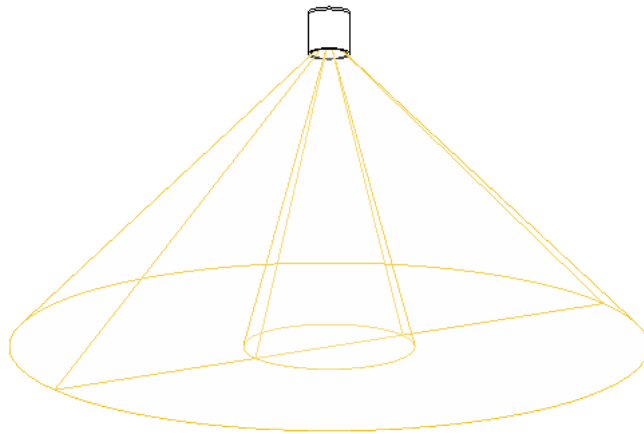
The geometry of a light source determines the shape of the light that emits from the lighting fixture. For example, the following image shows 2 different geometries for light sources.



NOTE The Family Editor is the only place where you can define the geometry of a light source in a lighting fixture family. You cannot change the geometry of a light source for a lighting fixture in the context of a project.

To define the geometry of a light source

- 1 Create a lighting fixture family, or open a lighting fixture family for editing.
See [Creating a Lighting Fixture with One Light Source](#) on page 1169 or [Modifying a Lighting Fixture Family](#) on page 1179.
- 2 In the drawing area, select the light source.
In the Family Editor, the light source is generally represented by a yellow outline or shape.

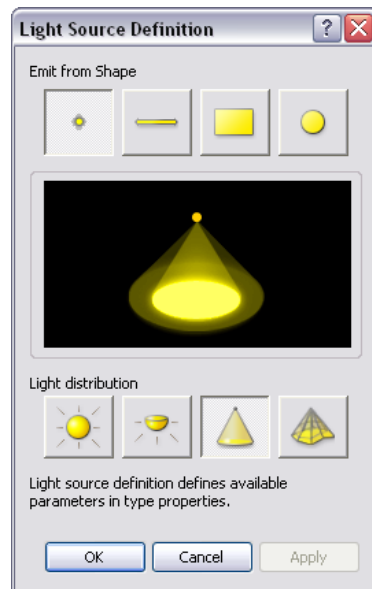


NOTE If the light source does not display in the Family Editor, the light source is not turned on. To turn it on, click Family Properties panel ► Category and Parameters, select Light Source, and click OK.

3 Click Modify Light Source tab ► Lighting panel ► Light Source Definition.

As an alternative, you can right-click the light source, and click Element Properties. In the Instance Properties dialog, for Light Source Definition, click Edit.

The Light Source Definition dialog displays.



4 For Emit from Shape, select the shape of the light to emit from the light source: Point, Line, Rectangle, or Circle.

5 For Light distribution, select the pattern of light distribution for the light source: Spherical, HemiSpherical, Spot, or Photometric Web.

TIP If you plan to specify an IES file to define the photometric shape of the light source, select Photometric Web. See [Specifying an IES File for a Light Source](#) on page 1178.

The middle image changes to illustrate the combined settings. These settings determine the parameters that are available for the light source. See [Defining Parameters for Lighting Fixtures and Light Sources](#) on page 1182.

6 Click OK.

The outline shape for the light source may change in the drawing area, depending on the selected light source definition settings.

7 Save changes to the lighting fixture family.

Defining Parameters for Lighting Fixtures and Light Sources

The parameters that you can define for a lighting fixture and its light source vary, depending on the light source definition settings that you specify. (See [Defining the Geometry of a Light Source](#) on page 1180.)

NOTE In addition to defining these parameters for a lighting fixture family in the Family Editor, you can also change many of them for an instance or type of lighting fixture in a project. See [Changing a Lighting Fixture in a Building Model](#) on page 1192.

To define parameters for a lighting fixture and its light source

1 Create a lighting fixture family, or open a lighting fixture family for editing.

See [Creating a Lighting Fixture with One Light Source](#) on page 1169 or [Modifying a Lighting Fixture Family](#) on page 1179.

2 Click Family Properties panel ► Types.

3 In the Family Types dialog, for Name, select the family type to modify.

You can define different parameter values for different family types. For more information, see [The Families Guide](#) on page 418.

4 Define parameters as desired.

See [Parameters for Lighting Fixtures and Light Sources](#) on page 1182.

5 Click Apply.

6 (Optional) Repeat this process for other family types defined for the lighting fixture family: For Name, select another family type. Define its parameters. Click Apply.

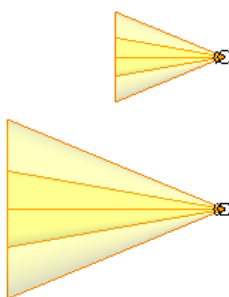

7 Click OK.


8 Save changes to the lighting fixture family.

Parameters for Lighting Fixtures and Light Sources

You can change parameters for lighting fixtures and their light sources when defining a lighting fixture in the Family Editor, or when modifying a lighting fixture in a building model. (See [Modifying a Lighting Fixture Family](#) on page 1179 or [Changing a Lighting Fixture in a Building Model](#) on page 1192.)

Parameter	Description
Electrical - Lighting	
Calculate Coefficient of Utilization (default)	A value used by Revit MEP to indicate that the Coefficient of Utilization will be calculated for the lighting fixture by default. In a project, you can change this default behavior by changing instance properties.
Coefficient of Utilization (default)	A value used by Revit MEP to define the efficiency of a lighting fixture in transferring luminous energy to the work plane in a particular area.

Parameter	Description
	<p>This value shows the percentage of lumens that reach the work plane after light is lost due to the fixture's efficiency at transmitting light, the room proportions, and the ability of room surfaces to reflect light. If you select Calculate Coefficient of Utilization (default), this parameter is read-only. If you clear Calculate Coefficient of Utilization (default), you can enter a value between 0 and 1, or enter a formula.</p> <p>In a family, this parameter defines the default value for the lighting fixture. In a project, you can change the default in instance properties.</p>
Electrical - Loads	
Apparent Load	A value used by Revit MEP to define the real and reactive power used by a fixture. To determine Apparent Load, multiply the apparent current by the voltage. This parameter is measured in volt amps (VA).
Dimensions: These parameters do not affect rendered images.	
Light Source Symbol Size	<p>The size of the symbol that represents the light source in 2D and 3D views, extending from the boundary of the Emit from Shape outwards. For example, suppose you define a light source with an Emit from Shape of circle and an Emit from Circle Diameter of 500 mm. If you specify a Light Source Symbol Size of 200 mm, in a 2D view, Revit Architecture shows a light source symbol that is 900 mm in diameter (200+500+200). This parameter is available when the Emit from Shape setting is Circle or Rectangle. (See Defining the Geometry of a Light Source on page 1180.) This parameter does not affect the light in a rendered image.</p>
Light Source Symbol Length	<p>The length of the symbol that represents a spotlight in 2D and 3D views, extending from the spotlight outwards. This parameter is available when the light distribution setting is Spot. (See Defining the Geometry of a Light Source on page 1180.) This parameter does not affect the light in a rendered image.</p> <p>Spotlights with different light source symbol lengths (plan view)</p> 
Identity Data	
Keynote	Keynote for the lighting fixture. Enter text or click  to select a standard keynote. See Keynotes on page 1117.

Parameter	Description
Model	Model number or code assigned to the lighting fixture by the manufacturer or vendor.
Manufacturer	Name of the manufacturer of the lighting fixture.
Type Comments	User-defined comments or other information about this family type for the lighting fixture family.
URL	URL of the Web site for the manufacturer or vendor.
Description	Description of the lighting fixture.
Assembly Code	Unifomat assembly code for the lighting fixture. See Unifomat Assembly Codes on page 818.
Cost	Cost of the lighting fixture.
Electrical: These parameters do not affect rendered images.	
Ballast Voltage	Voltage required to operate the ballast. A ballast is an electrical device that provides the starting voltage and limits the current to sustain lamp operation. (This information is used by Revit MEP.)
Ballast Number of Poles	The number of leads in the circuit. Enter 1, 2, or 3. (This information is used by Revit MEP.)
Lamp	Number and type of light bulbs used in the lighting fixture. (This information can be useful in schedules.)
Wattage Comments	User-defined information about wattage requirements for the lighting fixture.
Photometrics: The following parameters affect rendered images. You may be able to obtain parameter values from the manufacturer of the light source. Check the manufacturer's website.	
Photometric Web File	<p>The IES file that defines the light emitted from the light source. This parameter is available when the Light distribution setting is Photometric Web. (See Specifying an IES File for a Light Source on page 1178.)</p> <p>To specify a file, click in the Value column, and click . Navigate to the IES file, and click Open.</p> <p>NOTE Revit Architecture does not maintain a link to the IES file. If you change or update the IES file on disk, you must also update this parameter by navigating to the new version of the file.</p>
Spot Tilt Angle	The angle to tilt the light source to direct its light. (See Angles for Spotlights on page 1195.) Enter a value between 0 and 160. This parameter is available when the Light distribution setting is Spot or Photometric Web. (See Defining the Geometry of a Light Source on page 1180.)
Spot Field Angle	The angle at which the light intensity reaches 10% of the peak intensity. Enter a value between 0 and 160. This parameter is available when

Parameter	Description
	the Light distribution setting is Spot. (See Angles for Spotlights on page 1195.)
Spot Beam Angle	The angle at which the light intensity reaches 50% of the peak intensity. This parameter is available when the Light distribution setting is Spot. (See Angles for Spotlights on page 1195.)
Light Loss Factor	A value used to calculate the amount of light lost (or gained) due to environmental factors, such as dust and ambient temperature. Click in the Value field to display the Light Loss Factor dialog. See Light Loss Factor Parameters on page 1187.
Initial Intensity	Brightness of the light before environmental factors reduce or change the quality of the light. Click in the Value field to display the Initial Intensity dialog. See Initial Intensity Parameters on page 1188.
Initial Color	The color of the light source before it is affected by color filters and environmental factors. Click in the Value field to display the Initial Color dialog. See Initial Color Parameters on page 1189.
Emit from Circle Diameter	The diameter of the light source that emits light in a rendered image. This parameter is available when the Emit from Shape setting is Circle. (See Defining the Geometry of a Light Source on page 1180.)
Emit from Rectangle Width	The width of the rectangle that represents the light source in a rendered image. This parameter is available when the Emit from Shape setting is Rectangle. (See Defining the Geometry of a Light Source on page 1180.)
Emit from Rectangle Length	The length of the rectangle that represents the light source in a rendered image. This parameter is available when the Emit from Shape setting is Rectangle.
Emit from Line Length	The length of the line that represents the light source in a rendered image. This parameter is available when the Emit from Shape setting is Line. (See Defining the Geometry of a Light Source on page 1180.)
Emit Shape Visible in Rendering	<p>Select this option to make the shape of the light visible as a self-luminous surface (glow) when the camera (of the 3D view) is aimed directly at the light source. This parameter is available when the Emit from Shape setting is Rectangle or Circle. (See Defining the Geometry of a Light Source on page 1180.)</p> <p>In addition to setting this parameter, when defining render settings, you must select the Soft Shadows option on the Render Quality Settings dialog. See Defining a Custom Render Quality on page 1225 and Render Quality Settings on page 1225.</p> <p>TIP If the Emit from Shape setting is Point or Line, the light source does not display a self-luminous surface in rendered images. To see the light source in rendered images, use a thin rectangle shape or a small circle shape instead.</p>
Dimming Lamp Color Temperature Shift	Specify whether the color and intensity of a dimmed light source change based on predefined curves. For example, incandescent lights

Parameter	Description
	typically become more yellow when dimmed. Select Incandescent Lamp Curve or none. To see the effect of this parameter, you must dim lights in the building model. See Dimming Lights on page 1197.
Color Filter	Color used to change the light emitted from the light source. Click in the Value column. In the Color dialog, select the desired color, and click OK. See Colors on page 525.

Defining the Light Loss Factor

The light loss factor is a value used to calculate the amount of light lost due to environmental factors, such as dust and ambient temperature.

You can define the light loss factor for a lighting fixture family file (as follows). In a project, you can change the light loss factor of an individual lighting fixture. (See [Changing the Light Loss Factor for a Light Source](#) on page 1196.)

To define the light loss factor

- 1 Open the lighting fixture family.
- 2 Click Family Properties panel ► Types.
- 3 For Name, select the family type to modify.
- 4 Scroll down the list to locate the Light Loss Factor parameter, and click in its Value column.
The Light Loss Factor dialog displays.
- 5 Specify the calculation method for Light Loss Factor:

Simple calculation

- Specify as follows:
 - a For Method, select Simple.
 - b For Total Light Loss Factor, move the slider to adjust the value between Dimmer and Brighter.
 - c Click OK.

Advanced calculation

- Specify as follows:
 - a For Method, select Advanced.
 - b Under Value, adjust the sliders for each parameter, or enter a value in the text box.
See [Light Loss Factor Parameters](#) on page 1187.
 - c Click OK.

The Family Types dialog displays the new Light Loss Factor value.

- 6 Click OK.
- 7 Save changes to the lighting fixture family.

Light Loss Factor Parameters

When you turn on a lighting fixture, light travels through the light source (lamp or ballast) and the lighting fixture (such as a lamp shade or lensed troffer), until it reaches the work plane where it is needed. Along the way, the amount of transmitted light is reduced, obscured by the light source, the lighting fixture, and other environmental factors. The Light Loss Factor measures the reduction of light as it travels from the light source.

When [defining the Light Loss Factor](#) for a light, define the parameters as follows. Check with the lamp manufacturer for the appropriate Light Loss Factor values for a particular type of lamp.

Parameter	Description
Temperature Loss/Gain Factor	For fluorescent light sources, a measure of the amount of light lost or gained due to deviations above or below the ideal operating temperature. Valid values are between 0 and 2. A value of 1.0 indicates that no light is lost or gained due to temperature changes. Values greater than 1.0 indicate an increase in light. Values less than 1.0 indicate a loss of light.
Voltage Loss/Gain Factor	A measure of the amount of light lost or gained due to fluctuations in voltage delivered to the light source. Valid values are between 0 and 2. A value of 1.0 indicates that no light is lost or gained due to voltage changes. Values greater than 1.0 indicate an increase in light. Values less than 1.0 indicate a loss of light.
Ballast Loss Factor	Lamps and ballasts experience losses when operating together as a system. The Ballast Loss Factor is the percentage of a lamp's initial rated lumens that is produced by a given ballast. Valid values are between 0 and 1. For example, a value of 0.95 indicates that the ballast produces 95% of its initial lumens and loses 5%.
Lamp Tilt Loss Factor	For metal halide lamps, a measure of the amount of light lost due to the position of the lamp. A decrease in light occurs when the angle of the lamp shifts the cold spot of the bulb. Values less than 1.0 indicate a loss of light.
Surface Depreciation Factor	A measure of the amount of light lost due to deterioration of the surfaces of the lighting fixture as it ages. For example, blemishes and discolored shielding materials change the amount of light emitted. Values less than 1.0 indicate a loss of light.
Lamp Lumen Depreciation	As a lamp ages, it produces decreasing amounts of light on a predictable curve. A typical strategy is to use an average Lamp Lumen Depreciation (LLD) value at 40% of its life. Valid values are between 0 and 1. For example, a compact fluorescent has an LLD factor of 0.85, indicating an average output at 85% of its initial lumens, losing an average of 15% over its life as the lamp ages.
Luminaire Dirt Depreciation	A measure of the amount of light lost due to environmental dirt and dust that is trapped by the lighting fixture. Valid values are between 0 and 1. For example, a value of 0.9 indicates that the fixture produces 90% of its initial lumens and loses 10% due to trapped dust and dirt.
Total Light Loss Factor	A measure of the amount of light produced by a lamp, taking into account various environmental factors that obscure or reduce the emitted light. When the Method is Simple, use the slider or text box to specify a value. When the Method is Advanced, this parameter displays a read-only value,

Parameter	Description
	which is calculated by multiplying the values of the other parameters. Valid values are between 0 (total light loss) and 4 (light gain up to 400%). A value of 1 indicates no light loss (100% of initial light intensity).

Defining the Initial Intensity

When defining a lighting fixture, you can specify the initial intensity of its light source. The initial intensity is a measure of how much light is produced by the light source in ideal conditions. (The actual light emitted by a light source may be reduced by light loss factors. See [Light Loss Factor Parameters](#) on page 1187.)

You can define the initial intensity of a light source in a lighting fixture family file (as follows). In a project, you can change the initial intensity of an individual lighting fixture. (See [Changing the Initial Intensity of a Light Source](#) on page 1196.)

To define the initial intensity of a lighting fixture family

- 1 Open the lighting fixture family.
- 2 Click Family Properties panel ► Types.
- 3 For Name, select the family type to modify.
- 4 Scroll down the list to locate the Initial Intensity parameter, and click in its Value column.
- 5 In the Initial Intensity dialog, specify values for the parameters.
See [Initial Intensity Parameters](#) on page 1188.
- 6 Click OK.
The Family Types dialog displays the new Initial Intensity value.
- 7 Click OK.
- 8 Save changes to the lighting fixture family.

Initial Intensity Parameters

When [defining the Initial Intensity](#) of a light source, define the parameters as follows.

Parameter	Description
Wattage	<p>A measurement of the electrical power consumed by a light source.</p> <hr/> <p>TIP When adjusting Wattage, it is also important to consider Efficacy. If you change Wattage alone, you may make the light source unintentionally bright. Luminosity is defined as Wattage (W) times Efficacy (W/lm). Luminous Efficacy for a 100 W tungsten incandescent (110 V) is 175, while a 32 W fluorescent tube (T8) is 60.</p> <hr/>
Efficacy	The amount of light (luminous flux, measured in lumens) produced by a light source as a ratio of the amount of energy consumed to produce it (measured in watts).
Luminous Flux	The quantity of light energy per unit of time arriving, leaving, or going through a surface. The lumen (lm) is the unit of luminous flux in both the International System (SI) of units and in the American System (AS) of units. If you think of light as particles (photons) moving through space, then the luminous flux of a light beam arriving at a surface is proportional to the number of particles hitting the surface during a time interval of 1 second.

Parameter	Description
	TIP In general, Luminous Flux provides more accurate lighting in rendered images than Wattage and Efficacy.
Luminous Intensity	The light energy per unit of time emitted by a point source in a particular direction. Luminous intensity is used to describe the directional distribution of a light source, that is, to specify how the luminous intensity of a light source varies as a function of the outgoing direction. The Candela (cd) is the unit of luminous intensity.
Illuminance	The luminous flux incident on a surface of unit area. Illuminance measures how much energy has fallen on a surface. This quantity is useful for describing the level of illumination incident on a surface without making the measurement dependent on the size of the surface itself. The lux (lx) is the International System (SI) unit of illuminance. The American System (AS) unit for illuminance is the footcandle (fc), equivalent to 1 lumen per square foot.
At a distance of	Illuminance is a function of the distance from the light source. Specify the distance at which the illuminance is measured.

Defining the Initial Color

When defining a lighting fixture, you can specify the initial color of its light source. The initial color is the color appearance of the emitted light, before it is affected by color filters or environmental factors.

To define the initial color of a light source

- 1 Open the lighting fixture family.
- 2 Click Family Properties panel ► Types.
- 3 For Name, select the family type to modify.
- 4 Scroll down the list to locate the Initial Color parameter, and click in its Value column.
- 5 In the Initial Color dialog, specify values for the parameters.
See [Initial Color Parameters](#) on page 1189.
- 6 Click OK.
The Family Types dialog displays the new Initial Color value.
- 7 Click OK.
- 8 Save changes to the lighting fixture family.

Initial Color Parameters

When [defining the Initial Color](#) for the light source of a lighting fixture, define the parameters as follows.

Parameter	Description
Color Preset	Select a value from the list, or select Custom to specify a Color Temperature.
Color Temperature	The color appearance of the light produced by the light source, expressed on the Kelvin scale (K).

Using Lighting Fixtures in a Building Model

After using the Family Editor to define lighting fixtures, you can add lighting fixtures to the building model. When you render an image, you can specify whether Revit Architecture is to include artificial lights in the image, and which lights are turned on and off or dimmed.



Related topics

- [Turning Lights On and Off](#) on page 1202

Adding a Lighting Fixture to a Building Model

- 1 Load into the project the lighting fixture families that you want to use in the building model. See [Loading Families](#) on page 427.
- 2 In the project, open a view that displays the surface on which you can place the lighting fixture. For example, to place a ceiling-based lighting fixture, open a reflected ceiling plan. To place a wall-based lighting fixture, open a section or an elevation. To place a table lamp or a floor lamp, open a floor plan or a section.
- 3 Click Home tab ► Build panel ► Component drop-down ► Place a Component.
- 4 Click Place Component tab ► Element panel, and select the lighting fixture from the Type Selector drop-down.
- 5 In the drawing area, click to place instances of the lighting fixture in the desired locations.
- 6 To exit the Component tool, press *ESC* twice.

When placing the lighting fixture, consider the following:

- To see the light source symbol in a view, in addition to the lighting fixture geometry, make the light source visible. See [Displaying Light Sources in a View](#) on page 1192.
- If you want to place a table lamp on an elevated surface such as a desk or table, do so in a section view (or use the Offset parameter in the Instance Properties dialog to specify its height above the floor). If you place the lamp on a desk in a floor plan view, the lamp may be placed under the desk.

- In a floor plan view, wall-based lighting fixtures (such as sconces) may not display if the cut plane of the floor plan view occurs below the height at which the fixture is mounted to the wall. To correct this issue, see [Displaying a Wall-Based Lighting Fixture in a Floor Plan](#) on page 1191.

Displaying a Wall-Based Lighting Fixture in a Floor Plan

In a floor plan view, wall-based lighting fixtures (such as sconces) may not display if the cut plane of the floor plan view occurs below the height at which the fixture is mounted to the wall. For example, if the cut plane for a floor plan view is 1200 mm and the lighting fixture is mounted to the wall at 2000 mm, the floor plan view does not display the fixture.

To force Revit Architecture to display these lighting fixtures in floor plans, add an invisible model line to the lighting fixture family.

To display a wall-based lighting fixture in a floor plan

- 1 In the project, open the section view or elevation view in which the wall-based lighting fixture displays.
- 2 Select the lighting fixture.
- 3 Click Modify Lighting Fixtures tab ► Family panel ► Edit Family.
- 4 At the prompt, click Yes to open the lighting fixture family for editing.
Revit Architecture opens the lighting fixture family in the Family Editor.
- 5 Name a reference plane that is parallel to the wall, as follows:
 - a In the Project Browser, under Views (all) ► Floor Plans, double-click Ref. Level (or a floor plan view that shows reference planes for the lighting fixture).
 - b In the drawing area, select a reference plane that is near the wall and parallel to it.
If the lighting fixture family does not include a reference plane that is parallel to the wall, add one. See [Adding Reference Planes](#) on page 1106.
 - c Right-click the reference plane, and click Element Properties.
 - d In the Instance Properties dialog, for Name, enter a name for the reference plane (wall plane, for example).
 - e Click OK.
- 6 Add an invisible model line to the lighting fixture, using the named reference plane, as follows:
 - a In the Project Browser, under Views (all) ► Elevations, double-click Front or Placement Side (or an elevation view that shows the front of the lighting fixture).
 - b Click Create tab ► Model panel ► Model Line.
 - c In the Work Plane dialog, for Specify a new Work Plane, select Name.
 - d In the pull-down list for Name, select the wall plane.
 - e Click OK.
 - f Click Place Model Lines tab ► Element panel, and select Invisible lines from the Type Selector drop-down.
 - g In the drawing area, sketch a vertical line that extends from the center of the lighting fixture to the floor (or reference level).
 - h Press *ESC* twice.

- 7 Save changes to the lighting fixture family.
- 8 Load the updated family into the project, replacing the existing family with the same name.
- 9 Open a floor plan view for the level on which the wall-based lighting fixture resides.

The wall-based lighting fixture now displays in the floor plan, because the cut plane intersects the invisible model line.

Changing a Lighting Fixture in a Building Model

Many parameters for lighting fixtures and their light sources are defined by the lighting fixture family. Some of these parameters can be changed for individual instances in the building model. Other parameters must be changed in the family type or family.

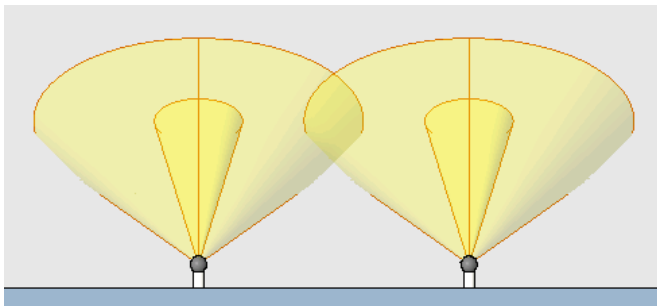
To change a lighting fixture in a building model

- 1 In a project view, select the lighting fixture.
- 2 Click Modify Lighting Fixtures tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 3 In the Instance Properties dialog, change the values of the parameters, as needed.
The instance parameters that are available vary depending on the lighting fixture family and how its family parameters are defined.
- 4 To change type parameters, do the following:
 - a In the Instance Properties dialog, click Edit Type.
 - b In the Type Properties dialog, change parameter values as desired.
The type parameters that are available vary depending on the lighting fixture family and how its family parameters are defined. See [Parameters for Lighting Fixtures and Light Sources](#) on page 1182.
To specify an IES file for the light source, see [Specifying an IES File for a Light Source](#) on page 1178.
 - c Click OK.
- 5 Click OK.

Displaying Light Sources in a View

When adding lighting fixtures to a building model, you can display the light sources. By making light sources visible, you can more easily plan their placement for maximum effect.

Spotlights in an elevation view with light sources displayed and Shading with Edges turned on



NOTE For spotlights, the length of a light source symbol in a view does not indicate the extent of the intensity of the light. However, the spot beam angle and spot field angle render as shown in views. See [Angles for Spotlights](#) on page 1195.

To display light sources in a view

- 1 Add lighting fixtures to the building model.

See [Adding a Lighting Fixture to a Building Model](#) on page 1190.

- 2 Open a view in which you can plan the placement of the lighting fixtures.

For example, to position spotlights that illuminate a wall, open a section view, elevation view, or 3D view.

- 3 Turn on the visibility of light sources, as follows:

- a Click View tab ► Graphics panel ► Visibility/Graphics.
- b On the Model Categories tab of the Visibility/Graphics dialog, expand Lighting Fixtures.
- c Select Light Source.

NOTE To hide light sources in views, clear Light Source.

- d Click OK.

- 4 (Optional) On the View Control Bar, for Model Graphics Style, click Shading or Shading with Edges.

Shading allows you to see the difference between the beam angle and the field angle for spotlights. (See [Angles for Spotlights](#) on page 1195.)

Aiming a Spotlight

In a building model, you can control the position of a spotlight to achieve the desired lighting effects. To position a spotlight, use its angle parameters and the Rotate tool.

To aim a spotlight

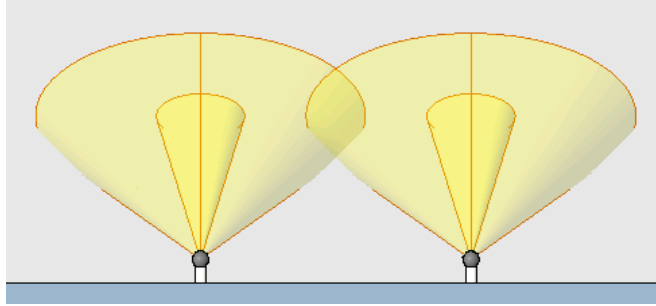
- 1 Add spotlights to the building model, placing them in their approximate locations.

See [Adding a Lighting Fixture to a Building Model](#) on page 1190.

- 2 Set up views, as follows:

- a Leave open (or re-open) the view in which you added the lighting fixtures. (For this procedure, this view is referred to as the placement view.) Zoom in on the fixtures, so you can easily select them for rotating or repositioning. Turn on the display of light sources. (See [Displaying Light Sources in a View](#) on page 1192.)
- b Click View tab ► Windows panel ► Close Hidden to close all other project views.
- c Open a second view in which you will be able to see the light cast on surfaces (such as an elevation view, section view, or 3D view). (For this procedure, this view is referred to as the lighting view.) On the View Control Bar, for Model Graphics Style, select Shading or Shading with Edges. Turn on the display of light sources. (See [Displaying Light Sources in a View](#) on page 1192.)

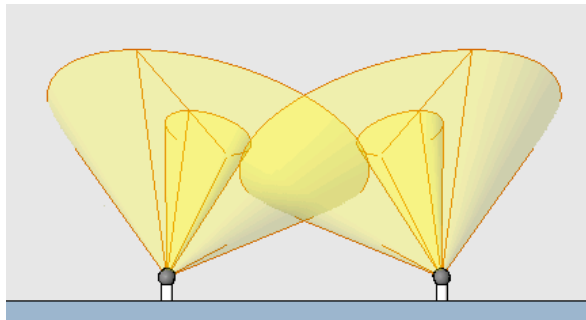
Spotlights in an elevation view with light sources displayed and Shading with Edges turned on



- d** To tile the windows, so you can see both views at the same time, click View tab ► Windows panel ► Tile.

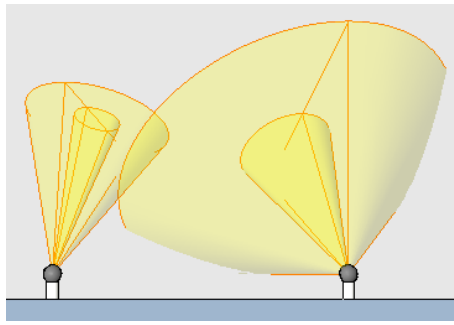
3 In the placement view, rotate the spotlights to aim their light in the desired direction. Use the Rotate tool. See [Rotating Elements](#) on page 379.

Spotlights rotated 30 degrees toward center



4 To tilt a spotlight and control the size of its beam, do the following:

- a** In either view, select a spotlight, and click Modify Lighting Fixtures tab ► Element panel ► Element Properties drop-down ► Type Properties.
- b** Click Duplicate to create a new type.
- c** Enter a name for the type, and click OK.
- d** In the Type Properties dialog, scroll down to locate the Tilt Angle, Spot Field Angle, and Spot Beam Angle parameters.
- e** Enter the desired values for each parameter.
See [Angles for Spotlights](#) on page 1195.
- f** Click OK.
- g** Check the results in the lighting view.
For example, in the following image, the left spotlight has a smaller beam angle and field angle. For the right spotlight, the tilt angle was changed from 60 degrees to 45 degrees.



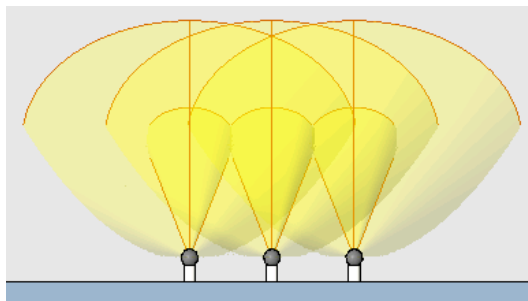
Repeat this step for each spotlight that needs to be tilted.

5 If necessary, make adjustments to achieve the desired result.

For example, you may need to add or remove spotlights, adjust their positions, and change their rotation angles and tilt, field, and beam angles to obtain the desired lighting effects.

TIP To evenly illuminate a surface, position the lighting fixtures so the beam angles overlap each other slightly.

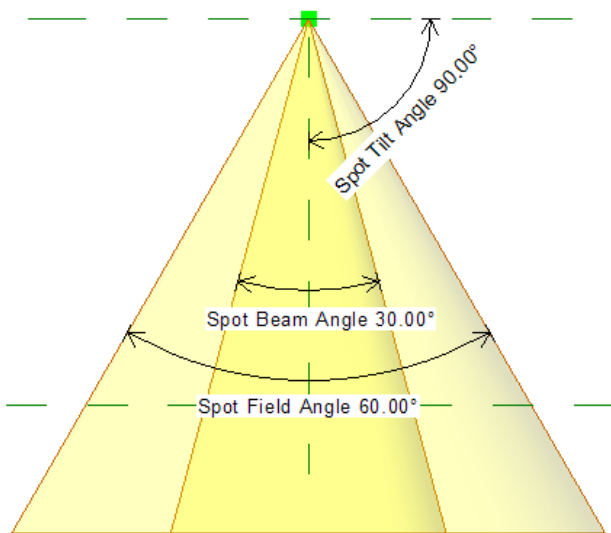
3 spotlights with beam angles overlapping slightly for even illumination of the wall



Angles for Spotlights

When defining a spotlight, you can specify the following angles:

- **Beam angle:** The angle at which light intensity reaches 50% of the peak intensity. Enter a value between 0 and 160 degrees. To make a spot that is small and bright, enter a smaller value.
- **Field angle:** The angle at which light intensity reaches 10% of the peak intensity. Enter a value between 0 and 160 degrees. To limit the spread of the spotlight, enter a smaller value.
- **Tilt angle:** The angle that the spotlight is tilted from its origin. You can adjust the tilt angle of a spotlight to aim its light in the desired direction.



Controlling the Brightness of a Light Source

In a project, you can change the brightness of a light source using the following methods:

- **Change the Initial Intensity.** For example, if you want to change the bulb in a table lamp from a 60 watt bulb to a 100 watt bulb, change its Initial Intensity value in the type properties.
- **Change the Light Loss Factor.** To enhance or reduce light output to reflect environmental factors in the project, change this value in the type properties for the lighting fixture.
- **Dim the light.** Use this method, for example, if you want to represent a ceiling light that is dimmed to create mood lighting in a rendered image.

Changing the Initial Intensity of a Light Source

When you change the initial intensity of a light source, the change affects all relevant project views.

- 1 In a project view, select a lighting fixture, and click Modify Lighting Fixtures tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 2 Click Duplicate to create a new type.
- 3 Enter a name for the type, and click OK.
- 4 In the Type Properties dialog, for Initial Intensity, click in the Value column.
- 5 In the Initial Intensity dialog, specify the desired value.
See [Initial Intensity Parameters](#) on page 1188.
- 6 Click OK twice.

Changing the Light Loss Factor for a Light Source

When you change the Light Loss Factor for a light source, the change affects all relevant project views.

- 1 In a project view, select a lighting fixture, and click Modify Lighting Fixtures tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 2 Click Duplicate to create a new type.

- 3 Enter a name for the type, and click OK.
- 4 In the Type Properties dialog, for Light Loss Factor, click in the Value column.
- 5 In the Light Loss Factor dialog, specify the desired value.
See [Light Loss Factor Parameters](#) on page 1187.
- 6 Click OK twice.

Dimming Lights

When you dim lights in a 3D view for rendering, the settings are saved as part of the view properties, and the lights are dimmed for that view only. The dimmed light settings do not affect rendered images for any other 3D views.

NOTE To specify the color temperature shift for dimmed lights, change type properties for the lighting fixtures. Modify the value of Dimming Lamp Color Temperature Shift. See [Changing a Lighting Fixture in a Building Model](#) on page 1192.

To dim lights

- 1 Open the 3D view to render.
 - 2 Define render settings.
See [Defining Render Settings](#) on page 1221.
 - 3 In the Rendering dialog, under Lighting, for Scheme, select a setting that includes artificial lights.
 - 4 Click Artificial Lights.
 - 5 In the Artificial Lights dialog, in the Dimming column, enter dimming values for light groups or individual lighting fixtures.
Enter a value between 0 and 1 to indicate the relative amount of dimming. A value of 1 means that the light is completely on (not dimmed). A value of 0 means that the light is completely dimmed (off).
-
- NOTE** If a lighting fixture is a nested family that contains multiple light sources but is not shared, you cannot dim individual light sources in the fixture. See [Sharing a Lighting Fixture Family](#) on page 1171.
-
- 6 Click OK.
 - 7 To see the effects of dimming the lights, render the image.
See [Creating the Rendered Image](#) on page 1229.

Light Groups

You can create groups of artificial lights in a building model. For example, you may want to create groups for functional areas of a building, such as exterior lights, kitchen lights, hallway lights, and so on. Light groups can include one or more lighting fixtures of multiple types.

When you render an image, you can use light groups to turn on or off entire sets of lights, rather than controlling lighting fixtures individually. You can also use light groups to control dimming of lights in a rendered image.

Task lights are turned on; central light is turned off.



Central light is turned on; task lights are turned off.



Light groups are available in all relevant areas of Revit Architecture. However, settings to dim or turn on or off light groups (or individual lighting fixtures) apply to individual 3D views only.

NOTE The number of lights in a 3D view to be rendered can significantly increase render time. Use light groups to turn off unnecessary lights in the view. See [Render Performance and Lighting](#) on page 1234.

Opening the Artificial Lights Dialog

The Artificial Lights dialog lists all lighting fixtures in the building model, including ungrouped lights and grouped lights. Use this dialog to create and modify light groups, and to add or remove individual lighting fixtures in groups.

When you open this dialog from a 3D view, you can also use it to dim or turn on or off light groups or individual lighting fixtures for rendering. See [Dimming Lights](#) on page 1197 and [Turning Lights On and Off](#) on page 1202.

You can open the Artificial Lights dialog from the Rendering dialog or from any view that contains lighting fixtures.

To open the Artificial Lights dialog from a view

- 1 In a Revit Architecture project, open a view that contains one or more lighting fixtures.
- 2 Select a lighting fixture.
- 3 On the Options Bar, for Light Group, select Edit/New.

To open the Artificial Lights dialog from the Rendering dialog

- 1 In a Revit Architecture project, open a 3D view.
- 2 Open the Rendering dialog.
See [Opening the Rendering Dialog](#) on page 1222.
- 3 Under Lighting, for Scheme, select a setting that includes artificial lights.
- 4 Click Artificial Lights.

Creating a Light Group

- 1 Open the Artificial Lights dialog.
See [Opening the Artificial Lights Dialog](#) on page 1199.
- 2 Under Group Options, click New.
- 3 In the New Light Group dialog, enter a name for the light group, and click OK.
In the Artificial Lights dialog, the new light group name displays in the list under Grouped Lights.
- 4 Add lights to the group.
See [Adding and Removing Lights in a Light Group Using the Artificial Lights Dialog](#) on page 1200.
- 5 (Optional) Turn the light group on or off for rendering.
See [Turning Lights On and Off](#) on page 1202.

Adding and Removing Lights in a Light Group

You can add and remove lights in a [light group](#) in several ways, depending on your current point in the software.

Adding and Removing Lights in a Light Group from a View

- 1 Open a project view that displays lighting fixtures.
- 2 Select a lighting fixture.

- 3 To add the lighting fixture to a light group, do the following:
 - a On the Options Bar, for Light Group, select the desired group.
If the light group does not yet exist, select Edit/New, and create a group. See [Creating a Light Group](#) on page 1199.
 - b At the prompt, click OK.
- 4 To remove the lighting fixture from a light group, do the following:
 - a On the Options Bar, for Light Group, select None.
 - b At the prompt, click OK.

Adding and Removing Lights in a Light Group Using the Artificial Lights Dialog

- 1 Open the Artificial Lights dialog.
See [Opening the Artificial Lights Dialog](#) on page 1199.
- 2 To add an individual lighting fixture to a light group, do the following:
 - a In the Artificial Lights dialog, under Ungrouped Lights, select the lighting fixture.
 - b Under Fixture Options, click Move to Group.
 - c In the Light Groups dialog, select the desired light group, and click OK.

In the Artificial Lights dialog, the selected lighting fixture displays under the selected light group name.

- 3 To remove an individual lighting fixture from a light group, do the following:
 - a In the Artificial Lights dialog, under Grouped Lights, expand the light group name.
 - b Select the lighting fixture to remove from the group.
 - c Under Fixture Options, click Remove from Group.

In the Artificial Lights dialog, the selected lighting fixture displays under Ungrouped Lights.

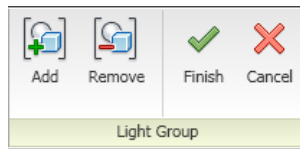
- 4 When you are finished in the Artificial Lights dialog, click OK.

Adding and Removing Lights in a Light Group Using the Light Group Editor

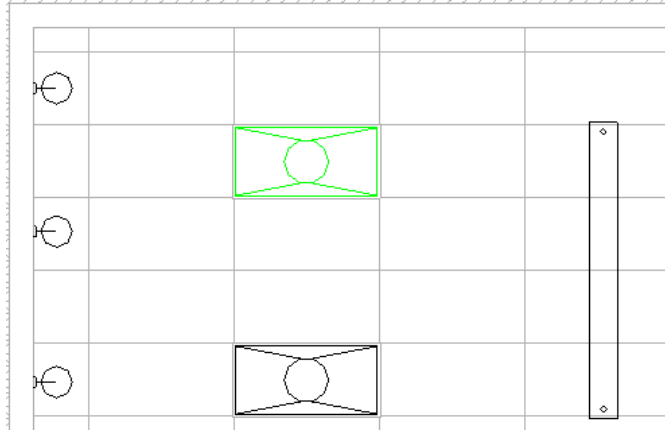
- 1 Open the Light Group Editor, using either of the following methods:
 - In a project view, select a lighting fixture. On the Options Bar, for Light Group, click Edit.

NOTE If Light Group displays None, select the light group to which you want to add the selected lighting fixture. Then click Edit.
 - [Open the Artificial Lights dialog](#). In the Artificial Lights dialog, select the group name. Under Group Options, click Edit.

Revit Architecture enters light group edit mode. The Light Group panel displays on the ribbon. Model elements and lighting fixtures that belong to another light group display in halftone. Lighting fixtures that belong to the selected light group display in green. Lighting fixtures that are not currently assigned to a light group display normally.



A reflected ceiling plan in light group edit mode



- 2** If necessary, use the Project Browser to open any view in which you can see the lighting fixtures to add or remove in the group.
- 3** To add lighting fixtures to the group, do the following:
 - a** Click Light Group panel ► Add.
Revit Architecture highlights lighting fixtures that are not currently assigned to a light group. All other model elements continue to display as halftone, indicating that you cannot select them.
 - b** Select each lighting fixture that you want to add to the group.
When you select a lighting fixture, Revit Architecture displays it as green to indicate that it is being added to the group.
 - c** If necessary, you can open another project view, click Light Group panel ► Add, and select more lighting fixtures to add to the group.
- 4** To remove lighting fixtures from the group, do the following:
 - a** Click Light Group panel ► Remove.
The lighting fixtures that are currently assigned to a light group display as green.
 - b** Select each lighting fixture that you want to remove from the group.
After you select a lighting fixture, it displays normally, indicating that it is no longer part of the group.
 - c** If necessary, you can open another project view, click Light Group panel ► Remove, and select more lighting fixtures to remove from the group.
- 5** When you are finished adding and removing lights for the current light group, click Light Group panel ► Finish.


Turning Lights On and Off

Individual lighting fixtures or entire light groups can be turned on or off to achieve the desired lighting effects in a rendered image. When you turn on or off lights in a 3D view, the settings are saved as part of the view properties, and they affect that view only. They do not affect rendered images for any other 3D views.

If a lighting fixture is a nested family that is not shared, you cannot control individual light sources in the fixture. Instead, you turn the entire lighting fixture on or off. See [Sharing a Lighting Fixture Family](#) on page 1171.

NOTE Render time is directly proportional to the number of lights in the scene. See [Render Performance and Lighting](#) on page 1234.

To turn lights on or off

- 1 In a Revit Architecture project, open a 3D view.
- 2 On the View Control Bar, click  (Show Rendering Dialog).
- 3 In the Rendering dialog, under Lighting, for Scheme, select a setting that includes artificial lights.
- 4 Click Artificial Lights.
- 5 In the Artificial Lights dialog, under On/Off, select individual lighting fixtures or light groups to include them in the rendered image. Clear the check boxes to omit the lights in the rendered image.
You can also enter values in the Dimming column to dim individual lighting fixtures or entire light groups. See [Dimming Lights](#) on page 1197.
- 6 Click OK.
- 7 To see the results, render the image.
See [Rendering an Image](#) on page 1220.

Renaming a Light Group

- 1 Open the Artificial Lights dialog.
See [Opening the Artificial Lights Dialog](#) on page 1199.
- 2 In the Artificial Lights dialog, select the group name.
- 3 Under Group Options, click Rename.
- 4 In the Rename dialog, enter a new group name.
- 5 Click OK.

Deleting a Light Group

- 1 Open the Artificial Lights dialog.
See [Opening the Artificial Lights Dialog](#) on page 1199.
- 2 In the Artificial Lights dialog, select the group name.
- 3 Under Group Options, click Delete.

Revit Architecture deletes the light group. All of the lighting fixtures that belonged to that group are listed under Ungrouped Lights.

Plants and Entourage

You can include plants, cars, people, and other entourage in project views. When you render a view, the entourage is also rendered, adding realistic details to the image.



Plants and Entourage Overview

Entourage includes the landscaping and other environmental features shown in a rendering of a building. For example, entourage can include plants, trees, people, cars, signs, and office clutter (such as picture frames and computers).

Similar to model elements in Revit Architecture, entourage objects are defined in Revit families. Revit Architecture provides a library of entourage families. If you have additional entourage objects that you want to use in projects, you can add them to existing families, or create families for them.

In 2D and 3D views, entourage is represented using simple line drawings as placeholders. When you render a 3D view, a photorealistic representation of the entourage displays in the rendered image.

3D view with placeholder geometry for entourage



Rendered image with photorealistic entourage



People

Revit Architecture includes ArchVision® realpeople™ for more realistic renderings. ArchVision realpeople are pictures of actual people and objects from multiple angles that display using a technique called image-based rendering. They are part of ArchVision's RPC (Rich Photorealistic Content) product family.



In a Revit entourage family for people, you can use an RPC file to specify a rendering appearance. You can place people in floor plans and 3D views, where each person is represented by a placeholder. (You cannot place people in elevation views or section views.) When you render a 3D view, the people are displayed in detail.

Revit Architecture provides 2 RPC families for people: RPC Male and RPC Female (for metric systems, M_RPC Male and M_RPC Female). In each family, types provide render appearances for different men and women. When you load these RPC families into a project, the Type Selector displays the available people. Select the desired RPC person, and then place it in a project.

If you purchase additional RPC people from ArchVision, you can add types to existing families for the new render appearances, or create families for them. See [Creating an RPC Family](#) on page 1206.

Plants

When you render a building and its surrounding site, you may want to include plants and other forms of vegetation to show landscaping options.



In a Revit plant family, you can use an RPC file to specify a render appearance. Revit Architecture provides several RPC families for trees and plants (for example, RPC Tree - Conifer, RPC Tree - Deciduous, and RPC Shrub). In each family, types provide render appearances for different species of trees and plants. For example, when you load M_RPC Trees - Conifer.rfa into a project, the Type Selector displays a list of conifers to choose from. Select the desired RPC tree, and then place it in a project.

In line and shaded views, a placeholder represents the plant. Revit Architecture offers autumn versions of many deciduous trees. To control the size of a plant, you can modify its type parameters in the family or in a project.

Cars and Vehicles

When you render a building and its surrounding site, you may want to include cars and other types of vehicles. Revit Architecture provides one RPC car. You can purchase more vehicles from ArchVision.

When you place a car in a view, you can modify its properties. For example, you can tint the windows and specify a custom license plate. See [Automobile Properties](#) on page 1207.



Office Clutter

When you render an interior view, you may want to add furnishings and fixtures to lend realism to the scene. ArchVision refers to this type of entourage as office clutter. Revit Architecture provides office chairs, picture frames, and a notebook computer. You can purchase more office clutter from ArchVision.

When you place office clutter in a view, you can modify its properties. For office chairs, you can specify their materials and colors, whether they are tilted and turned, and other characteristics. For a picture frame, you can specify its orientation (landscape or portrait), whether it stands on a desk or hangs on a wall, and

an image to display in the frame. For a notebook computer, you can specify whether it is opened or closed, powered on or off, or displays an image on the screen. See [Office Clutter Properties](#) on page 1209.




Creating an RPC Family

Use the Family Editor to create a Revit family for entourage, including people, cars, plants, and office clutter. In an RPC family, you can specify an ArchVision RPC file to use for the render appearance.

NOTE To create a Revit family for entourage that will use a source other than an RPC file for the render appearance, see [Creating an Entourage Family](#) on page 1210.

To create an RPC family

- 1 Click  ► New ► Family.
- 2 In the New Family – Select Template File dialog, select RPC Family.rft or Metric RPC Family.rft, and click Open.

By default, a placeholder for a person displays in the drawing area. (You can see it more clearly in an elevation view.) However, you can change this entourage family to be any type of object, such as a tree, chair, or car. When you select a render appearance for the entourage, the drawing area displays an appropriate placeholder for it.
- 3 Create family types, and specify their parameters.

See [The Families Guide](#) on page 418.

For example, suppose you want to include a variety of red ash trees in a project, so you create an RPC family named Red Ash. You define 3 family types named Tall, Short, and Autumn. In the type parameters, you can specify a different height for each tree type.
- 4 For each family type, specify the render appearance.

See [Specifying a Render Appearance for an RPC Family](#) on page 1207. For example, for the red ash tree family, you specify Red Ash as the render appearance for the Tall and Short types, but Red Ash [Fall] as the render appearance for the Autumn type.

When you specify the render appearance, the drawing area displays a placeholder for the object in 2D and 3D views. The detailed render appearance displays only in rendered images.
- 5 Specify visibility settings for the entourage placeholder, as follows:
 - a In the drawing area, select the placeholder.
 - b Click Modify <Element> tab ► Visibility panel ► Visibility Settings.
 - c In the Family Element Visibility Settings dialog, select the desired settings.

See [Setting Family Geometry Visibility](#) on page 513.

d Click OK.

6 Save the family.

7 Load the family into a project.

Specifying a Render Appearance for an RPC Family

An RPC family is a Revit entourage family created using the RPC Family.rft or Metric RPC Family.rft template files. (See [Creating an RPC Family](#) on page 1206.) For these entourage objects, use the following procedure to specify RPC files for their render appearances.

To specify an RPC render appearance

1 Open the Revit RPC family in the Family Editor.

2 Click Family Properties panel ► Types.

3 For Name, select the family type to modify.

4 In the Family Types dialog, for Render Appearance, click in the Value column.

The Render Appearance Library displays.

5 Locate the desired render appearance, select it, and click OK.

See [Searching for a Render Appearance](#) on page 491.

6 In the Family Types dialog, for Render Appearance Properties, click Edit.

7 Specify parameters for the render appearance, and click OK.

See [Render Appearance Properties for RPC Objects](#) on page 1207.

8 In the Family Types dialog, click Apply.

9 (Optional) Repeat this process for other family types defined for the RPC family.

10 Click OK.

11 Save changes to the RPC family.


Render Appearance Properties for RPC Objects

The properties for render appearances vary depending on the type of RPC object. The following topics describe the render appearance properties for each RPC type.

NOTE If you purchase additional RPC content, those render appearances may display properties that are not listed in the following sections. For information about those properties, see the ArchVision documentation.

Automobile Properties

Property	Description
General	
Cast Reflections	Whether the rendered image shows a reversed, mirror reflection of the vehicle on other surfaces, such as glass. When this option is cleared, the rendered image shows a repeat image in the reflecting surface instead of a reversed, mirror image. See Cast Reflections on page 1210.


Property	Description
Glass	
Transparency	How much light passes through the windows of the vehicle. Use the slider to specify less transparency (left) or more transparency (right).
Tinting	How much black is mixed in with the vehicle windows to tint them, thus reducing the visibility of interior details. Use the slider to indicate less tinting (left) or more tinting (right).
Use Tinting	Whether the vehicle windows are tinted.
Customize	
License Plate	Whether the vehicle displays a license plate.
Custom Plate	Whether the license plate uses a custom image.
License Plate File Name	The path and file name of the image to use for the custom license plate. Click  (Browse) to navigate to the file. See Best Practice for Storing Image Files on page 519.

Properties for Plants, Trees, and Shrubs

Property	Description
Parameters	
Cast Reflections	Whether the rendered image shows a reversed, mirror reflection of the plant on other surfaces, such as glass. When this option is cleared, the rendered image shows a repeat image in the reflecting surface instead of a reversed, mirror image. See Cast Reflections on page 1210.
View	
Lock View	Whether to use a single image for the plant, regardless of the direction from which it is viewed in a walkthrough. To lock the view, select this option, and then specify the view to use. When this option is turned off, as the camera moves around the plant in a walkthrough, the plant image changes based on the position of the camera. If you use RPC Stills content in a walkthrough, the plant seems to jump as the camera moves and the image is updated. This property applies to RPC content in rendered walkthroughs only. See Walkthrough Views on page 164.

Furniture Properties


Property	Description
Swivel Chair: The following properties display for swivel chairs.	
Swivel	Rotation of the chair from its origin, based on the slider setting.

Property	Description
Elevation	Height setting for the seat of the chair. Select Low, Medium, or High.
Arm Height	Height setting for the arms of the chair. Select Low, Medium, or High.
Tilt	Angle to tilt the back of the chair, based on the slider setting.
Color Preview	Image to use to preview the color for the object. Click  (Browse) to navigate to the file.
Color	Color of the object. Select a value from the list.


Office Clutter Properties

Property	Description
Cast Reflections	Whether the rendered image shows a reversed, mirror reflection of the object on other surfaces, such as glass. When this option is cleared, the rendered image shows a repeat image in the reflecting surface instead of a reversed, mirror image. See Cast Reflections on page 1210.

Notebook Computer: The following properties display for notebook computers.

Open	How much to open the computer. Use the slider to close it or control its angle when open.
Power	Whether the notebook computer is turned on and can display an image.
Custom Screen	Whether the computer screen displays a specified image when the computer is open and turned on.
Screen File Name	Custom image to display on the computer screen. Click  (Browse) to navigate to the file. This image displays only when Power and Custom Screen are selected. See Best Practice for Storing Image Files on page 519.

Picture Frame: The following properties display for picture frames.

Portrait	Whether the frame is oriented in portrait mode (vertically). Clear this option to orient the frame in landscape mode (horizontally).
Stand	Whether the frame leans on a stand. Clear this option if the frame hangs on a wall.
Frame Material	Material for the frame. Select a value from the list.
Use Custom Picture	Whether an image displays in the picture frame when it is rendered.
Picture File Name	Custom image to display in the picture frame when it is rendered. Click  (Browse) to navigate to the file. See Best Practice for Storing Image Files on page 519.

People Properties

Property	Description
Cast Reflections	Whether the rendered image shows a reversed, mirror reflection of the person on other surfaces, such as glass. When this option is cleared, the rendered image shows a repeat image in the reflecting surface instead of a reversed, mirror image. See Cast Reflections on page 1210.
Jitter	Whether to control the transition between frames in a walkthrough. Use this option when the camera is relatively close to the RPC content or is moving slowly around it, or both. This option results in a smoother appearance during a walkthrough. However, it may cause the RPC content to be blurry in still images. When this option is turned off, you may notice small image jumps or ticks in a walkthrough. This property applies to RPC content in rendered walkthroughs only. See Walkthrough Views on page 164.
Billboard	Whether to lock the RPC content to a fixed image. As the camera revolves around the RPC content in a walkthrough, the image is not updated but continues to face the active camera. This option can greatly reduce RAM and render time required during the rendering process. This property applies to RPC content in rendered walkthroughs only. See Walkthrough Views on page 164.
Motion: For animated RPC content, you can specify the frame to use in a rendered image.	
Use Specified Frame	Whether to use the specified frame in a rendered image.
Frame	The frame to use in a rendered image.

Cast Reflections

The Cast Reflections property for RPC objects works differently than a similar setting in Autodesk® 3ds Max®. RPC content provides a specialized texture that is applied to a flat plane. When the texture is applied to the opposite side of the plane, unusual reflections can result. The Cast Reflections property for RPC content produces a more realistic result.

When you turn on Cast Reflections, the object includes a second plane that faces away from the camera. This plane shows the image of the opposite side of the RPC object. The reflection is accurate only when the RPC object is directly between the camera and the reflective surface. As the reflective surface moves to a more acute angle, the reflection thins.

The Cast Reflections property can significantly increase memory requirements and render time. Use this property only when the RPC content should cast a reflection on a vertical surface directly behind it. RPC trees (and other plants) may not require this property turned on, even when a reflection is expected, because the front of a tree closely resembles the back.

Creating an Entourage Family

You can create an entourage family that does not use RPC content for render appearances. For example, if you have already used AutoCAD or other design software to create a render appearance for the object, use the following procedure.

NOTE To create a Revit family for entourage that uses RPC content for render appearances, see [Creating an RPC Family](#) on page 1206.

To create an entourage family



1 Click  ► New ► Family.

2 In the New Family – Select Template File dialog, select Entourage.rft or Metric Entourage.rft, and click Open.

3 In the drawing area, sketch the geometry to represent the entourage in 2D and 3D views, or import a CAD file that contains the geometry.

See [Family Editor](#) on page 416 or [Importing or Linking CAD Formats](#) on page 1387.

4 Specify visibility settings for the entourage placeholder.

To specify visibility settings

- a In the drawing area, select the placeholder.
- b Click Modify <Element> tab ► Visibility panel ► Visibility Settings.
- c In the Family Element Visibility Settings dialog, select the desired settings.
See [Setting Family Geometry Visibility](#) on page 513.
- d Click OK.

5 Create family types, and specify their parameters.

See [The Families Guide](#) on page 418.

6 Specify a render appearance.

By default, for an entourage family, Revit Architecture uses the family geometry (that you imported or sketched in the drawing area) to represent the object in a rendered image.

If desired, you can specify an RPC file to define its geometry, instead.

To specify an RPC file

- a Click Family Properties panel ► Category and Parameters.
- b Under Family Parameters, for Render Appearance Source, select Third Party.

NOTE If you want to use the geometry that you create or import for a render appearance, for Rendering Appearance Source, select Family Geometry.

- c Click OK.
- d Specify the render appearance.
See [Specifying a Render Appearance for an RPC Family](#) on page 1207.

7 Save the family.

8 Load the family into a project.

Using the ArchVision Content Manager

Revit Architecture provides many RPC objects that you are licensed to use in rendered images for Revit projects. If you purchase additional RPC content, you must use the ArchVision Content Manager (ACM) to manage it.

NOTE Use the ACM only to manage additional RPC content that you purchase from ArchVision. You do not need to use the ACM for the RPC content that is provided with Revit Architecture.

If the additional RPC content resides on the local computer, you must configure Revit Architecture to access it. See [Configuring Revit Architecture for Local RPC Content](#).


If your organization stores additional RPC content in a network location, you need to specify network paths for the RPC files and for the ACM. See [Configuring Revit Architecture for Networked RPC Content](#).

Configuring Revit Architecture for Local RPC Content

- 1 Install and configure the ACM.

This utility is available free from <http://acm.archvision.com>. For instructions, see the ArchVision Content Manager Help (<http://acm.archvision.com/help>).

Now you must specify the location of the ACM so that Revit Architecture can access the additional RPC content.

- 2 In Revit Architecture, click  ➤ Options.

- 3 In the Options dialog, click the Rendering tab.


- 4 Under ArchVision Content Manager Location, select Local.

- 5 For Executable Location, specify the location of the ACM executable file (rpcACMapp.exe).

By default, Revit Architecture attempts to connect to the ACM using the IP address 127.0.0.1 (the local host) and port 14931. If it cannot connect to the ACM there, it attempts to start the ACM executable that you specify here.

- 6 Click OK.

Configuring Revit Architecture for Networked RPC Content

- 1 In Revit Architecture, click  ➤ Options.

- 2 In the Options dialog, click the Rendering tab.

- 3 Under Additional Render Appearance Paths, add a path to indicate the location of the additional RPC files that you have downloaded from ArchVision.

If needed, you can add multiple paths for RPC files.

- 4 Under ArchVision Content Manager Location, select Network.

- 5 For Address, specify the network address where the ACM resides.

You can enter a machine name or an IP address.

- 6 For Port, specify the port used by the ACM.

The default is 14931.

- 7 Click OK.

Using Additional RPC Content from ArchVision

Revit Architecture provides many RPC objects that you are licensed to use in rendered images for Revit projects. If desired, you can download additional RPC content to use in projects. (Go to <http://www.archvision.com> or <http://commerce.vismasters.com>.)

NOTE If you do not own a license to use the additional RPC content, it renders with watermarks.

To use additional RPC content with Revit Architecture

- 1 Configure Revit Architecture to access the additional RPC content.
See [Using the ArchVision Content Manager](#) on page 1212.
- 2 If the additional RPC content has not yet been downloaded to the local computer or to a network location, download it.
For instructions, see the ArchVision Content Manager Help (<http://acm.archvision.com/help>).
- 3 Create or edit an RPC family, and specify the RPC content as the render appearance for a family type.
See [Specifying a Render Appearance for an RPC Family](#) on page 1207. When you open the Render Appearance Library, it lists the RPC content that Revit Architecture provides and the additional RPC content purchased by your organization.
- 4 Load the RPC family into a Revit project, and place the entourage objects in a project view for rendering.
See [Placing Plants and Entourage in a Project View](#) on page 1213.

Placing Plants and Entourage in a Project View

- 1 Open a floor plan view or a 3D orthographic view in a Revit Architecture project.
You cannot place plants or entourage in perspective views, elevation views, or section views.
- 2 Load a family of plants or entourage, as follows:
 - a Click Insert tab ► Load from Library panel ► Load Family.
 - b To load plants, open the Planting folder. To load people and other entourage, open the Entourage folder.
 - c Select the desired RPC or entourage family files (for example, RPC female.rfa or RPC Shrub.rfa), and click Open.
- 3 Place a plant or entourage object in the drawing area, as follows:
 - a Click Home tab ► Build panel ► Component drop-down ► Place a Component.
 - b Click Place Component tab ► Element panel, and select the desired family from the Type Selector drop-down.
 - c Click in the drawing area to place a plant or entourage object in the view.
 - d Move and rotate the object, as needed.
To move the object, drag it to the desired location. To rotate the object, select it and press *Spacebar* to rotate 90 degrees, or use the Rotate tool to rotate to a specific position. See [Rotating Elements](#) on page 379.

NOTE You cannot tag or schedule RPC objects.

- e To exit the Component tool, press Esc twice.

4 Open a 3D view for rendering.

The 3D view displays placeholders for entourage. When you render the image, the entourage objects are rendered in detail. See [Rendering an Image](#) on page 1220.

Changing the Size of Plants

You can change the size of plants using type properties in a project. The updated plant size displays in 2D views, 3D views, and rendered images.

NOTE You can also specify the size of a plant in its family. See [Creating an RPC Family](#) on page 1206.

Maple trees of different heights



To change the size of a plant in a project

- 1** In a view, select a plant to modify, and click Modify Planting tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 2** If you want to change the height of all plants of this type in the current project, do the following:
 - a** In the Type Properties dialog, for Height, enter a value to indicate the new height of the plant.
 - b** Click OK.
- 3** If you want to change the height of the selected plant only, do the following:
 - a** Click Duplicate.
 - b** Specify a name for the new plant type, and click OK.
 - c** In the Type Properties dialog, for Height, enter a value to indicate the new height of the plant.
 - d** Click OK.

Decals


Use the Place Decal tool to place images on surfaces of a building model for rendering. For example, you can use decals for signs, paintings, and billboards. For each decal, you can specify an image and its reflectivity, luminance, and texture (bump-mapping). You can place decals on flat surfaces and cylindrical surfaces.

Sample rendering with decals



Creating a Decal Type

1 Click Insert tab ► Link panel ► Decals drop-down ► Decal Types.

2 In the Decals Types dialog, click  (Create new decal).

3 In the New Decal dialog, enter a name for the decal, and click OK.

The Decal Types dialog displays the new decal name and its attributes.

4 For Image File, specify the file to use.

Click  (Browse) to navigate to the file. Revit Architecture supports image files of the following types: BMP, JPG, JPEG, and PNG. See [Best Practice for Storing Image Files](#) on page 519.

5 Specify the remaining attributes of the decal.

See [Decal Attributes](#) on page 1219.

6 Click OK.

Now you can place instances of the decal type in the building model. See [Placing a Decal in a View](#) on page 1216.

Related topics

- [Renaming a Decal Type](#) on page 1217
- [Duplicating a Decal Type](#) on page 1217
- [Sharing Decals Between Projects](#) on page 1218
- [Decal Properties](#) on page 1218

Placing a Decal in a View

1 In a Revit Architecture project, open a 2D view or a 3D orthographic view.

The view must contain a flat or cylindrical surface on which you can place decals. You cannot place decals in 3D perspective views.

2 Click Insert tab ► Link panel ► Decals drop-down ► Place Decal.

If no decals exist in the current project, the Decal Types dialog displays, and you need to create a decal type. See [Creating a Decal Type](#) on page 1215.

3 Click Decal tab ► Element panel, and from the Type Selector drop-down, select the type of decal to place in the view.

4 If you want to change the physical size of the decal, on the Options Bar, enter values for Width and Height. To maintain the aspect ratio between these dimensions, select Lock Proportions.

5 In the drawing area, click a flat surface (such as a wall face or roof face) or a cylindrical surface on which to place the decal.

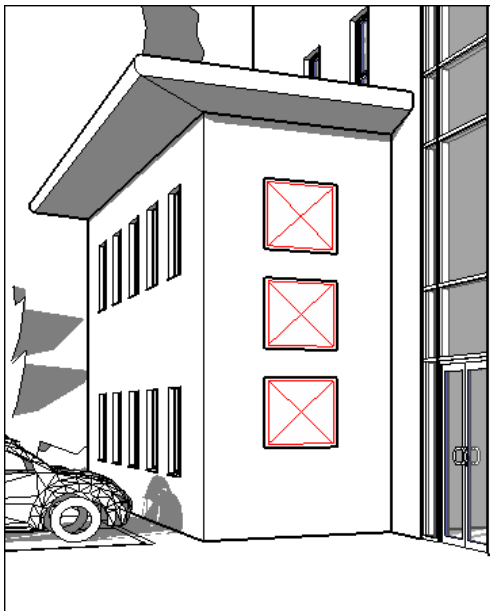
The decal displays as a placeholder (a clear box with 2 lines through it) in all non-rendered views, as shown. The detailed decal image is visible only in rendered images.



6 After placing a decal, you can continue placing more decals of the same type. To place a different decal, select the desired decal in the Type Selector, and then click the desired location on the building model.

7 To exit the Decal tool, press Esc twice.

3D view showing placeholders for decals



Related topics

■ [Modifying a Placed Decal](#) on page 1217

■ [Decals](#) on page 1215


- [Sharing Decals Between Projects](#) on page 1218
- [Decal Properties](#) on page 1218

Modifying a Placed Decal


- 1 In a project view, select the decal.
- 2 To move the decal, drag it to a new location.
- 3 To resize the decal, drag its blue grips, or on the Options Bar, enter new values for Width and Height. To maintain the aspect ratio between these dimensions, select Lock Proportions.
- 4 To return the decal to its original size, on the Options Bar, click Reset.
- 5 To rotate the decal, use the Rotate tool.
See [Rotating Elements](#) on page 379.
- 6 To change the decal's properties, click Modify <Element> tab ► Element panel ► Element Properties drop-down ► Instance Properties or Type Properties.
See [Decal Properties](#) on page 1218.

NOTE You can also change the decal image and its attributes by clicking Insert tab ► Link panel ► Decals drop-down ► Decal Types.


Renaming a Decal Type

- 1 Click Insert tab ► Link panel ► Decals drop-down ► Decal Types.
- 2 In the decals list, select the decal type to rename.
- 3 Click  (Rename).
- 4 In the Rename dialog, enter a new name, and click OK.

Duplicating a Decal Type

- 1 Click Insert tab ► Link panel ► Decals drop-down ► Decal Types.
- 2 In the decals list, select the decal type to copy.
- 3 Click  (Duplicate).
- 4 In the Duplicate Decal dialog, enter a name for the new decal type, and click OK.
- 5 Under Settings, specify an image file and attributes for the new decal type.
See [Decal Attributes](#) on page 1219.
- 6 Click OK.

Deleting a Decal Type

- 1 Click Insert tab ► Link panel ► Decals drop-down ► Decal Types.
- 2 In the decals list, select the decal type to delete.
- 3 Click  (Delete).
- 4 To confirm that you want to delete the selected decal type, click Yes at the prompt.

Sharing Decals Between Projects

If you create several decals in one project, you can use them in another project. To do this, click Manage tab ► Project Settings panel ► Transfer Project Standards. In the Select Items to Copy dialog, select Decal Types. See [Transferring Project Standards](#) on page 446.

Make sure that the image files for the decals are available to the target project. When Revit Architecture needs to access the image file, first it looks in the location specified for the file, using the absolute path. If it cannot find the file in that location, Revit Architecture then searches the paths specified on the Rendering tab of the Options dialog. See [Setting Options](#) on page 516.

If you send the project file to another team member, you must also send the image files for the decals. See [Best Practice for Storing Image Files](#) on page 519.

Decal Properties

You can modify properties for each decal instance and decal type. You can also change attributes of the decal image.

Modifying Decal Properties

- 1 In a project view, select the decal, and click Modify <Element> ► Element panel ► Element Properties drop-down ► Instance Properties.
- 2 In the Instance Properties dialog, edit the instance parameters.
See [Decal Instance Properties](#) on page 1218.
- 3 To edit decal type parameters, in the Instance Properties dialog, click Edit Type.
See [Decal Type Properties](#) on page 1219.
- 4 To change the decal image and its attributes, in the Type Properties dialog, for Decal Attributes, click Edit.
See [Decal Attributes](#) on page 1219.

NOTE You can also change the decal image and its attributes by clicking Insert tab ► Link panel ► Decals drop-down ► Decal Types.

- 5 Click OK.

Decal Instance Properties

Parameter	Description
Dimensions	
Width	Physical width of the decal.
Height	Physical height of the decal.
Lock Proportions	Whether the ratio between the height and width is maintained. Clear this option to change the Width or Height without also affecting the other dimension.
Identity Data	


Parameter	Description
Comments	Text that describes the decal.
Mark	User-specified identifier for this particular decal.
Subcategory	Subcategory for the geometry of the decal. The subcategory controls the line weight, color, and pattern in 2D and 3D views. Select a Generic Model subcategory from the list, or create one. See Creating Object Style Subcategories on page 493.
Phasing	
Phase Created	Phase during which the decal is created. See Project Phasing on page 1331.
Phase Demolished	Phase during which the decal is demolished. See Project Phasing on page 1331.

Decal Type Properties

Parameter	Description
Decal Attributes	Image for and attributes of the decal. Click Edit to change them. See Decal Attributes on page 1219.
Keynote	Keynote for the decal. See Keynotes on page 1117.
Model	Manufacturer's model number or code for the decal.
Manufacturer	Manufacturer of the decal.
Type Comments	Comments or information about this type of decal.
URL	URL of the website for the manufacturer or vendor.
Description	Description of the decal.
Assembly Description	Description of the selected assembly code. (read-only)
Assembly Code	Unifomat assembly code for the decal. See Unifomat Assembly Codes on page 818.
Type Mark	User-specified identifier for this type of decal.
Cost	Cost of the decal.

Decal Attributes

The following properties display in the Decal Types dialog when you create or modify a decal type. See [Creating a Decal Type](#) on page 1215.

Property	Description
Image File	Image file to display for the decal. Click  (Browse) to navigate to the file. Revit Architecture supports image files of the following types: BMP, JPG, JPEG, and PNG. See Best Practice for Storing Image Files on page 519.

Property	Description
Brightness	Perception of the luminance of the decal. Brightness is a multiplier, so a value of 1.0 makes no change. If you specify 0.5, its brightness is reduced by half.
Reflectivity	Measurement of how much light the decal reflects from its surface. Enter a value between 0 (no reflections) and 1 (maximum reflections). See Transparency and Translucency on page 485.
Transparency	Measurement of how much light passes through the decal. Enter a value between 0 (completely opaque) and 1 (completely transparent).
Finish	Texture of the decal surface.
Luminance (cd/m ²)	Light emitted by the surface, measured in candelas per square meter. Select a pre-defined value, or select Custom to enter a value.
Bump Pattern	Bump pattern (additional texture) to use on the decal surface. See Specifying an Image File for a Render Appearance on page 485. This texture is layered on top of any texture already applied to the surface on which the decal is placed. For example, if you place a decal on a brick wall, the texture of the brick wall affects the decal, in addition to the decal texture specified here.
Bump Amount	Relative amplitude of the bumps. Enter 0 to make the surface flat. Enter higher decimal values (up to 1.0) to increase the depth of the surface irregularities.
Cut-outs	Shapes cut into the surface of the decal. Select a shape, or select Custom to define cut-outs using an image. See Specifying an Image File for a Render Appearance on page 485.

Rendering an Image

You can use Revit Architecture to render 3D views. You can then place rendered images on sheets to present designs to clients. The rendering interface uses intelligent defaults so that you can easily generate a quality rendered image without in-depth understanding of rendering technology. The interface also offers advanced settings for users with more rendering experience.

As an alternative, you can export a 3D view, and use another software application to render the image. See [Exporting to 3ds Max](#) on page 1373.



Related topics

- [Rendering Workflow](#) on page 1163
- [Rendering Best Practices](#) on page 1233

Defining Render Settings

1 Open the Rendering dialog.

See [Opening the Rendering Dialog](#) on page 1222.

2 Define the view area to render.

See [Defining the View Area to Render](#) on page 1223.

3 In the Rendering dialog, under Quality, specify the render quality.

See [Specifying the Render Quality](#) on page 1224.

4 Under Output, specify the following:

- **Resolution:** To generate a rendered image for screen display, select Screen. To generate a rendered image for printing, select Printer.
- **DPI:** When Resolution is Printer, specify the DPI (dots per inch) to use when printing the image. (If the project uses metric units, Revit Architecture converts the metric values to

inches before displaying the DPI or pixel size.) Select a predefined value, or enter a custom value.

The Width, Height, and Uncompressed image size fields update to reflect the settings. See [Render Performance and Image Size/Quality](#) on page 1236.

5 Under Lighting, specify lighting settings for the rendered image.

See [Controlling Lighting in a Rendered Image](#) on page 1228.

6 Under Background, specify a background for the rendered image.

See [Specifying the Background for a Rendered Image](#) on page 1229.

7 (Optional) Adjust exposure settings for the rendered image.

If you know the exposure settings that you want to use, you can set them now. Otherwise, wait to see the results of the current render settings, and, if needed, adjust the exposure settings after rendering the image. See [Adjusting the Exposure of a Rendered Image](#) on page 1230.

These render settings are view-specific. They are saved as part of the view properties. To apply these settings to other 3D views, use a view template. See [View Templates for Render Settings](#) on page 1232.

When you finish defining render settings, create the rendered image. See [Creating the Rendered Image](#) on page 1229.

Opening the Rendering Dialog

1 Open the 3D view to render.

You can render 3D views only.

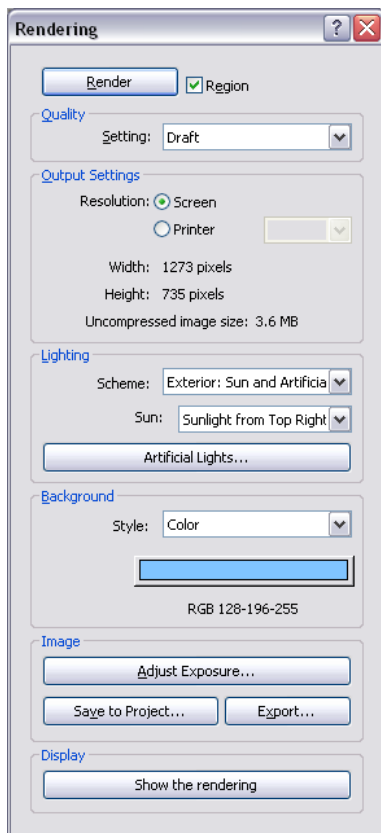
TIP To render a 2D view, create a 3D view that is oriented to a 2D view (such as a section view or elevation view). Right-click the [ViewCube](#) on page 219, and click Orient To View or Orient to a Direction. For details, see [Specifying Camera Position in a 3D View](#) on page 161.

If the Rendering dialog was open when the 3D view was last open in the current session, the dialog redisplay.

2 If the Rendering dialog does not open automatically, use any of the following methods:

■ Type **rr**.

■ On the View Control Bar, click  (Show Rendering Dialog).



Defining the View Area to Render

You can render part of a 3D view. You might use this strategy for the following reasons:

- To focus on a particular part of the 3D view.
- To test render appearances for materials applied to model elements.
See [Applying Materials to Elements](#) on page 471.
- To reduce the amount of time required to render the image.
See [Rendering Best Practices](#) on page 1233.
- To reduce the size of the resulting image file.
See [Controlling the Size of the Rendered Image](#) on page 1228.

When you click Render, Revit Architecture renders only the specified part of the building model.

To define the view area to render, use one or more of the following methods:

- **Crop region:** Open the 3D view, and apply a crop region to define the area to render. See [Cropping a View](#) on page 211. To check or change the size of the cropped view, select the crop region, and click Modify Cameras tab ► Crop panel ► Size Crop.
- **Render region:** [Open the Rendering dialog](#), and click Region. In the 3D view, Revit Architecture displays the render region boundary. Select the render region, and use the blue grips to adjust its size. For orthographic views, you can also drag the render region to move its location in the view. If the view uses a crop region, the render region must reside within the crop region boundaries.
- **Camera clipping plane:** The camera clipping plane defines the depth of the 3D view to render. When you reduce this clipping plane, Revit Architecture has fewer model elements to process when producing

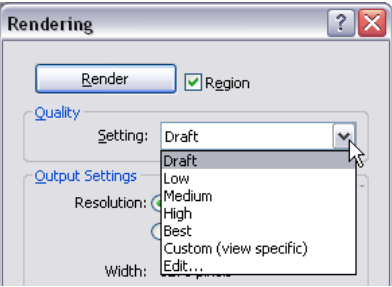
the rendered image. As a result, the rendering process requires fewer resources, takes less time, and produces a smaller image file. See [Modifying the Camera Position in a Perspective 3D View](#) on page 161.

- **Section box:** A crop region and a render region define a 2D portion of a 3D view to render. A section box, however, allows you to define a 3D portion of the view to render. By using a section box, you can omit many model elements from the rendering process, thus reducing the number of calculations and the processing time required. See [Using a Section Box in a 3D View](#) on page 159.

NOTE When using a section box, be careful about the parts of the building geometry that you exclude from the view. For example, if a section box excludes an exterior wall for an interior 3D view, sunlight may illuminate the entire room, affecting the rendered image and increasing render time. See [Render Performance and Lighting](#) on page 1234.

Specifying the Render Quality

To present a design to clients, you typically want a high quality rendered image. However, high quality rendered images can be slow to generate. For testing purposes, you may want to generate a draft quality image quickly. Use the Quality Setting on the Rendering dialog to specify the desired quality for the rendered image.



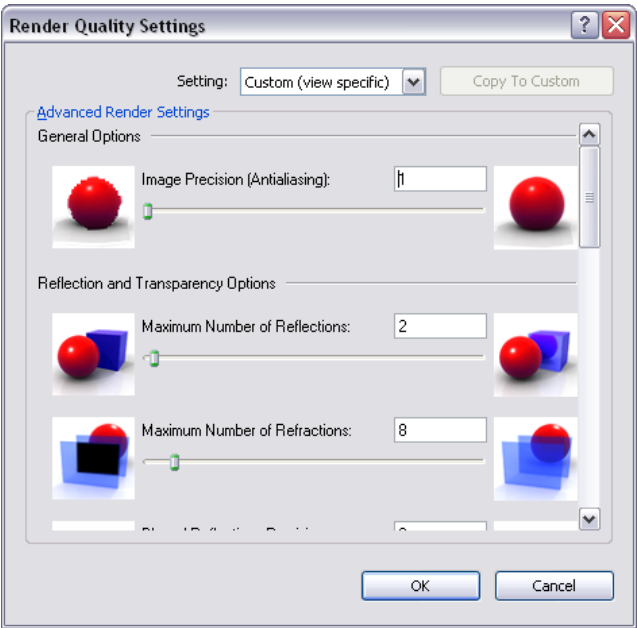
Quality	Relative Render Speed	Description
Draft	Fastest	Render as quickly as possible to get a general idea of the rendered image. The image contains many artifacts (small inaccuracies or imperfections in the rendered image).
Low	Fast	Render quickly with a better level of quality and several artifacts.
Medium	Medium	Render with a quality that is usually satisfactory for presentations, with few artifacts.
High	Slow	Render with high quality that is satisfactory for most presentations, with very few artifacts. This render quality requires a long time to produce.
Best	Slowest	Render with very high quality and a minimum of artifacts. This render quality requires the most time to produce.
Custom	Varies	Use the settings specified in the Render Quality Settings dialog. Render speed depends on the custom settings. See Defining a Custom Render Quality on page 1225.

Related topics

- [Rendering Best Practices](#) on page 1233

Defining a Custom Render Quality

- 1 In the [Rendering dialog](#), under Quality, for Setting, select Edit.
The Render Quality Settings dialog displays.



- 2 For Setting, select the predefined setting to use as a starting point for your custom settings, and click Copy to Custom.
- 3 Under Advanced Render Settings, specify the desired parameter values.
See [Render Quality Settings](#) on page 1225.
- 4 Click OK.
- 5 [Continue](#) to define other render settings.

Render Quality Settings

Use the following parameters to define advanced render settings. (See [Defining a Custom Render Quality](#) on page 1225.) In general, increasing (or turning on) any one of these settings increases the quality of the rendered image. However, it also increases the time required to generate the image. Increasing the values of multiple settings may increase render time exponentially. See [Rendering Best Practices](#) on page 1233.

Setting	Description
General Options	
Image Precision (Antialiasing)	Increase this value to smooth jagged edges in the rendered image. Enter a value between 1 (most jagged) and 10 (smoothest). See Render Performance and Image Size/Quality on page 1236.
Reflection and Transparency Options	

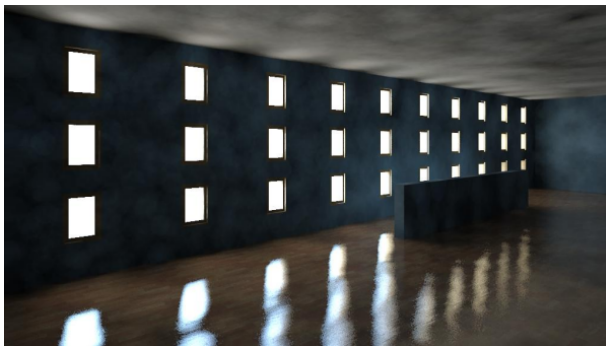
Setting	Description
Maximum Number of Reflections	Increase this value when objects are missing from reflections in the rendered image. Enter a value between 0 (no reflections) and 100 (most reflections). See How Refractions and Reflections Affect Render Performance on page 1236.
Maximum Number of Refractions	Increase this value when you cannot see objects through multiple panes of glass. Enter a value between 0 (completely opaque) and 100 (completely transparent). See How Refractions and Reflections Affect Render Performance on page 1236.
Blurred Reflections Precision	Increase this value when the edges or surfaces of objects in blurred reflections are speckled. Enter a value between 1 (speckled) and 11 (smoothest).
Blurred Refractions Precision	Increase this value when the edges of objects seen through rough glass are speckled. Enter a value between 1 (speckled) and 11 (smoothest).
Shadow Options	
Enable Soft Shadows	Select this option to make shadow edges blurred. Clear it to make shadow edges sharp and distinct. See Soft shadows on page 1235.
Soft Shadow Precision	Increase this value when the edges of soft shadows are speckled instead of smooth. Enter a value between 1 (speckled shadows) and 10 (smoothest shadows).
Indirect Illumination Options	
Compute Indirect and Sky Illumination	Select this option to include light from the sky and light that bounces off other objects. Clear it to omit these light sources from the rendered image. See Indirect illumination on page 1235.
Indirect Illumination Precision	Increase this value to achieve more detailed indirect illumination (the level of detail that is visible in indirect light) and shadows. Greater precision yields smaller subtle effects, usually in corners or below objects. Enter a value between 1 (less detail) and 10 (more detail).
Indirect Illumination Smoothness	Increase this value when indirect illumination looks splotchy or scaly. Greater precision yields smaller subtle effects, usually in corners or below objects. Enter a value between 1 (most splotchy) and 10 (least splotchy).
Indirect Illumination Bounces	Increase this value when areas of the scene that should be indirectly illuminated do not display as desired. This setting determines the number of times that indirect light bounces off objects in the scene. It controls the amount of realism in indirect lighting. With more bounces, light can penetrate further into a scene, resulting in more physically correct lighting and a brighter scene. Enter a value between 1 (less indirect illumination) and 100 (most indirect illumination). Typically, 3 bounces achieve sufficient results for indirect illumination. Further bounces can add more subtle effects, but they are often not significant.

Setting	Description
Daylight Portal Options (only applies to sunlit interiors): These settings are available only for interior views that include daylight. See Daylight Portals on page 1227.	
Windows	Whether the rendering engine calculates daylight portals for windows. By default, this setting is turned off.
Doors	Whether the rendering engine calculates daylight portals for doors that contain glass. By default, this setting is turned off.
Curtain Walls	Whether the rendering engine calculates daylight portals for curtain walls. By default, this setting is turned off.

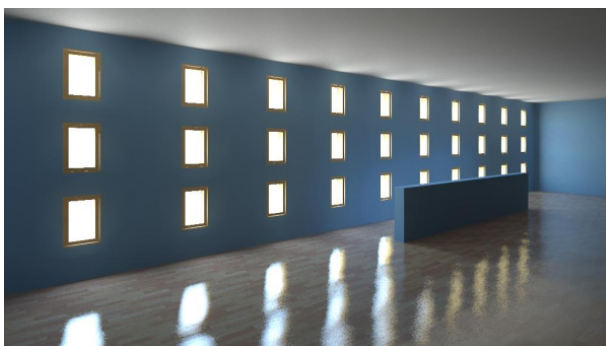
Daylight Portals

During the rendering process, daylighting is performed automatically. For advanced lighting quality in interior views, you can enable daylight portals, if needed. Daylight portals improve the quality of light that shines through windows, doors that contain windows or glass, and curtain walls.

Rendered image without daylight portals



Rendered image with daylight portals



Daylight portals are useful only for interior views that include sunlight. That is, on the Rendering dialog, under Lighting, the selected Scheme must be Interior: Sun only, or Interior: Sun + Artificial. (See [Controlling Lighting in a Rendered Image](#) on page 1228.)

By default, daylight portals are turned off. If a rendered image shows sunlight reflecting off surfaces, and the sunlight is speckled or splotchy, you may be able to improve the image by turning on daylight portals.

NOTE The use of daylight portals can significantly increase render time.

To turn on daylight portals for an interior view that includes sunlight, use the Render Quality Settings dialog. See [Defining a Custom Render Quality](#) on page 1225 and [Render Quality Settings](#) on page 1225.

Controlling the Size of the Rendered Image

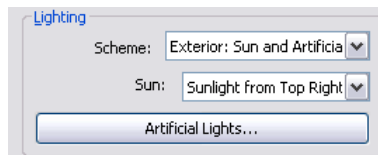
Before rendering a 3D view, you can use the following techniques to control its print size (in pixels) and file size (in bytes). The width and height of the rendered image display on the Rendering dialog under Output.

- **Render part of the 3D view:** Use a render region, a crop region, or a section box. See [Defining the View Area to Render](#) on page 1223.
- **Zoom in or out:** When creating a rendered image for screen output, you can zoom in or out to make the rendered image larger or smaller. See [Zoom Tool](#) on page 240.
- **Change the output resolution:** When creating a rendered image for printing, you can specify the image resolution in DPI (dots per inch). See [Defining Render Settings](#) on page 1221.
- **Change the view scale:** When rendering an image for printing, you can change the view scale to reduce the image size. See [View Scale](#) on page 243.

NOTE Higher resolution and larger image size increase render time. See [Render Performance and Image Size/Quality](#) on page 1236.

Controlling Lighting in a Rendered Image

- 1 In the [Rendering dialog](#), under Lighting, for Scheme, select the desired setting.



- 2 If you selected a lighting scheme that uses sunlight, for Sun, select the desired sun position.
To define new sun and shadow settings for the rendered image, select Edit/New. See [Defining the Sunlight Source for Shadows](#) on page 253. Click OK or Cancel to return to the Rendering dialog.
- 3 If you selected a lighting scheme that uses artificial light, click Artificial Lights to control artificial light in the rendered image.
You can create light groups and add lighting fixtures to light groups. You can also dim or turn on or off light groups or individual lighting fixtures. See [Light Groups](#) on page 1197. Click OK or Cancel to return to the Rendering dialog.

TIP To improve render performance, turn off any lights that are not required for the rendering. See [Turning Lights On and Off](#) on page 1202 and [Render Performance and Lighting](#) on page 1234.

- 4 If the lighting scheme is Interior: Sun only or Interior: Sun + Artificial, consider whether you want to turn on daylight portals.
During the rendering process, daylighting is performed automatically. For advanced lighting quality in interior views, you can enable daylight portals, if needed. Daylight portals improve the quality of the rendered image, but they can also increase render time. By default, daylight portals are turned off. See [Daylight Portals](#) on page 1227.
- 5 [Continue](#) to define other render settings.

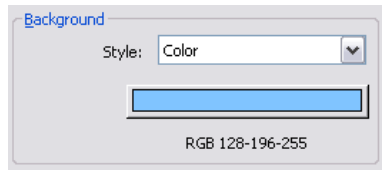
Specifying the Background for a Rendered Image

In the Rendering dialog, use the Background settings to specify a background for a rendered image. The background can display a solid color or sky and clouds.

NOTE When you create an interior view that includes natural light, the sky and cloud background can affect the quality of light in the rendered image. For more diffuse natural light, use more clouds.

To specify a solid color

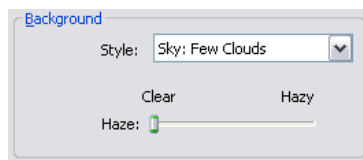
- 1 In the [Rendering dialog](#), under Background, for Style, select Color.



- 2 Click the color swatch.
- 3 In the Color dialog, specify the background color for the rendered image.
See [Colors](#) on page 525.
- 4 Click OK.
- 5 [Continue](#) to define other render settings.

To specify a background with sky and clouds

- 1 In the [Rendering dialog](#), under Background, for Style, select a Sky option that indicates the desired number of clouds.

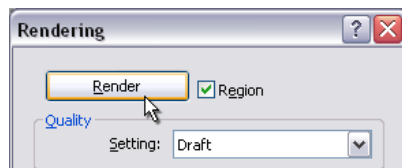


- 2 For Haze, drag the slider between Clear and Hazy.
- 3 [Continue](#) to define other render settings.

Creating the Rendered Image

Before starting the render process, see [Rendering Best Practices](#) on page 1233 for information about how you can improve performance.

After preparing the 3D view and using the Rendering dialog to select desired [settings](#), click Render to render the image.



Revit Architecture begins the rendering process, rendering one block of the image at a time. Revit Architecture displays a progress dialog, which shows information about the rendering process, including the numbers of daylight portals and artificial lights.

NOTE To cancel the rendering process before it completes, click Cancel.

When the rendering process is complete, Revit Architecture displays the rendered image in the drawing area. You can then do the following:

- Change render settings, and render the image again.
See [Defining Render Settings](#) on page 1221.
- Adjust exposure settings.
See [Adjusting the Exposure of a Rendered Image](#) on page 1230.
- Save the rendered image as a project view.
See [Saving the Rendered Image as a Project View](#) on page 1231.
- Export the rendered image to a file.
See [Exporting the Rendered Image to a File](#) on page 1231.
- Display the building model in the drawing area.
In the Rendering dialog, click Show the model. To display the rendered image again, click Show the rendering.

Adjusting the Exposure of a Rendered Image

After [rendering an image](#), you can adjust exposure settings to improve the image. If you know the desired exposure settings, you can set them before rendering the image. When you select a lighting scheme, the software uses default exposure settings, optimized for the type of light in the view.

If you adjust the exposure settings, the settings are saved as part of the view properties. The next time you render this view, the same exposure settings are used.

To adjust the exposure of a rendered image

- 1 In the [Rendering dialog](#), under Image, click Adjust Exposure.
- 2 In the Exposure Control dialog, specify the desired settings.
See [Exposure Control Settings](#) on page 1230.
- 3 Click Apply to see the results of the changes in the rendered image.
- 4 To return to the default exposure settings, click Reset to Default.
The default Exposure Value is optimized for the selected lighting scheme. Other exposure settings have neutral settings.
- 5 Click OK to return to the Rendering dialog.

Exposure Control Settings

When [rendering an image](#), exposure control (or tone mapping) is just as important as the lighting and materials used. Exposure control helps to convert real-world luminance values into a realistic image. It mimics the human eye response to luminance values with regard to color, saturation, contrast, and glare. Use the following settings to [adjust the exposure](#) of a rendered image.

Setting	Description
Exposure Value	Overall brightness of the rendered image. This setting is comparable to the exposure compensation setting in cameras with automatic exposure. Enter a value between –6 (brighter) and 16 (darker). The default value is different for each lighting scheme.

Setting	Description
Highlights	Light level for the brightest areas of the image. Enter a value between 0 (darker highlights) and 1 (brighter highlights). The default is 0.25.
Mid Tones	Light level for areas of the image whose brightness lies between the highlights and the shadows. Enter a value between 0.1 (darker mid tones) and 4 (brighter mid tones). The default is 1.
Shadows	Light levels for the darkest areas of the image. Enter a value between 0.1 (lighter shadows) and 4 (darker shadows). The default is 0.2.
White Point	Color temperature of the light sources that should display as white in the rendered image. This setting is similar to the White Balance setting on digital cameras. If the rendered image looks too orange, reduce the White Point value. If the rendered image looks too blue, increase the White Point value. If the scene is illuminated with daylight, use a value of 6500. If the scene is illuminated with incandescent lights, match the White Point value to the color temperature of the lights (see Initial Color Parameters on page 1189), or start with a value of 2800 and adjust it up or down as necessary to achieve the desired results.
Saturation	Intensity of colors in the rendered image. Enter a value between 0 (gray/black/white) and 5 (more intense colors). The default is 1.

Saving the Rendered Image as a Project View

After [rendering an image](#), you can save the image as a project view. In a project, rendered images display in the Project Browser under Views (all) ► Renderings. You can then place the rendered view on a sheet in a construction document set.

To save the rendered image as a project view

- 1 In the [Rendering dialog](#), under Image, click Save to Project.
- 2 In the Save to Project dialog, enter a name for the rendered view, and click OK.
- 3 (Optional) Place the rendered view on a sheet.
See [Adding Views to a Sheet](#) on page 1033.

Exporting the Rendered Image to a File

After [rendering an image](#), you can export the image to a file. This file is stored outside the project in the specified location. Revit Architecture supports the following image file types: BMP, JPEG, JPG, PNG, and TIF.

NOTE To preserve the alpha channel for transparency, use the PNG or TIF file format. If you plan to use the exported image in Adobe® Photoshop®, export to TIF for best results. (If you export to PNG and open the file in Adobe® Photoshop®, the background sky and clouds may not display.)

To export the rendered image

- 1 In the [Rendering dialog](#), under Image, click Export.
- 2 In the Save Image dialog, for Save in, navigate to the desired location.
- 3 For Files of type, select a file type.

4 For File name, enter a name for the image file.

5 Click Save.

Changing Render Settings for a View

You can define render settings for a 3D view before or after [rendering an image](#). These settings are saved as part of the view properties.

To change render settings for a view

1 In the Project Browser, under Views (all) ► 3D Views, right-click the view name, and click Properties.

2 In the Instance Properties dialog, under Camera, for Rendering Settings, click Edit.

The Rendering Settings dialog displays a subset of the settings in the Rendering dialog.

TIP These settings can be saved in a view template and applied to other 3D views. See [View Templates for Render Settings](#) on page 1232.

3 Specify the desired settings, as follows:

- Quality: See [Specifying the Render Quality](#) on page 1224.
- Lighting: See [Controlling Lighting in a Rendered Image](#) on page 1228.
- Background: See [Specifying the Background for a Rendered Image](#) on page 1229.
- Image: See [Adjusting the Exposure of a Rendered Image](#) on page 1230.

4 Click OK.

View Templates for Render Settings

A view template is a collection of properties that you define for views of a particular type. After [defining render settings](#) for a 3D view, you can store those settings in a view template. When you want to use the same render settings for another 3D view, apply the view template to that view.

A 3D view template can store the following render settings:

- Quality
- Lighting scheme and sun position
- Settings for artificial lights that are dimmed and turned on and off
- Background color or sky and cloud settings
- Exposure settings

Creating a View Template for Render Settings

The following is a basic procedure for creating a 3D view template for render settings, and applying it to other 3D views. For more information about view templates, see [View Templates](#) on page 507.

To create a view template for render settings

1 Open a 3D view, and define the render settings as desired.

See [Defining Render Settings](#) on page 1221.

- 2 Click View tab ► Graphics panel ► View Templates drop-down ► Create template from current view.
- 3 In the New View Template dialog, enter a name, and click OK.
The View Templates dialog displays the new view template name and its view properties.
- 4 (Optional) To check or change render settings for the view template, under View Properties, for Rendering Settings, click Edit. Change the settings as desired, and click OK.
Specify the desired settings, as follows:
 - Quality: See [Specifying the Render Quality](#) on page 1224.
 - Lighting: See [Controlling Lighting in a Rendered Image](#) on page 1228.
 - Background: See [Specifying the Background for a Rendered Image](#) on page 1229.
 - Image: See [Adjusting the Exposure of a Rendered Image](#) on page 1230.
- 5 Check the other view properties that are included in the view template. Change properties as desired. For any properties that you want to exclude from this view template, clear the Include option.
- 6 Click OK.

Now you can apply the view template to other 3D views, as desired. See [Applying a View Template](#) on page 509.

View Properties for Renderings

When you save a rendered image in the project, Revit Architecture stores properties for the image. To change its properties, under Views (all) ► Renderings, right-click the image name, and click Properties. Change the parameters as desired, and click OK.

Parameter	Description
Identity Data	
View Name	The name of the view, as it displays in the Project Browser and other areas of Revit Architecture.
Title on Sheet	The view title to display on sheets. See View Titles on Sheets on page 1059.
Default View Template	The view template to apply to the rendering. See View Templates on page 507.

Rendering Best Practices

The mental ray® rendering engine uses complicated algorithms to produce a photorealistic image from a 3D view of a building model. The amount of time required to generate the rendered image varies depending on many factors, such as the numbers of model elements and artificial lights, the complexity of the materials, and the size or resolution of the image. Furthermore, the interplay of other factors can affect render performance. For example, reflections, refractions, and soft shadows can increase render time.

Ultimately, render performance is a balance between the quality of the resulting image and the resources (time, computing power) that can be devoted to the effort. Low quality images are generally quick to produce, while high quality images can require significantly more time.

Before rendering an image, consider whether you need a high quality image or a draft quality image. In general, start by rendering a draft quality image to see the results of the initial settings. Then refine materials, lights, and other settings to improve the image. As you get closer to the desired result, you can use the low or medium quality setting to produce a more realistic image. Use the high quality setting to produce a final image only when you are sure that the material render appearances and the render settings will give the desired result.

The following topics describe some features and settings that can affect render performance.

The Rendering Process

In the Windows Task Manager, the rendering process is named `fbxooptender.exe`. When you render an image, the rendering process will use up to 4 CPUs. If other processes are also running, the rendering process releases some of the existing capacity to support those processes.

Before rendering an image, turn off active screen savers, and shut down any non-essential processes that use processor power. (For example, some web pages that use Flash graphics may slow down the rendering process.) Doing so makes more CPU capacity available to the rendering process and can reduce render time.

While rendering an image, you may want to use the Windows Task Manager to monitor processes. If `fbxooptender.exe` is not using close to 99% of processor power, other active processes may be interfering with the rendering process. Shut down non-essential tasks to make more processor power available for the rendering process.

Render Performance and the Building Model

One of the most effective ways to reduce the amount of time required to render an image is to reduce the number of model elements that the rendering engine must consider. Use one or more of the following strategies.

Hide unnecessary model elements

For example, if a rendered image will not show furniture that exists on the far side of an interior wall, hide the furniture in the view before rendering. By doing so, you reduce the number of elements that the rendering engine must consider during the rendering process. See [Hiding Elements in a View](#) on page 208.

Change the detail level

Change the view's detail level to coarse or medium. By reducing the amount of detail in the 3D view, you reduce the number of objects to render, and thus reduce render time. See [Specifying the Detail Level for a View](#) on page 513.

Reduce the view area to render

Render only the part of the 3D view that you need to show in the image, omitting areas that are not required. You can do this using a section box, a crop region, the camera clipping plane, or a render region. See [Defining the View Area to Render](#) on page 1223.

Render Performance and Lighting

The rendering process involves the simulation of light interactions with materials. As a result, render performance is significantly affected by lighting calculations. When preparing to render an image, consider the following.

Number of lights

Render time is directly proportional to the number of lights in the scene. In general, mental ray requires more time to render more lights. Consider turning off lights that are not required for the rendered image. See [Turning Lights On and Off](#) on page 1202.

In general, an interior view takes longer to render than an exterior view. An exterior view with no natural light (that is, at nighttime) that shows many interior lights turned on takes a long time to render.

Light source shape

More accurate lights require more render time. The Emit from Shape setting for a light source can impact render time. For example, point lights render faster than the other shapes. Line lights are slower. Rectangle and circle lights are slowest to render. See [Defining the Geometry of a Light Source](#) on page 1180.

Soft shadows

Revit Architecture uses area light sources to produce more realistic images. However, area shadows are expensive to compute. If you increase the quality of soft shadows, render time increases. (In the Render Quality Settings dialog, use the Soft Shadow options. See [Render Quality Settings](#) on page 1225.)

Indirect illumination

Indirect illumination simulates the interaction of light with the environment by bouncing light off surfaces, including surfaces that are not directly exposed to a light source. If you increase the precision of indirect illumination and the number of bounces, you can improve the smaller, subtle effects of lighting, and the amount of light in a scene. However, increasing the amount of indirect illumination also increases the time required to render the image. (In the Render Quality Settings dialog, use the Indirect Illumination options. See [Render Quality Settings](#) on page 1225.)

Section boxes and light groups

When you use section boxes to limit the geometry being rendered, you can significantly reduce the amount of time required to render an image. (See [Defining the View Area to Render](#) on page 1223.) You can also use light groups to turn off lighting fixtures, thus reducing the number of lights that will impact the rendered image. (See [Light Groups](#) on page 1197. Remember, however, that lights that are not within the view can still have a significant impact on the quality of the rendered image.) Section boxes exclude lights that are clipped. When planned carefully and with forethought, the combined use of section boxes and light groups can greatly reduce the amount of time required to render an image.

Render Performance and Materials

Materials simulate various effects such as reflections and textures. You specify the render appearance for each material using the Materials dialog. (See [Changing the Render Appearance of a Material](#) on page 475.)

When mental ray renders materials, its performance depends on the effects being simulated. In fact, complicated render appearances for materials can slow down the rendering process more than complicated geometry in the building model.

When preparing to render an image, consider the following.

How Colors and Patterns Affect Render Performance

The complexity and size of a color or pattern affect render speed. More complex patterns require the rendering engine to calculate more samples so it can capture the details. The rendering engine works best when it can identify areas of similar surface treatment and can estimate appearances over large homogeneous areas.

For example, a smooth monochrome surface renders more quickly than a smooth patterned surface. A large-scale pattern renders more quickly than a dense, intricate pattern. A detailed, perforated surface renders more slowly than a simple surface.

The material render appearances that require the most time to render are (from slower to slowest): metallic paint, flecked metal, hammered metal, water, frosted glass, and perforated metal. Slower render times for these materials are proportional to how much of the scene they cover.

At the draft to medium quality settings, complicated materials may show many artifacts (small inaccuracies or imperfections in the rendered image). Imperfectly reflective materials (such as wood floors and metal mullions) appear speckled. These issues can be improved by adjusting the Blurred Reflection Precision value. (See [Render Quality Settings](#) on page 1225.)

To improve the appearance of patterned surfaces and silhouettes without significantly increasing render time, adjust the Image Precision (Antialiasing) value. (See [Render Quality Settings](#) on page 1225.) To produce images with little lighting depth but crisp geometry, use the draft quality setting with a high value for Image Precision (Antialiasing), such as 6.

How Reflection Types Affect Render Performance

The render appearance of a material specifies its reflectivity. Revit Architecture can render matte reflections quickly. However, any material characteristic that causes visual distortions (such as blurred reflections or transparencies) requires more work to render, and so requires more render time.

Shiny and mirrored reflections are slightly more difficult to render than matte reflections. A fritted surface is more difficult to render than a smooth, glossy surface. Water is more difficult to render than glass. Metal with a patina or a hammered surface is more difficult to render than polished metal.

Blurred reflections are the most difficult to calculate. However, you can control the quality of blurred reflections to reduce the impact on render performance. (Use the Reflections and Transparency options. See [Render Quality Settings](#) on page 1225.)

How Refractions and Reflections Affect Render Performance

Refractive materials, like glass, usually involve reflections as well. As a result, these materials are more expensive (in time and resources) to render than others. Also, the average pane of glass has 2 layers or sides, requiring multiple layers of refraction. When rendering an image, all of the layers must be calculated so you can see through the glass. For example, you need at least 6 refractions to see through 3 panes of solid glass.

When rendering an image, you can specify the number of bounces off reflective surfaces (Maximum Number of Reflections), and the number of panes of glass for refractions (Maximum Number of Refractions). Higher settings generally result in longer render times. Blurry refractions increase render time further. (In the Render Quality Settings dialog, use the Reflections and Transparency options. See [Render Quality Settings](#) on page 1225.)

Render Performance and Image Size/Quality

The image size or resolution of a rendered image has a predictable effect on render time. The Image Precision (Antialiasing) setting affects render time in a similar way. (See [Render Quality Settings](#) on page 1225.) Higher values for image size, resolution, or precision require more time to generate the rendered image.

Effect of Increasing Image Resolution

If you double the image resolution (for example, from 75 dpi to 150 dpi) without changing other settings, render time can increase by 2 to 4 times. (Depending on the complexity of the image being rendered, the

increase in render time can vary from 1.9 to 3.9 times, with an average of 2.7 times the render time of the original 75-dpi image.)

If you double the resolution again (from the original 75 dpi to 150 dpi, then to 300 dpi), each jump in resolution increases render time by 2.7 times. Therefore, if you increase the resolution from 75 dpi to 300 dpi, the render time is typically increased 2.7×2.7 times, or about 7.3 times the original 75-dpi render time. If you increase the resolution from 75 dpi to 600 dpi, the render time is typically increased $2.7 \times 2.7 \times 2.7$ times, or about 19.7 times the original 75-dpi render time.

Checking the Image Size

When defining the view area to render, check that the image size is appropriate and reasonable. If you specify a very large image size, the render speed may be very slow.

- **Crop region:** When using a crop region to define the view area to render, you can specify the height and width of the crop region. (See [Resizing Crop Regions Explicitly](#) on page 215.) The crop region size defines the paper size of the rendered image.
- **Render region:** When using a render region to define the view area to render in an orthographic view, you can drag the render region boundary. ([Defining the View Area to Render](#) on page 1223.) The resulting height and width display in the Rendering dialog under Output.

See [Controlling the Size of the Rendered Image](#) on page 1228.

Troubleshooting Issues with Rendering

When rendering a 3D view, you may encounter the following issues.

Press Render to Update the Image

Error: Changes you have made to the rendering are not shown in this image. Press Render to update the image.

Issue: This message displays in the drawing area when you render an image and then change the render settings or the building model. It indicates that the rendered image is out of date.

Solution: To update the rendered image, click Render in the Rendering dialog.

Missing Images

Warning: The following render appearance images are missing.

NOTE If you see this warning during the rendering process, copy and paste the list of missing files into a text file or document. This strategy enables you to check on the status of these missing files later.

Issue: When mental ray cannot locate files used in render appearances (including decals), it continues the rendering process, and it renders that part of the view as black. (Click Cancel if you want to cancel the rendering process instead of proceeding.) For example, if an image file that defines a custom color or texture is missing, elements to which that material is applied display as black in the rendered image. Likewise, if a decal image file is missing, the decal displays as black.

Solution: Check the render appearances of the relevant materials. (See [Changing the Render Appearance of a Material](#) on page 475.)

When you move the mouse over the Image File field for a decal or color or bump pattern, Revit Architecture displays the path of the image file. Check whether the image file resides in the specified location. If not,

check whether the image file resides in a path specified on the Rendering tab of the Options dialog. (See [Additional Render Appearance Paths](#) on page 518.) If the Revit project was sent to you by another team member, you may need to request the relevant image files.

Not Enough Memory to Create the Rendered Image

Error: There is not enough memory to create the rendered image.

Issue: This message displays when you try to render an image, but the computer has insufficient memory to perform the operation.

Solution: To make more memory available for the rendering process, use one or more of the following strategies:

- Reduce the size of the image to be rendered. See [Controlling the Size of the Rendered Image](#) on page 1228 and [Render Performance and Image Size/Quality](#) on page 1236.
- Close unnecessary views in the Revit project.
- Close unnecessary applications.

Disk Space Insufficient for Rendering

Error: There is not enough space on drive X to create the temporary files that the rendering process needs.

Issue: This message displays when you try to render an image, but the disk drive has insufficient space or the image file size is too large.

Solution: To make more disk space available for the rendering process, use one or more of the following strategies:

- Reduce the size of the image to be rendered. See [Controlling the Size of the Rendered Image](#) on page 1228 and [Render Performance and Image Size/Quality](#) on page 1236.
- Make more disk space available on the disk drive.

Rendering Process Is Taking Too Long

Symptom: The rendering process is taking too long, or is taking longer than expected.

Issue: Many factors can affect the amount of time required to render an image, including image size, resolution, render quality settings, lighting, complex materials, and more.

Solution: See [Rendering Best Practices](#) on page 1233. That section describes many of the factors that affect render time. It also provides recommendations and tips on how to balance the need for a quality image with the amount of time required to render it.

Rendered Image Is Black

Symptom: All or part of the rendered image is black.

Issues and Solutions: If parts of the rendered image are black, some image files used by render appearances or decals may be missing. See [Missing Images](#) on page 1237.

If the rendered image is all black, it could be caused by the following:

- **No lights:** The render settings do not include natural or artificial light. For example, suppose you specify an interior lighting scheme that uses artificial lights only, but all interior lights are turned off. To correct this situation, in the Rendering dialog, check the lighting settings. Change them to include natural light or artificial light, or both. See [Controlling Lighting in a Rendered Image](#) on page 1228. If needed, turn on artificial lights. See [Turning Lights On and Off](#) on page 1202.
- **Exposure settings:** The exposure settings are not defined correctly. To correct this situation, check the exposure settings. In the Rendering dialog, under Image, click Adjust Exposure. See [Exposure Control Settings](#) on page 1230.

Rendered Image Is Washed Out or Faded

Symptom: The rendered image shows too much light, so it looks washed out or faded.

Issues and Solutions: To solve the problem, try the following:

- **Exposure:** Check the exposure setting. Try using a darker exposure. See [Adjusting the Exposure of a Rendered Image](#) on page 1230.
- **Initial Intensity:** The Initial Intensity settings for the light sources may be incorrect. In general, Luminous Flux (lumens) provides more accurate lighting in a rendered image than Wattage. Determine the manufacturer value for lumens, and enter this value for the Luminous Flux parameter of the Initial Intensity dialog. (See [Changing the Initial Intensity of a Light Source](#) on page 1196.)
- **Wattage and Efficacy:** If you specify a Wattage value on the Initial Intensity dialog, be sure to also specify a value for Efficacy. (If you change Wattage alone, you may make the light source unintentionally bright.) Efficacy is the amount of light (luminous flux, measured in lumens) produced by a light source as a ratio of the amount of energy consumed to produce it (measured in watts).
Examples: For a 100 watt tungsten incandescent (110 V), efficacy is 175. For a 32-watt fluorescent tube (T8), efficacy is 60.
After changing the Efficacy value, render the image again. Try adjusting the Efficacy value until you achieve the desired result in the rendered image.

Elements Are Gray in Rendered Image

Symptom: In the rendered image, some of the elements display as gray. They do not display render appearances as expected.

Issue: This problem occurs when you upgrade a Revit 2008 (or an earlier release) project that uses custom materials. During the upgrade process, Revit Architecture upgrades all standard materials to use the new render appearances. However, it cannot upgrade any custom materials.

Solution: Assign render appearances to the custom materials. See [Changing the Render Appearance of a Material](#) on page 475.

Entourage Did Not Render Correctly

Symptom: The 3D view contains entourage (such as cars and people), but it did not render properly.

Issue: This problem occurs when the entourage objects do not have render appearances assigned to them.

Solution: Assign render appearances to the entourage objects. See [Specifying a Render Appearance for an RPC Family](#) on page 1207.

Plants and Trees Are Missing from Rendered Image

Symptom: The 3D view includes plants and trees, but they do not display in the rendered image.

Issue: This problem can occur when you render an image in a project that was created using Revit 2008 (or an earlier release), and the plants were defined using AccuRender procedures. Revit Architecture no longer supports AccuRender procedures.

Solution: Edit the plant family properties to specify a render appearance. Then render the image again. See [Specifying a Render Appearance for an RPC Family](#) on page 1207.

Glass is Too Light or Too Dark

Symptom: Areas of glass or glazing in the rendered image appear darker or lighter than expected.

Issue: The render appearance for the glazing may not indicate the actual number of glass panes that are modeled in the geometry and rendered in the image.

Solution: Change the render appearance of the glazing material to increase or decrease the Sheets of Glass parameter. See [Changing the Render Appearance of a Material](#) on page 475 and [Glazing Properties](#) on page 481.

Rendered Image Is Poor Quality

Symptom: The rendered image has one or more of the following issues:

- It contains artifacts (small inaccuracies or imperfections in the rendered image).
- In some places, light reflecting on surfaces looks splotchy or speckled.
- Edges of model elements and their shadows are not crisp. Instead, the edges are soft and fuzzy.

Issue: These issues may be caused by inappropriate render quality settings, or the use of default settings.

Solution: Try adjusting the render quality settings to obtain the desired result. See [Render Quality Settings](#) on page 1225 and [Rendering Best Practices](#) on page 1233.

Rendered Image is Wrong Color

Symptom: In the rendered image, the lighting looks too blue or too orange.

Issue: This problem occurs when the white point needs to be adjusted.

Solution: Adjust exposure settings for the rendered image. See [Adjusting the Exposure of a Rendered Image](#) on page 1230.

- If the image looks too orange, reduce the White Point value.
- If the image looks too blue, increase the White Point value.

Light Source Shapes Do Not Display in Rendered Image

Symptom: The light does not display a self-luminous surface (glow) in the rendered image.

Issue: In the lighting fixture family, you specified an Emit from Shape of Circle or Rectangle. (See [Defining the Geometry of a Light Source](#) on page 1180.) In the lighting fixture parameters, you selected Emit Shape Visible in Rendering. (See [Parameters for Lighting Fixtures and Light Sources](#) on page 1182.) Therefore, you

expect the light to display a self-luminous surface in the rendered image. However, the luminous surface does not display because the Soft Shadows option is turned off.

Solution: Select the Soft Shadows option on the Render Quality Settings dialog. (See [Defining a Custom Render Quality](#) on page 1225 and [Render Quality Settings](#) on page 1225.) Then render the image again.

Solar Studies

In Revit Architecture, you can create solar studies of a project to evaluate the impact of natural light and shadows on the buildings and site. Exterior solar studies can show how shadows from terrain and surrounding buildings affect the site. Interior solar studies can show where natural light penetrates a building during specific times of the day and year. Solar studies yield valuable information that can help support effective passive solar design.

Related topics

- [Project Location and Orientation](#) on page 448
- [Defining the Sunlight Source for Shadows](#) on page 253

Creating Views for Solar Studies

To study the effect of light and shadow on a project, use 3D views of a building model. Typical plan views, such as floor plans and ceiling plans, do not display many elements in 3D, so no shadows will be cast from these elements. You can use 3D plan views, section views, and views created from callouts as a basis for solar studies. For more information, see [Project Views](#) on page 125.

To produce solar studies that accurately represent the position of the sun in relation to the project when Project North differs from True North, rotate the view to True North. See [Rotating a View to True North](#) on page 449.

As an alternative, when producing a still solar study, you can specify the sun's location relative to the view. See [Still Solar Studies Based on Azimuth and Altitude](#) on page 1243.

Creating a Solar Study




In Revit Architecture, you can create a solar study as either of the following:

- An animation, which is a series of frames that show shadow movement over a defined period of time.
- A still, which is a single frame that shows shadow patterns for a specific date and time.

You save solar study settings under a unique name so that you can view or modify the solar study at a later time.

To create a solar study

- 1 In a project, open a 3D view.
- 2 Customize the view as needed to enhance solar study analysis.
For example, you can use SteeringWheels and ViewCube options to adjust the view. See [Navigating Views](#) on page 217.
- 3 On the View Control Bar, for Model Graphics Style, select Hidden Line, Shading, or Shading with Edges.
You cannot see shadows using the Wireframe style.

- 4 Click View tab ► Graphics panel ►  (Graphic Display Options).
- 5 Under Sun and Shadows, for Sun Position, click .
- 6 In the Sun and Shadows Settings dialog, click the Still, Single-Day, or Multi-Day tab to create the desired type of solar study:
- **Still:** Creates a single frame showing shadow patterns for a specific location and time. For example, you can view shadow patterns for a project in Los Angeles, California, on May 10 at 3:55 PM.
 - **Single-Day:** Produces an animation that shows the movement of shadows at the project location during a defined range of time on a specific day. For example, you can track shadows from 7:00 AM to 7:00 PM on June 22.
 - **Multi-Day:** Produces an animation that shows the impact of shadows at the project location at a specific time of day over a defined range of days. For example, you can view shadow patterns at 2:00 PM every day from June 20 through June 25.
- The tab displays the predefined sun and shadow settings. To create a new sun and shadow setting, click Duplicate to copy an existing setting. In the Name dialog, enter a descriptive name, and click OK.
- 7 Specify settings for the solar study.
- For a still study, see [Specifying Settings for a Still Solar Study](#) on page 1242.
 - For a single-day study, see [Specifying Settings for a Single-Day Solar Study](#) on page 1244.
 - For a multi-day study, see [Specifying Settings for a Multi-Day Solar Study](#) on page 1245.
- 8 In the Graphic Display Options dialog, under Sun and Shadows, do the following:
- Select Cast Shadows.
This option has the same effect as clicking  (Shadows On) on the View Control Bar.
 - Select Use sun position for shaded display.
 - For Sun, adjust the amount of ambient light.
 - For Shadows, adjust the darkness of the shadows.
- 9 Under Edges, for Silhouette style, select the type of lines to use if the model graphics style is Hidden Line or Shading with Edges.
- 10 (Optional) Under Background, select Gradient background, and select the desired colors for the sky, horizon, and ground.
- 11 To test the new sun and shadow settings, click Apply.
- 12 When you are finished setting up the solar study, click OK.

Now you can preview a solar study animation, or export the solar study to one or more files. See [Previewing a Solar Study Animation](#) on page 1245 and [Exporting a Solar Study](#) on page 1246.

Specifying Settings for a Still Solar Study

After you perform the initial steps to [create a still solar study](#), decide whether to base the study on a project location (such as Los Angeles) or on azimuth and altitude values.

Still Solar Studies Based on Location

You can set up solar studies for the same building model in different locations. For example, if the same retail store will be constructed in Los Angeles and London, change the Place setting at the project level, and then export a solar study for each city location.


Use this procedure to specify the location settings for a still solar study after performing the initial steps to [create the study](#).

To create a still solar study based on location

- 1 On the Still tab of the Sun and Shadows Settings dialog, under Settings, select By Date, Time and Place.

The Place defined at the project level displays.

- 2 To change the place, do the following:

- a For Place, click .
- b On the Place tab of the Manage Place and Locations dialog, select a city or specify a latitude and longitude. Click OK.
See [Specifying the Project Location](#) on page 448.

- 3 In the Sun and Shadows Settings dialog, enter a date and time for the solar study.

- 4 To specify the level to be used for shadow display, select Ground Plane at Level, and select the level.

When you select Ground Plane at Level, Revit Architecture casts shadows on the specified level in 2D and 3D shaded views. When you clear Ground Plane at Level, Revit Architecture casts shadows on the toposurface, if one exists.

NOTE This option does not affect shadows in rendered images.

- 5 To test the new sun and shadow settings, click Apply.

- 6 When you are finished setting up the solar study, click OK.

Still Solar Studies Based on Azimuth and Altitude

Use this procedure to specify the azimuth and altitude settings for a still solar study after you perform the initial steps to [create the study](#).

To create a still solar study based on azimuth and altitude

- 1 On the Still tab of the Sun and Shadows Settings dialog, under Settings, select Directly.

- 2 Enter values for Azimuth and Altitude.

Azimuth is the bearing angle (180 degrees at mid-day). Altitude is the vertical angle between the horizon and the sun, as measured with a sextant. Altitude changes from day to day through the solar year.

- 3 To orient the sunlight along the orientation of the view, select Relative to View.

This option provides consistent shadow graphics on a series of elevations, regardless of their actual orientation.

To orient the sunlight along a True North-South trajectory, clear Relative to View.

- 4 To specify the level to be used for shadow display, select Ground Plane at Level, and select the level.

When you select Ground Plane at Level, Revit Architecture casts shadows on the specified level in 2D and 3D shaded views. When you clear Ground Plane at Level, Revit Architecture casts shadows on the toposurface, if one exists.

NOTE This option does not affect shadows in rendered images.

- 5 To test the new sun and shadow settings, click Apply.

- 6 When you are finished setting up the solar study, click OK.

Specifying Settings for a Single-Day Solar Study

A single-day solar study is an animation that shows the movement of shadows at a project location during a defined range of time on a specific day. For example, you can track shadows from 7:00 AM to 7:00 PM on June 22.

Changing the place allows you to set up solar studies for the same building model in different locations. For example, if the same retail store will be constructed in Los Angeles and London, change the Place setting at the project level, and then export a solar study for each city location.


Use this procedure after performing the initial steps to [create the study](#).

To specify settings for a single-day solar study

- 1 On the Sun and Shadows Settings dialog, click the Single-Day tab.

- 2 Select a solar study from the list.

- 3 To change the place, do the following:

- a For Place, click .

- b On the Place tab of the Manage Place and Locations dialog, select a city or specify a latitude and longitude. Click OK.

See [Specifying the Project Location](#) on page 448.

- 4 In the Sun and Shadows Settings dialog, for Date, specify the date for the solar study.

- 5 For Time Range, select Sunrise to sunset. Or to enter a time range for the solar study, clear Sunrise to sunset, and enter a start time and a stop time.

- 6 For Time Interval, select the amount of time to elapse between each image in the animation.

When you select a time interval, Frames displays the number of individual images that the solar study animation will contain.

- 7 To specify the level to be used for shadow display, select Ground Plane at Level, and select the level.

When you select Ground Plane at Level, Revit Architecture casts shadows on the specified level in 2D and 3D shaded views. When you clear Ground Plane at Level, Revit Architecture casts shadows on the toposurface, if one exists.

NOTE This option does not affect shadows in rendered images.

- 8 To test the new sun and shadow settings, click Apply.

- 9 When you are finished setting up the solar study, click OK.


Specifying Settings for a Multi-Day Solar Study

A multi-day solar study is an animation that shows the impact of shadows at a project location at a specific time of day over a defined range of days. For example, you can view shadow patterns at 2:00 PM every day from January 1 through March 31.

Changing the place allows you to set up solar studies for the same building model in different locations. For example, if the same retail store will be constructed in Los Angeles and London, change the Place setting at the project level, and then export a solar study for each city location.

Use this procedure after performing the initial steps to [create the study](#).


To create a multi-day solar study







- 1 On the Sun and Shadows Settings dialog, click the Multi-Day tab.
 - 2 Select a solar study from the list, or select the default: Multi-Day Solar Study – User Defined.
 - 3 To change the place, do the following:
 - a For Place, click .
 - b On the Place tab of the Manage Place and Locations dialog, select a city or specify a latitude and longitude. Click OK.
See [Specifying the Project Location](#) on page 448.
 - 4 In the Sun and Shadows Settings dialog, for Date, specify the start date and end date for the solar study.
 - 5 For Time, enter the time of day when the solar study is to show shadows for each day.
 - 6 For Time Interval, select the amount of time to elapse between each image in the animation.
When you select a time interval, Frames displays the number of individual images that the solar study animation will contain.
 - 7 To specify the level to be used for shadow display, select Ground Plane at Level, and select the level.
When you select Ground Plane at Level, Revit Architecture casts shadows on the specified level in 2D and 3D shaded views. When you clear Ground Plane at Level, Revit Architecture casts shadows on the toposurface, if one exists.
-
- NOTE** This option does not affect shadows in rendered images.
-
- 8 To test the new sun and shadow settings, click Apply.
 - 9 When you are finished setting up the solar study, click OK.

Previewing a Solar Study Animation

After you create a solar study animation, you can preview specific frames or the full animation using control buttons on the Options Bar.

To preview a solar study animation

- 1 In the Project Browser, double-click a view for which you created a solar study animation.
See [Creating a Solar Study](#) on page 1241.
- 2 Click View tab ► Graphics panel ►  (Graphic Display Options).


- 3 In the Graphic Display Options dialog, for Sun Position, select the desired solar study from the list.
- 4 Adjust other settings as desired.
- 5 Click OK.
- 6 On the View Control Bar, click  (Shadows On), and click Preview Solar Study.
- 7 To play the animation from start to finish, on the Options Bar, click  (Play).
- 8 To stop the animation, on the status bar, click Cancel.
- 9 To control the animation, use the following buttons on the Options Bar:
 - To move backward 10 frames, click .
 - To move forward 10 frames, click .
 - To display the previous frame, click .
 - To display the next frame, click .
 - To display a specific frame of the animation, for Frame, enter the frame number.

Exporting a Solar Study

In Revit Architecture, you can export solar studies to a variety of file formats. These files can be easily distributed and viewed by colleagues and clients. The export file types include AVI, JPEG, TIFF, BMP, and PNG. AVI files are standalone video files. All other export file types have a single-frame format, allowing you to save specified frames of an animation as separate image files.

NOTE When you want to export to a single-frame format, first create a folder in which to save the files (especially if you are exporting several frames). The export process saves each of the specified frames as a separate image file.

To export a solar study

- 1 In the Project Browser, double-click a view for which you created a solar study animation.
See [Creating a Solar Study](#) on page 1241.
- 2 If you plan to export a solar study using rendered images (instead of shaded views or hidden line views), check render settings for the 3D view.
See [Changing Render Settings for a View](#) on page 1232.
- 3 Click  ► Export ► Images and Animations ► Solar Study.
- 4 In the Length/Format dialog, under Output Length, select All frames to export the entire animation, or select Frame range, and specify the start and end frames in the range.
- 5 If you are exporting to an AVI file, enter the number of frames per second.
Based on the interval that you specify, Revit Architecture calculates the output length, and displays it under Total time.

6 Under Format, for Model Graphics Style, select one of the following:

- **Wireframe:** This option displays an image of the model with all edges and lines drawn, but with no surfaces drawn.
- **Hidden Line:** This option displays the image with all edges and lines drawn except those occluded by surfaces.
- **Shading:** This option displays the image with all surfaces shaded according to their material settings and project light locations.
- **Shading with Edges:** This option displays the image in shaded mode, but with all non-occluded edges drawn as well.
- **Rendering:** This option uses defined render settings to create a photorealistic image for each frame in the solar study.

7 Enter dimensions (in pixels) or a zoom percentage to specify the size of the frame in the export file.

If you enter a value for one dimension, Revit Architecture calculates and displays the value for the other dimension to maintain the proportions of the frame, and it displays the equivalent zoom percentage. Likewise, when you change the zoom percentage, Revit Architecture calculates and displays the equivalent dimensions.

8 Click OK.

9 In the Export Animated Solar Study dialog, under Save In, navigate to the target folder.

10 For File name, enter a file name.

11 For Files of type, select an export file type.

12 Click Save.

If you are exporting to a single-frame format, the animation plays while the files are being saved.

13 If you are exporting to an AVI file, do the following:

- a In the Video Compression dialog, select Full Frames (Uncompressed), or select one of the compressed video types.

Results from various video compression formats (Codecs) vary widely.

- b If Compression Quality is enabled, use the slider to specify the compression quality.

- c Click OK.

The animation plays while the AVI file is being saved.

NOTE Uncompressed AVI files can be zipped to reduce the file size. Typically, the AVI file can be played from within the ZIP file.

Working in a Team

20

You can work in a team in Revit Architecture using worksharing or linked models.

Worksharing allows simultaneous access to a shared model through use of a central file. Use worksharing when you are working with a single model (one RVT file) that will have multiple team members working on it.

Using linked models, project elements or systems are separated into individually managed models that can be linked together. Use linked models when your project contains distinct buildings, such as a campus, or when you are working with team members from other disciplines, such as structural engineers or MEP engineers. You can also use worksharing in linked models.

Worksharing is covered in this topic; for information on linked models, see [Working with Linked Models](#) on page 1277.

Worksharing Workflow

The following steps provide the general workflow for setting up and using workshared projects.

1 Select the project to share.

A workshared project is one that several team members need to work on at the same time. For example, a team may have different members assigned to work on specific functional areas, such as the interior layout, the exterior shell, and the furniture layout.

2 Enable worksharing.

When you enable worksharing, Revit Architecture creates the central file for the project. The central file is like the project database. It stores all changes made to the project and stores all current workset and element ownership information. It is recommended that after the central file is created, all work be done in local copies of the central file. All users will need to save a copy of the central file on their local network or hard drive. All changes can be published to the central file and all users can load other users' changes from the central file at any time.

See [Enabling Worksharing](#) on page 1250.

3 Optionally, set up worksets.

A workset is a collection of elements, such as walls, doors, floors, or stairs. When you enable worksharing, several default worksets are created (2 default user-created worksets, and worksets for the families that are loaded in the project, project standards, and project views). For more information, see [Default Worksets](#) on page 1254.

You can create worksets based on functional areas, such as interior, exterior, or site.

See [Setting Up Worksets](#) on page 1252.

4 Begin worksharing.

Team members create a copy of the central file on their local network or hard drive to begin using worksharing.

See [Using Workshared Files](#) on page 1257.

Worksharing Terminology

Term	Definition
worksharing	A design method that allows multiple team members to work on the same project file at the same time.
central file	The master project file for a workshared project. The central file stores the current ownership information for all elements in the project, and acts as the distribution point for all changes published to the file. All users save their own local copies of the central file, work locally, and then Synchronize with Central so that other users can see their work.
workset	A collection of elements in a project. A workset is typically a discrete functional area, such as interior, exterior, site, or parking. When you enable worksharing, you can divide a project into worksets, with different team members responsible for each workset.
active workset	The workset to which new elements are added. The active workset name displays on Collaborate tab ► Worksets panel.
element borrowing	Allows you to edit an element that you do not own. If no one owns the element, permission to borrow is automatically granted. If another team member is currently editing the element, that team member is the owner of the element and you must place a request to borrow the element from that team member.

Enabling Worksharing

Enabling worksharing involves creating a master project file, known as a central file, from an existing model.

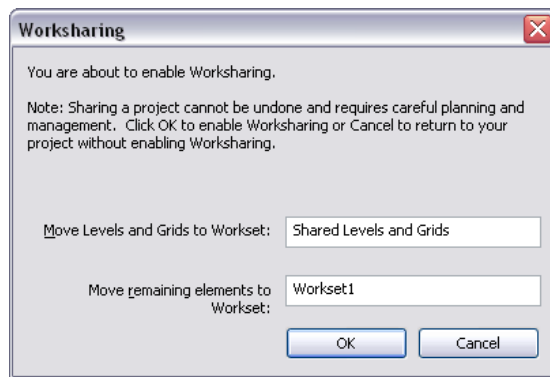
The central file stores the current ownership information for all worksets and elements in the project, and acts as the distribution point for all changes published to the file. All users should save their own local copy of the contents of the central file, edit locally in this workspace, and then synchronize with central to publish their save changes to the central file so that other users can see their work.

To enable worksharing and create a central file:

- 1 Open the Revit project file (RVT) you want as the central file.

- 2 Click Collaborate tab ► Worksets panel ► Worksets.

The Worksharing dialog displays, showing the default user-created worksets (Shared Levels and Grids, and Workset1).




3 If desired, rename the worksets.

4 In the Worksharing dialog, click OK.

The Worksets dialog displays.

5 In the Worksets dialog, click OK.

You do not need to create worksets at this point. For more information, see [Setting Up Worksets](#) on page 1252.

6 Click  ► Save As ► Project.

7 In the Save As dialog, specify a file name and directory location for the central file.

When specifying a name for the central file, use a naming convention that identifies the file as the central file (for example, OfficeBuilding_CentralFile.rvt).

NOTE Because legacy versions of Revit appended backup file names with a decimal point and a numerical string, you should not end your file name in this manner. Otherwise, a proper backup directory will not be created. For example, if you want to name your central file hotel.2010.rvt, consider naming it hotel_2010.rvt.

IMPORTANT When you save the central file, be sure that it is saved to a network drive that all team members have access to.

8 In the Save As dialog, click Options.

9 In the File Save Options dialog, select Make this a Central File after save.

NOTE If this is the first time you have saved after enabling worksharing, this option is selected by default and cannot be changed.

10 Select a default workset for local copies. See [Save Options](#) on page 115. In the Open workset default list, select one of the following.

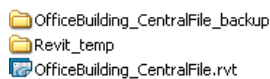
Workset Default	Description
All	Opens all worksets in the central file. Opening all worksets will significantly reduce performance in larger project files.
Editable	Opens all editable worksets. Depending on how many editable worksets are in the central file, this option may significantly reduce performance in larger project files.

Workset Default	Description
Last Viewed	Opens worksets according to their state from a previous Revit Architecture session. Only worksets open in the last session open. If you are opening the file for the first time, all worksets open.
Specify	Opens specified worksets. When you click Open, the Opening Worksets dialog displays. Initial status is based on when the file was last opened. Specify different worksets or click OK to confirm the default. Press <i>Ctrl+A</i> to select all worksets in this dialog.

11 Click OK.

12 In the Save As dialog, click Save.

The file is now the central file for the project. Revit Architecture creates the file in the directory you specified and creates a backup folder for the file. For example, if your central file is called OfficeBuilding_CentralFile, you see the Revit project file and the backup folder (OfficeBuilding_CentralFile_backup) in the directory.



The backup folder contains the backup information and editing permission information for the central file. For more information on backup files and folders, see [Workshared Project Rollback](#) on page 1271.

The Revit_temp folder contains files that provide progress information on operations (such as Synchronize with Central) to the Worksharing Monitor. For more information, see [Worksharing Monitor](#) on page 1274.

Related topics

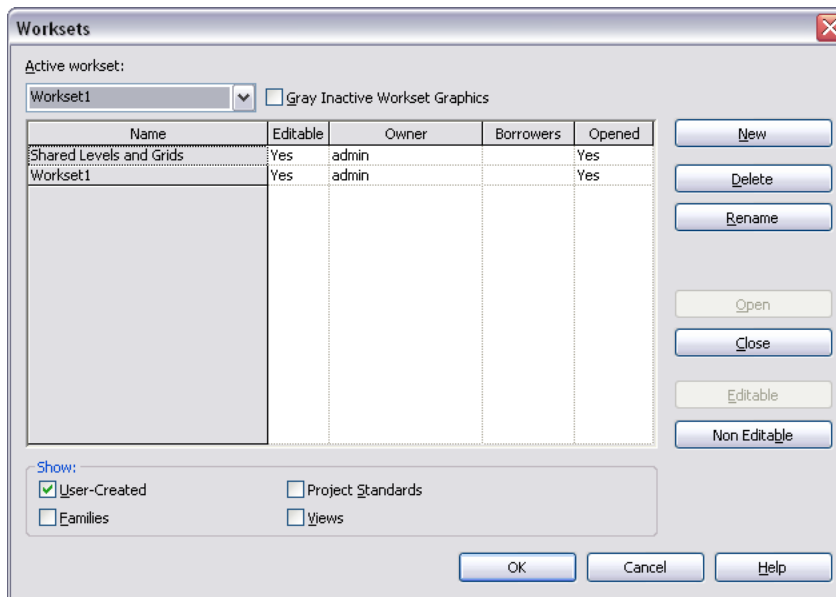
- [Worksharing Workflow](#) on page 1249
- [Setting Up Worksets](#) on page 1252
- [Using Workshared Files](#) on page 1257

Setting Up Worksets

A workset is a collection of elements, such as walls, doors, floors, or stairs. Only one user can edit each workset at a given time. All team members can view worksets owned by other team members, but they cannot make changes to them. This restriction prevents potential conflicts within the project. It is possible to borrow an element from a workset that you do not own. For more information, see [Borrowing Elements](#) on page 1259.

When you enable worksharing, several default worksets are created (two default user-created worksets, and worksets for the families that are loaded in the project, project standards, and project views). For more information, see [Default Worksets](#) on page 1254.

The following image shows the Worksets dialog, with the two default user-created worksets, Shared Levels and Grids and Workset1.



The Worksets dialog provides the following information:

- **Active workset** designates the workset to which new elements are added. The active workset can be a workset that is editable by you or one that is owned by another team member. You can add elements to worksets you do not own.

NOTE The active workset name also displays on the Worksets panel of the Collaborate tab.

- **Gray Inactive Workset Graphics.** Displays all elements in the drawing area that are not part of the active workset as gray. This has no effect on printing.
- **Name.** Indicates the name of the workset. You can rename all user-created worksets.
- **Editable.** Indicates the editable status of a workset. You cannot change editable status until you synchronize with central.
- **Owner.** Indicates the owner of the workset. If the Editable status of the workset is Yes, or you change the Editable status of the workset to Yes, then you are the owner of the workset. The Owner value is the user name that is listed on the General tab of the Options dialog. For more information on the Options dialog, see [Options](#) on page 516.
- **Borrowers.** Lists the users who are currently borrowing an element from the workset. If there is more than one borrower, you can view the list of borrowers from the drop-down list.
- **Opened.** Indicates if a workset is open (Yes) or closed (No). Elements in open worksets are visible in the project, elements in closed worksets are not.
- **Show.** Allows you to show or hide the different types of project worksets (User-Created, Families, Project Standards, Views) that appear in the Name list.

Worksets and Element Borrowing

Generally, it is recommended that you work in your local copy of the central file and not make worksets editable. When you edit an element that is not being edited by another team member, you automatically become the borrower of the element and can make the changes you need. It is recommended that you synchronize with central frequently as you work. Synchronizing relinquishes borrowed elements by default, allowing other team members to edit them.

Use worksets when you want to reserve parts of a project so that only the assigned user can edit the elements in that workset. Also consider these benefits for creating worksets:

- **Convenience for editing**
Dividing a project into worksets makes it easier to make whole sections of a project editable at once.
- **Visibility control**
You can control overall visibility in a project when you link Revit models into other Revit projects. For example, it is often convenient to turn off visibility of the Shared Levels and Grids workset when linking Revit models so that you do not have to turn off levels and grids individually in each view.

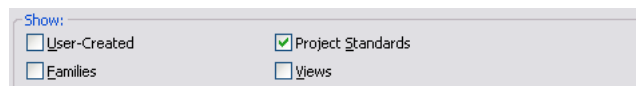
Default Worksets

When you enable worksharing, Revit Architecture creates default worksets and assigns project elements and settings to these worksets. The default worksets are:

- **User-created.** Revit Architecture creates 2 default user-created worksets.
 - **Shared Levels and Grids.** Contains all existing levels, grids, and reference planes. You can rename this workset.
 - **Workset1.** Contains all existing model elements in the project. When you create worksets, you can reassign elements from Workset1 into the appropriate workset. You can rename this workset, but you cannot delete it.
- **Families.** Each family that is loaded in the project is assigned to a separate workset. You cannot rename or delete family worksets.
- **Views.** Contains all project view worksets. For example, Floor Plan Level 1 view is assigned to a workset called View: "Floor Plan Level 1". View worksets contain view properties and any view-specific elements, such as annotations, dimensions, or text notes. When you add view-specific elements to a view, they are automatically added to the appropriate view workset.
You cannot make a view workset the active workset, but you can change its editable status so that you can modify a view-specific element (for example, a section in a plan view). If the associated workset for the section view is not editable by you, change the editable status of the workset so that you can edit it. See [Making Worksets Editable](#) on page 1263.
You cannot reassign view-specific elements from a view workset to another workset. View worksets cannot be renamed or deleted.
- **Project Standards.** Contains all project-wide settings defined for the project (for example, line styles and fill patterns). You cannot rename or delete project standard worksets.

For a complete list of project standard worksets:

- 1 In a workshared file, click Collaborate tab ► Worksets panel ► Worksets.
- 2 In the Worksets dialog, select only Project Standards in the Show field.



All project standards worksets display in the Name column.

Considerations for Worksets

In general, when [Setting Up Worksets](#) on page 1252, you should consider the following:

■ Project size

The size of the project may affect the way you enable worksharing for the team. In general, elements that are edited together should be in one workset. You do not need to create a workset for each floor of the building. In a multistory structure, however, you may want to create a workset for a set of building elements that only appear on one floor, such as a tenant interior.

If the floor plate of a project is too large to fit on a sheet and you need to split it up, you may want to consider creating a workset for each side of the building.

■ Team member roles

Typically, designers work in teams, with each assigned a specific functional task. Each team member has control over a particular portion of the design (for example, interior, exterior, or site). The workset structure for the project can reflect this breakdown of tasks, and you can name the worksets accordingly.

■ Worksets and templates

Worksets cannot be included in templates.

■ Default workset visibility

The performance of Revit Architecture improves if some worksets are not visible by default. This visibility control eliminates the time required to draw additional views of the project.

To identify visibility requirements, determine the frequency with which the elements in the workset display in the project. Under this guideline, you might have an exterior workset visible by default, while a specific furniture workset would not be.

■ Groups and families

Groups and families have a type workset and an instance workset that do not have to be the same.

All elements in a group are in the group instance workset. To edit the group, make the group type workset editable or borrow the group type. To modify the elements inside a group, make the group instance workset editable. You can determine which worksets the elements are in by accessing the element properties. If you use element borrowing to check out a group instance, Revit Architecture automatically borrows all elements in the group.

Creating Worksets

- 1 Open your local copy of the central file, or open the central file.
- 2 Click Collaborate tab ► Worksets panel ► Worksets.
- 3 In the Worksets dialog, click New.
- 4 In the New Workset dialog, enter a name for the new workset (for example, Interior).
- 5 If you want the workset to display in all open and new views, select Visible by default in all views. Clear this option if you want the workset to display only in views where you specifically turn on the visibility.

You can change the visibility of worksets later in the Visibility/Graphics dialog. For more information, see [Controlling Workset Visibility](#) on page 1265.

IMPORTANT Performance improves if new worksets are not visible by default. To identify visibility requirements, determine the frequency with which the elements in the workset will display in the project. Under this guideline, you might have an exterior workset visible by default, while a more specific workset would not be.

- 6 Click OK.

The new workset displays in the list of worksets; it is editable, and your user name displays for Owner.

If you are setting up a workshared file for your team and want to assign owners to each workset, each team member must open their local copy of the central file, select the workset in the Worksets dialog, and then select Yes in the Editable column, or click the Editable button.

7 When you finish creating worksets, click OK to close the Worksets dialog.

8 If you have added only one new workset, Revit Architecture prompts you to make the new workset active. Click Yes or No.

Adding Elements to a Workset

1 Click Collaborate tab ► Worksets panel, and select the workset from the Active Workset drop-down.

NOTE You can select a non-editable workset as the active workset. If you place an element in a non-editable workset, the element becomes non-editable after you synchronize with central. If you add view-specific elements, such as detail lines or dimensions, they are added to the workset of the active project view.

2 If you want all elements that were not created in the active workset to display as gray, click Collaborate tab ► Worksets panel ► Gray Inactive Worksets.

3 Add the necessary elements to the [Drawing Area](#) on page 97.

Reassigning an Element to a Different Workset

1 In the drawing area, select an element. For this example, a wall is chosen.

NOTE If you select several elements, and include view-specific elements (for example, tags) you will not be able to edit the Workset parameter. To automatically filter out elements that you cannot edit, on the Status Bar, select Editable Only before making your selection. Alternatively, you can click Multi-Select tab ► Filter panel ► Filter to remove any view-specific elements from your selection.

If the selection includes non-editable elements, right click it and select Make Elements Editable.

2 Click Modify Walls tab ► Element panel ► Element Properties.

3 In the Instance Properties dialog, locate the Workset parameter under Identity Data.

4 Click in the Value column for the parameter, and select a new workset.

5 Click OK.

Changing the Editable Status of a Workset

NOTE You can only change the editable status of worksets that are not owned by another user.

1 Click Collaborate tab ► Worksets panel ► Worksets.

2 In the Worksets dialog, click the Editable value next to the workset name, and select Yes or No. Alternatively, you can select the workset name, and click Editable or Non Editable.

If you change the editable status before you synchronize with central, Revit Architecture informs you that you remain the borrower of the elements you changed in the workset.

3 Click OK to close the Worksets dialog.

Renaming Worksets

You can rename user-created worksets.

NOTE You must be the owner of the workset to rename it.

- 1 Click Collaborate tab ► Worksets panel ► Worksets.
- 2 In the Worksets dialog, select the name of the workset and click Rename.
- 3 In the Rename dialog, enter a new name.
- 4 Click OK twice.

Deleting Worksets

NOTE You must be the owner of the workset to delete it.

- 1 Click Collaborate tab ► Worksets panel ► Worksets.
- 2 In the Worksets dialog, select the name of the workset you want to delete, and click Delete.
The Delete option is not available if another user is editing the workset.
- 3 In the Delete Workset dialog, select either to delete the elements in the workset or move them to another workset.
- 4 Click OK twice.

NOTE You cannot delete the Workset1, Project Standards, Families, or View worksets.

Using Workshared Files

One of the key features of worksharing is the ability for each team member to make changes to a local copy of the master project file (the central file) simultaneously. On many projects, team members are assigned a specific functional area to work on (for example interior, exterior, or site). Revit Architecture projects can be subdivided into worksets to accommodate such environments.

Typical worksharing tasks include the following:

- **Create a local copy of the central file.**

It is generally recommended that you create a local copy of the central file every day. After you create a local copy of the central file, this is the file you work in.

See [Creating a Local Copy of the Central File](#) on page 1258.

- **Open and edit your local copy of the central file.**

You can make edits by borrowing elements or using worksets.

See [Editing Workshared Projects](#) on page 1258.

- **Publish your changes to the central file, or get the latest changes from the central file.**

Publishing your changes is known as synchronizing with central. You can update your local copy of the central file without synchronizing with central by reloading the latest updates from the central file. Also, when you Synchronize with Central, your local copy of the central file also updates with the latest changes other team members have saved to the central file.

See [Saving Workshared Files](#) on page 1265 and [Loading Updates from the Central File](#) on page 1269.

- **Work offsite or offline.**

You do not have to be connected to a network to make your changes, or to open or edit worksets. This is useful for team members who work offsite and access the central file remotely.


WARNING Working offline can put your project at risk.

See [Working Offsite and Offline](#) on page 1269.

Creating a Local Copy of the Central File

It is good practice to create a local copy of the central file every day. Creating a new local copy ensures a local copy is always on your hard drive each time you begin modifying a project.

Creating a Local Copy of a Central File from the Open Dialog


- 1 Click  ► Open.
- 2 In the Open dialog, navigate to the folder where the central project file resides and select it.
This procedure cannot be used for multiple files at one time.
- 3 Verify that Create New Local is selected in the worksharing section.

NOTE If you select Detach from Central, then Create New Local will be cleared. Clear both options to open the central file itself instead of a copy.

- 4 Click Open.

If you are already working in the central file, use Save As to create a local copy.

Creating a Local Copy from an Open Central File

- 1 Click  ► Save As.
- 2 In the Save As dialog, navigate to the desired location on your local network or your hard drive.
- 3 Enter a name for the file, and click Save.

Editing Workshared Projects

When using a workshared project, you can edit individual elements, or you can edit worksets. When you checkout an individual element or a whole workset, the elements are visible to other users, but are not editable until you relinquish the borrowed element or workset.

When you request to borrow an element that is not owned by anyone, permission to edit the element is automatically granted. If you need to modify an element that is owned by another team member, you can request to borrow just that element.

NOTE To edit an element or a workset, they must be up-to-date. If you attempt to edit an element or a workset that is not up-to-date, you are prompted to update your local copy of the central file, so that you have all of the latest changes.

Borrowing Elements

You can edit an element without having ownership of the workset it belongs to. To do this, you borrow the element from the workset. The borrowing process is automatic unless another user is editing the element or the workset it belongs to. If this occurs, you can submit a request to borrow the element. When your request is granted, you can edit the element. If changes were made to the element, you are prompted to reload the latest changes from the central file before you can edit the element.

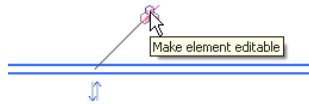
When you borrow an element from a workset, your name is listed in the Worksets dialog as a borrower. Your name also displays in the Instance Properties dialog for the Edited by parameter.


The simplest way to borrow an element is to make a change to the element. If the workset to which the element belongs is not owned by another user, you automatically become the borrower of the element and can make changes.

To borrow an element:

- 1 Select an element that is not editable by you. Be sure that the Editable Only option on the Status Bar is not selected.

Elements that are not editable by you display the Make element editable icon, when you select them in the drawing area.



- 2 Click  (Make element editable) in the drawing area, or right-click the element, and click Make Elements Editable.

If no one else is editing the element, it opens for you to edit.

If another team member is editing the element or has ownership of the workset to which the element belongs, a message displays indicating that you cannot edit the element until the other team member (the owner) relinquishes it.

NOTE If you try to make a change to an element that is being editing by another team member, the same message displays, allowing you to place a request to borrow the element.

- 3 In the Error dialog, click Place Request.

The Check Editability Grants dialog displays.

- 4 Ask the owner to approve your request.

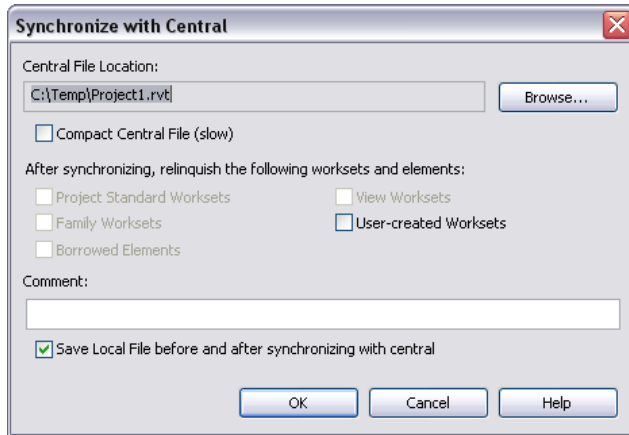
The owner does not receive automatic notification of your request. You must contact the owner.

NOTE Your request is granted automatically if the owner synchronizes with central and relinquishes the element.

- 5 You can leave the Check Editability Grants dialog open, so that you can check to see if your request has been granted, or you can click Continue to close the Check Editability Grants dialog and continue working. If you tried to edit the element, click Cancel in the error dialog to cancel the edit.

NOTE If you close the Check Editability Grants dialog, you will not be able to reopen it. To check the status of your request, ask the owner or click Collaborate tab ► Synchronize panel ► Editing Requests to review pending requests.

When you synchronize with central, borrowed elements are relinquished by default. You can keep them by clearing Borrowed Elements in the Synchronize with Central dialog.



Granting a Request to Borrow an Element

This is an explicit granting process. There is also an implicit granting process that occurs when you Synchronize with Central and relinquish the requested elements.

- 1 After being notified of a pending request, click Collaborate tab ► Synchronize panel ► Editing Requests.

NOTE Notification of a pending request is not automatic. A colleague should inform you, independent of Revit Architecture, when they need to borrow an element from you.

- 2 In the Editing Requests dialog, expand Others' pending Requests.
- 3 Select the request. It has a time stamp and the user name of the person submitting the request. You can expand the request to see the element name. To view the element, select it from the list and, if the element is not visible in the current view, click Show.

NOTE If you have modified the requested element, and you have not saved your changes to the central file, an asterisk appears next to the request.

- 4 Click Grant or, if you do not want the other user to borrow this element, click Deny/Retract. You can also use Deny/Retract to withdraw your own request to borrow an element.

NOTE If you try to grant a request that has an asterisk next to it, Revit Architecture notifies you that you have not saved your changes to central. You must either save your changes to central and then grant the request, or you must relinquish your elements without saving to central. For more information, see [Relinquishing Ownership without Synchronizing with Central](#) on page 1269.

Related topics

- [Relinquishing Unchanged Borrowed Elements](#) on page 1261
- [Viewing Requests for Borrowed Elements](#) on page 1261
- [Retracting a Request to Borrow an Element](#) on page 1261

Relinquishing Unchanged Borrowed Elements

If you borrow an element and do not make any changes to it, you can relinquish it.

- 1 Click Collaborate tab ► Worksets panel ► Worksets.
- 2 Select the workset to which the element belongs.
- 3 Click Non Editable.

Viewing Requests for Borrowed Elements

When you initially make a request to borrow an element, you can check the status of the request in the Check Editability Grants dialog. If you close this dialog, and continue working, you can check to see if your request is still pending. You can also check status of a request by asking the owner if it was granted or denied.

To view pending requests:

- 1 Click Collaborate tab ► Synchronize panel ► Editing Requests.
- 2 Expand My pending Requests.
If your request is listed, it is still pending.

Retracting a Request to Borrow an Element

- 1 Click Collaborate tab ► Synchronize panel ► Editing Requests
- 2 Under My pending Requests, select the request.



- 3 Click Deny/Retract.
- 4 Click Close.

Outdated Workshared Elements

If another user changes an element and publishes the changes, that element in your local file is outdated. It cannot be edited (even if you borrow it) until you Reload Latest (see [Loading Updates from the Central File](#) on page 1269) or synchronize with central.

Using Worksets

When you work on a workshared project, you specify an active workset. Each new model element you add to the project is then contained in the active workset. View-specific elements, such as annotations and dimensions, are placed in the workset for the current view.

The general workflow for using worksets is:

- 1 Open worksets so they are visible in the project. See [Opening Worksets](#) on page 1262.
- 2 Make the workset editable. See [Making Worksets Editable](#) on page 1263.
- 3 Edit a workset. See [Editing a Workset](#) on page 1263.


- 4 Synchronize with the central file or reload the latest changes from the central file. See [Saving Workshared Files](#) on page 1265 and [Loading Updates from the Central File](#) on page 1269.
- When you Synchronize with Central, the latest changes from the central file are loaded before saving.

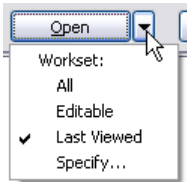
Opening Worksets

When you open a workshared project, you can select which worksets to open. When you open only selected worksets and leave others closed, program performance improves. Closed worksets are not visible in a project, so less time is required for common operations such as opening files, opening new views, redrawing the screen, and snapping.

You can open worksets from the Open dialog when you initially open your workshared project, or you can open them from the Worksets dialog in the project.

To open worksets from the Open dialog:

- 1 Click  > Open > Project.
- 2 Navigate to your local copy of the central file, and select it.
- 3 Select an option from the Open list. See [Save Options](#) on page 115.



Workset Default	Description
All	Opens all worksets in the central file. Opening all worksets will significantly reduce performance in larger project files.
Editable	Opens all editable worksets. Depending on how many editable worksets are in the central file, this option may significantly reduce performance in larger project files.
Last Viewed	Opens worksets according to their state from a previous Revit Architecture session. Only worksets open in the last session open. If you are opening the file for the first time, all worksets open.
Specify	Opens specified worksets. When you click Open, the Opening Worksets dialog displays. Initial status is based on when the file was last opened. Specify different worksets or click OK to confirm the default. Press Ctrl+A to select all worksets in this dialog.

4 Click Open.

To open worksets from the Worksets dialog:

- 1 Open your local copy of the central file.
- 2 Click Collaborate tab ► Worksets panel ► Worksets.
- 3 In the Worksets dialog, select the desired workset, and click Open, or, under Opened, click Yes.
- 4 Click OK.

Making Worksets Editable

There are various methods you can use to make worksets editable.

To make worksets editable from the Worksets dialog:

- 1 Open your local copy of the central file.
- 2 Click Collaborate tab ► Worksets panel ► Worksets.
- 3 In the Worksets dialog, to filter the display of worksets, make the appropriate selections under Show. For example, to see the Project Standards worksets, select Project Standards.
- 4 Click under Editable for the workset, and select Yes. Alternatively, you can select the workset name, and click Editable.

NOTE If a workset is owned by another user, you cannot change its editable status.

- 5 Repeat the previous step for as many worksets as you want to edit.

TIP To check out multiple worksets at once, click the workset name under the Name column to select it, hold *Ctrl* or *Shift* and select other worksets, and then click Editable. You can select all worksets by pressing *Ctrl+A*.

- 6 Click OK.

When you click OK, ownership information is communicated to the central file and to all local copies of the central file, so that all team members have the current ownership information.

To make worksets editable by selecting an element

In the drawing area, right-click an element, and click Make Worksets Editable.

To make project view worksets editable from the Project Browser

In the Project Browser, right-click a project view, and click Make Workset Editable.

To make a sheet view workset editable

In the Project Browser, right-click a sheet view, and click Make Workset Editable With All Views. The sheet view workset and all the project view worksets that are on the sheet are now editable.

Use the Make Workset Editable option if you only want to make the sheet editable. If you already own the workset, this option is not available.

Editing a Workset

- 1 Click Collaborate tab ► Worksets panel, and select the workset from the Active Workset drop-down.
- 2 If you want all elements that are not in the active workset to be gray, click Gray Inactive Worksets.

3 Edit or add elements in the workset, as necessary.

NOTE If you add view-specific elements, such as detail lines or dimensions, they are added to the workset of the active project view.

Related topics

- [Reassigning an Element to a Different Workset](#) on page 1256
- [Editing Workshared Projects](#) on page 1258
- [Making Worksets Editable](#) on page 1263

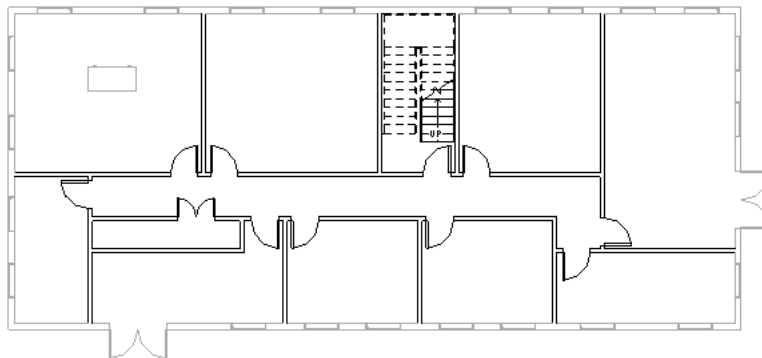
Visually Distinguishing Active Workset Elements

All elements that are not in the active workset can display as gray in the drawing area. Temporary elements, such as temporary dimensions and controls, do not display in gray. This option has no effect on printing, but helps to prevent adding elements to an undesired workset.

To visually distinguish the active workset:


- 1 Click Collaborate tab ► Worksets panel ► Worksets.
- 2 In the Worksets dialog, select Gray Inactive Workset Graphics, and click OK.
Alternatively, Click Collaborate tab ► Worksets panel ► Gray Inactive Worksets.

The following image shows a project floor plan where the Interior Layout workset is active, and all other worksets are gray.



Filtering Non-Editable Workset Elements from Selection

When you select elements in the drawing area, you can filter any that are non-editable. This option is not selected by default.

- 1 On the Quick Access toolbar, click  (Modify).
- 2 On the Status Bar, select Editable Only.
- 3 In the drawing area, make your selection.

Controlling Workset Visibility

- 1 Click View tab ► Graphics panel ► Visibility/Graphics.
- 2 Click the Worksets tab.
- 3 Use the following options as needed to specify which worksets to display:
 - Under Selection, click All to select all worksets on the tab. When all worksets are selected, the check boxes act as a single entity: select one to select all, or clear one to clear all.
 - Click None to clear the selection of any worksets.
 - Click Invert Selection to switch the selection of rows between ones that are selected and ones that are not. For example, if 6 rows are selected and you click Invert Selection, those 6 rows are no longer selected and all others are.
- 4 Click OK.

Saving Workshared Files

When saving the changes in your local workshared file, you can do either of the following:

- Synchronize with Central
- Save locally

When you Synchronize with Central, the changes you made to your local file are saved to the central file. In addition, any changes made by other team members to the central file since the last Synchronize with Central or Reload Latest, are copied to your local file. Any elements you borrowed are relinquished by default when you Synchronize with Central.

Between synchronizations with the central file, you should save changes to the local file frequently. You might want to establish specific times throughout the day when each team member will be synchronizing with central. This ensures that team members are not trying to Synchronize with Central at the same time. At the end of the day, you should relinquish the elements you borrowed and the worksets you own.

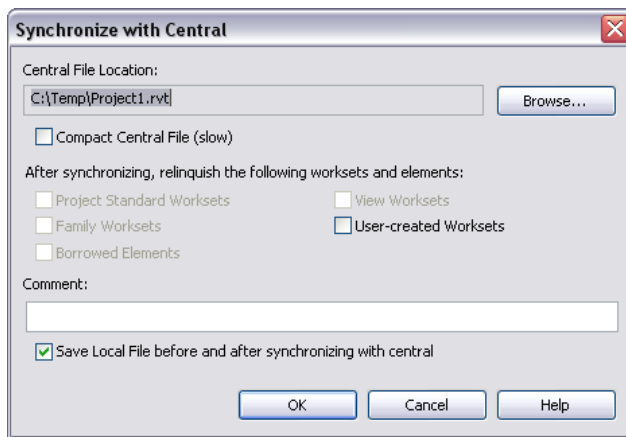
You save your local file the same way you save a project file that does not use worksharing. For more information, see [Saving Revit Files](#) on page 114. By default, you automatically save the changes in your local file when you synchronize with central.

You can specify save reminders for saving local files and saving to central. For more information, see [Setting Save Reminders](#) on page 115.

Synchronizing with the Central File

To Synchronize with Central: Click Collaborate tab ► Synchronize panel ► Synchronize with Central drop-down ► Synchronize Now.

If you want to modify the Synchronize with Central settings before you synchronize with central: Click Collaborate tab ► Synchronize panel ► Synchronize with Central drop-down ► Synchronize and Modify Settings. The Synchronize with Central dialog displays.



1 In the Synchronize with Central dialog, verify the location of the central file.

If necessary, click Browse to specify a different path for the central file. Specify the new path in the Central File Location dialog, and click OK.

2 Select Compact Central File to reduce file size when saving.

NOTE Selecting this option increases the time needed to save.

3 Under After synchronizing, relinquish the following worksets and elements, select from the following options:

- To make your changed worksets and elements available to other users, select the appropriate check boxes.
- To synchronize the changes to central but keep the worksets and elements editable, clear the appropriate check boxes.

4 If desired, enter a comment that is saved to the central file.

You can see all comments using the Show History tool. See [Viewing Workshared File History](#) on page 1272.

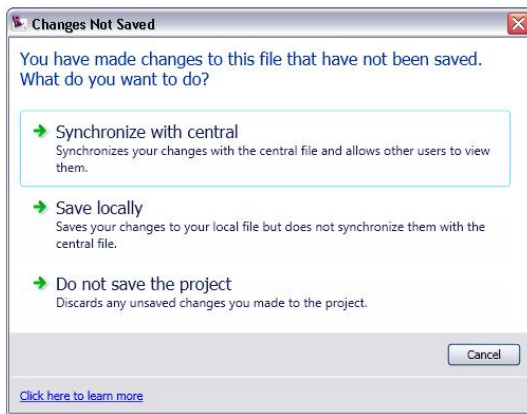
5 Verify that Save local file before and after synchronizing with central is selected to ensure your local file remains synchronized with central.

6 Click OK.

Your changes are saved to the central file and any changes from other team members are copied to your local file.

Closing Workshared Files without Saving

If you close your local file without saving, the Changes Not Saved dialog displays.



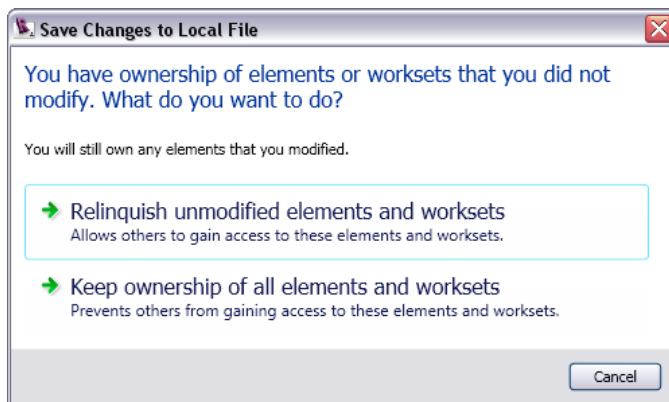
The following sections describe each of these options.

Synchronize with Central

Synchronize with central saves your changes to the central file. The default options are selected including saving your changes to the local file. Also, any changes that have been saved from other team members are copied to your local file.

Save Locally

Save locally saves your changes to the local file without synchronizing them with the central file and displays the Save Changes to Local File dialog. Because you did not Synchronize with Central, you still own any elements you modified.

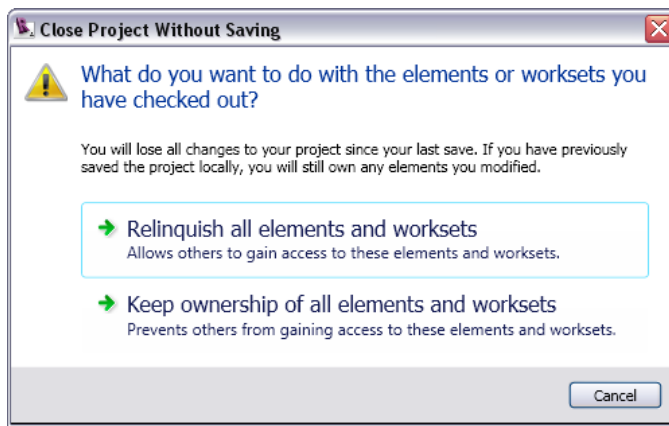


You have the following options:

- Click Relinquish unmodified elements and worksets if you want others to have access to them. Unchanged editable elements and worksets are relinquished, and the local file is saved. You remain the borrower of any elements you changed in the editable worksets.
- Click Keep ownership of all elements and worksets to retain all editing permissions when the local file is saved. The local file closes without synchronizing with central or relinquishing worksets or borrowed elements.

Do Not Save the Project

Do not save the project discards any changes you made to the local file. It has no effect on your last save to the local file. This option rolls back the state of your local file to the last time you saved it and displays the Close Project Without Saving dialog.




You have the following options:

- Click Relinquish all elements and worksets to let others gain access to both modified and unmodified elements and worksets. You relinquish all changes you made to the elements you borrowed and the worksets you own.
- Click Keep ownership of all elements and worksets to retain ownership of the elements you borrowed and the worksets you own. You will lose the changes you made.

Opening Workshared Files Independent of the Central File

Use this procedure to open a file independently for clients who want to see changes or make changes without saving them. Clients can view the file and modify it without worrying about borrowing elements or owning element worksets. This is also useful for project managers who are not working in the project file, but might want to open it for review without interrupting the team.

- 1 Click  ➤ Open ➤ Project.
- 2 In the Open dialog, navigate to the central file and select it.
- 3 Select Detach from Central.
- 4 Click Open.

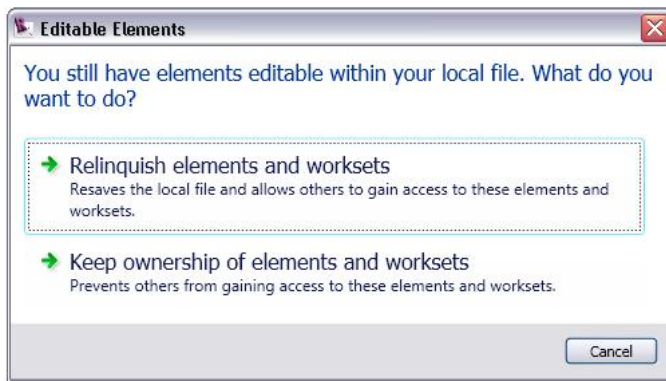
If a non-workshared file is opened with Detach from Central selected, Revit Architecture ignores the option, and opens the file normally.

After you open the file, it no longer has any path or permissions information. It is in a state similar to when worksharing was first enabled; all elements in the file can be modified, but no changes can be saved back to the central file. If you save the file, it is saved as a new central file.

NOTE If a longer-lasting independent copy of the central file is needed, such as when the central file is suspected to be corrupt, detach from the central file and save it as a new central file. Note that existing local files cannot synchronize with this new central file and new local files created from the detached central file cannot synchronize with the old central file.

Editable Elements

If you have saved all changes to the central file, but still have editable elements when you close the local file, the Editable Elements dialog displays.



If you do not want to keep ownership of the checked out worksets and borrowed elements, click Relinquish elements and worksets; otherwise, click Keep ownership of elements and worksets.

Relinquishing Ownership without Synchronizing with Central

To relinquish editable elements for which you have editing permissions without synchronizing with the central file:

- 1 With the local file open, click Collaborate tab ► Synchronize panel ► Relinquish All Mine. Revit Architecture checks for any changes that require synchronizing with central:
 - If there are no changes to the model elements, ownership of the worksets and borrowed elements is relinquished. A dialog does not display.
 - If there are changes, ownership status does not change. You still own any model elements you modified. A dialog displays telling you that you made changes and suggests synchronizing with central.
- 2 Click Close to close the dialog, if one displays.

If you do not mind discarding your local changes, you can relinquish permissions and borrow elements. Open the central file directly or create a new local file from the central file, and choose Relinquish All Mine. Best practice is to discard your original local file so that you do not accidentally work on an outdated or the wrong local file. If you retain your original local file, be aware that if other users have modified elements that you used to own, the original local file will be incompatible with the central file.

Loading Updates from the Central File

As you work, you can see the changes other team members have made to the project after they have been synchronized with the central file. You can load updates from the central file without publishing your changes to the central file.

In your local file, click Collaborate tab ► Synchronize panel ► Reload Latest.

Working Offsite and Offline

WARNING Working offline can put your project at risk. Your local file can become incompatible with the central file, preventing you from synchronizing with central. The central file itself remains safe.

You can work remotely, provided you have high-speed network access to the central file, or you can transfer your local file to someone with network access.

To work offsite or offline:

- 1 Make the necessary worksets editable while still at the office and connected to the network. See [Making Worksets Editable](#) on page 1263.
- 2 Be sure to save your local copy of the central file before you close it; otherwise, your changes to workset editability are not saved in the local file when you take it offline.
- 3 Work on the project offsite as you would in the office. You can modify elements in editable worksets, and you can create new elements in any workset.

Editing Elements You Do Not Own Offline

To modify elements in a workset you do not own, you can specify the status of the workset as Editable. This is known as Editable at Risk and should be avoided whenever possible.

If another team member synchronizes changes to any of the same elements that you have changed, you cannot synchronize any of your changes with the central file. All your changes in all worksets are lost.

If you make a workset Editable at Risk, it is recommended that you:

- 1 Ask a colleague, who is in the office and has access to the central file, to start a session of Revit Architecture and specify your name as the User Name. See [Options](#) on page 516.
- 2 Ask the colleague to open the central file, check out all the worksets that you have at risk, close the file, and reset the User Name to their name. It is not necessary to synchronize with the central file.

This procedure prevents other users from making the workset editable and changing the same elements. If someone else has checked out that workset or has borrowed elements in it, there is no way to assure that there will not be a conflict.

Rendering Workshared Projects Offline

WARNING Rendering offline is generally not recommended.

If you render the model offline, you will likely change material assignments and other project settings. To change project settings, you need to check out some of the Project Standards worksets. If you make these worksets editable while you are still connected to the central file, other team members working on the project cannot change the Project Standards worksets that you are changing. Instead, if you make the worksets Editable at Risk after going offline, you risk losing all your changes.

Upgrading Workshared Projects

Before you upgrade the central file to a new release of Revit Architecture, it is recommended that you create a backup copy of the central file for each workshared project in the current release. These backup copies are for use only if a new central file becomes corrupted.

IMPORTANT If there are linked models in the central file, the linked model files must be upgraded before the central file.


To create a backup copy of the central file in your current release of Revit Architecture:

- 1 Instruct all team members to synchronize with central, relinquish all elements, and close their local copy of the central file. See [Synchronizing with the Central File](#) on page 1265.
- 2 Use Windows Explorer to make a copy of the central file and its backup folder.


To upgrade the central file to a new release of Revit Architecture:

- 3 Open the central file in the new release.

TIP We recommend opening the central file with the Audit option to identify and fix any possible corrupt elements. This is more time consuming, but will prevent potential problems. See [Opening a Revit Project File](#) on page 112.

- 4 Click  ► Save As ► Project.
- 5 In the Save As dialog, click Options, and in the File Save Options dialog, select Make this a Central File after save.
- 6 Click OK.
- 7 Navigate to the directory with the upgraded central file and name it accordingly.
- 8 Click Save.

NOTE Backups of the central file will restart, after it has been upgraded in this manner.

- 9 Instruct all team members to open the central file and create a local copy of it using  ► Save As ► Project. Alternatively, use the Create New Local option in the Open dialog.

Workshared Project Rollback

When you save a workshared project, Revit Architecture creates a directory of backup files. In that directory, backup files are created each time a user saves to central, or saves their local copy of the central file. Successive backups share as much element information as possible; therefore, they are incremental rather than equal in size to the entire project.

You can roll back either a central file or a local file of your project. For example, you may want to roll back to a prior version of the project, if changes made after a certain date are deemed incorrect or inappropriate. You can also save a prior version as a new project file.

When you roll back a file, all later versions in the backup directory are lost. In addition, you lose all information on workset ownership, borrowed elements, and workset editability. You must coordinate with team members to reassign workset and element ownership.

Central File Backup Files and Folders

The backup folder for the central file contains files that store information about editability and ownership status (permission information). It also contains various DAT files and a worksharing log file (.slog) that provides progress information on operations (such as synchronize with central) to the Worksharing Monitor.

Revit Architecture stores central file backup information in a folder called *[Centralfilename]_backup*. Do not delete or rename any files in this folder. If you move or copy the project file, be sure the central file backup folder stays with the project file. If you rename the project file, rename the backup folder appropriately.

You can control the number of backups retained. For more information, see [Setting Save Reminders](#) on page 115.

Rolling Back Workshared Projects

IMPORTANT Rollbacks cannot be undone. When you roll back a project, all backup versions subsequent to the selected version are lost. Ensure that you want to roll back the project before continuing, and save any later versions, if necessary.

- 1 Click Collaborate tab ► Synchronize panel ► Restore Backup.
- 2 In the Browse for Folder dialog, navigate to the backup folder for the project.

To see the central file backups, browse to the central backup folder.

To see the local file backups, browse to the local backup folder.

3 Click Open.

4 In the Project Backup Versions dialog, select a version.

5 Click Rollback.

6 Click OK to continue the rollback, or click Cancel.

NOTE If your local copy of the central file has a version number greater than the version number the central file was rolled back to, you will need to open the central file and save a new local copy.

7 Click Close.

Saving a Specific Backup Version as a New File

1 Click Collaborate tab ► Synchronize panel ► Restore Backup.

2 In the Browse for Folder dialog, navigate to the backup folder, and click Open.

3 In the Project Backup Versions dialog, select the version to save.

4 Click Save As, and save the file.

5 When you save the project under the new name, Revit Architecture prompts you to open the extracted project. Click Yes or No.

Revit Architecture considers this file as a local version of the central file. If you want the file to become the new central file, you must explicitly save it as such. For more information, see [Creating a Central File from an Existing Workshared File](#) on page 1272.

Viewing Workshared File History

You can view a list of all the times a workshared file (the central file or a local copy of the central file) was saved and who saved it. The list also shows any comments entered in the Synchronize with Central dialog.

1 Click Collaborate tab ► Synchronize panel ► Show History.

2 In the Show History dialog, navigate to the shared file, select it, and click Open.

3 In the History dialog, click the column headers to sort alphabetically or chronologically.

4 If desired, click Export to export the history table as delimited text. The delimited text can then be read by a spreadsheet program.


5 When finished, click Close.

Creating a Central File from an Existing Workshared File

You may need to create a central file from an existing workshared file if you want to move the central file location (see [Moving the Central File](#) on page 1273). You may also need to abandon the existing central file and want to use a local copy of the central file (rather than a backup of the central file) as the new central file. You may need to do this if, for example, a team member was working offline on a local copy of the central file and those changes need to remain in the project.

Before you create a new central file, be sure to rename the workshared file or specify a different directory path before saving. You rename to avoid overwriting the existing central file and potentially losing all other team members' changes.

1 Open the existing workshared file.

2 Click  ► Save As ► Project.

3 In the Save As dialog, rename the file, and click Options.

4 In the File Save Options dialog, select Make this a Central File after save.

5 Select a default workset for local copies. See [Save Options](#) on page 115. In the Open workset default list, select one of the following.

Workset Default	Description
All	Opens all worksets in the central file. Opening all worksets will significantly reduce performance in larger project files.
Editable	Opens all editable worksets. Depending on how many editable worksets are in the central file, this option may significantly reduce performance in larger project files.
Last Viewed	Opens specified worksets. When you click Open, the Opening Worksets dialog displays. Initial status is based on when the file was last opened. Specify different worksets or click OK to confirm the default. Press <i>Ctrl+A</i> to select all worksets in this dialog.
Specify	Opens specified worksets. When you click Open, the Opening Worksets dialog displays. Press <i>Ctrl+A</i> to select all worksets in this dialog. Initial status is based on when the file was last opened. You can specify different worksets or click OK to confirm the default.

6 In the Save As dialog, click Save.

Moving the Central File

Some examples of when you may need to move a central file include:

- Your office has a new file server, and you need to move the central file from the old server to the new server.
- The current location of the central file contains too many projects.
- Your office has a new naming convention for projects and needs to rename the central file. Revit Architecture considers renaming a file the same as moving it.
- One office works on the project, then ships it to another office. The new office wants to work on it locally, so they want to move the central file location from the first office to the second one.

Use caution when moving the central file. If team members are unaware of the new location, they will be unable to submit changes and could lose work. When team members submit changed elements to a central file, those elements must be editable in the team members' names at the central location they specify. Also,

any changes to an element must be built on the last submission of that element to the central file, even though the file may now be in a different location.

NOTE Moving or copying the file using Windows® Explorer or DOS creates a local copy of the central file. Revit Architecture still looks for the central file in its original location. A central file is identified as having worksharing enabled and as residing in the central file location identified in the project. To view (or modify) this location, click Collaborate tab ► Synchronize panel ► Synchronize with Central drop-down ► Synchronize and Modify Settings.

To move the central file:


1 Make sure all team members save their work to the current central file location by clicking Collaborate tab ► Synchronize panel ► Synchronize with Central drop-down ► Synchronize Now.

This ensures no work is lost as a result of changing the central file location. When saving, each team member should relinquish all elements.

2 Move the file to the new location using either Windows Explorer or DOS commands.

If you move rather than copy the central file, you eliminate the risk of team members working with the old file.

3 Open the central file from its new location. A dialog displays telling you that the central file has been moved and that you must re-save it as the central file. Click OK to continue.

4 Click  ► Save As ► Project.

5 In the Save As dialog, click Options.

6 In the File Save Options dialog, select Make this a Central File after save, and click OK.

7 In the Save As dialog, click Save.

8 Each team member should create a new local file. See [Creating a Local Copy of the Central File](#) on page 1258.

NOTE If you discover that there is only one local file that was not saved to central, you can save it to the new location by clicking Collaborate tab ► Synchronize panel ► Synchronize with Central drop-down ► Synchronize and Modify Settings, and then navigating to the new central file location through the Browse option. The only time you can do this successfully is before any other changes are saved to the new central location.

If an old version of the central file remains in the old location, you can prevent other team members from saving to this obsolete central file by deleting it or making it read-only.

Worksharing Monitor

The Worksharing Monitor is a utility that allows you to find out information about a workshared project:

- Who is currently working on this project?
- Is my local copy of the project up to date?
- When will my Synchronize with Central operation finish?
- Has my request to borrow elements been granted?
- Are any issues interfering with my work on a Revit Architecture project?

The Worksharing Monitor is available to Revit Architecture subscription customers. To use this utility:

- 1** Download the Worksharing Monitor from the Autodesk customer subscription web page.

- 2 Install the Worksharing Monitor.
- 3 Open a Revit project, and click Add-Ins tab ► External Tools drop-down ► Worksharing Monitor.
- 4 In the Worksharing Monitor dialog, click Help to learn how to use the utility.

Working with Linked Models

21

You can link different file formats in a Revit project, including other Revit files (Revit Architecture, Revit Structure, Revit MEP), CAD formats (DWG, DXF, DGN, SAT, SKP), and DWF markup files.

When you are working with linked models, or a site, you can share (that is, publish or acquire) the coordinates of the project so that you can correctly position the model.

This topic contains information on linking Revit models, shared coordinates, multi-discipline coordination, and interference checking. For information on linking CAD formats and DWF, see [Importing or Linking CAD Formats](#) on page 1387 and [Linking DWF Markup Files](#) on page 1403.

Linking Revit Models

You can link Revit Architecture, Revit Structure, and Revit MEP models. Linking Revit models is primarily intended for linking separate buildings, such as those that compose a campus.

When you link a Revit model into a project, Revit Architecture opens the linked model and keeps it in memory. The more links a project contains, the longer it can take to open.

Linked Revit models are listed in the Revit Links branch of the Project Browser.

You can convert linked Revit models to groups, and you can convert groups to linked Revit models. See [Converting Groups and Linked Revit Models](#) on page 363. You can also mirror linked Revit models. See [Mirroring Elements](#) on page 380.

When Should You Use Linked Models?

It is recommended to use linked models for

- Separate buildings on a site or campus
- Parts of buildings which are being designed by different design teams or designed for different drawing sets
- Coordination across different disciplines (for example, an architectural model and a structural model)

Linked models may also be appropriate for the following situations

- Townhouse design when there is little geometric interactivity between the townhouses

- Repeating floors of buildings at early stages in the design, where improved Revit model performance (for example, quick change propagation) is more important than full geometric interactivity or complete detailing

In later stages of a project, it is generally not recommended to create a single building model with linked models due to the following

- Limited joining and interaction between elements in the host project and elements in the linked models will prevent elements from cleaning up or joining with elements in linked models
- Difficulty managing element names, numbers, and identity data between the host project and the linked models, which can result in duplicate names or numbers
- Separate project standards for the host project and linked models, causing models to become out of sync with one another
- Maintaining control; in order to do this linked models need to be carefully managed (for example, linked model file names and file paths do not change once files are imported into a host project)
- More complex detailing and annotation process; some details and annotations will need to be in the linked model and others will need to be in the host project

Linking Revit Models that Contain Links

When you import a Revit model that contains a linked Revit model, links become nested. You can show (or hide) nested linked models in the host model. By default, nested linked models are not visible in the host model.

When a nested link is visible, you can use *Tab* to select nested link instances and view properties of elements in the nested link, as you can with other linked models. In addition, the Interference Check tool checks for interference in the nested linked models as well as the parent linked model.

Nested links that are visible in the project display in the Revit Links branch of the Project Browser under their parent link. Nested links do not display in the Manage Links dialog.

Transferring Project Standards Between Linked Revit Models

If you open the host model, you cannot open the linked model in the same Revit Architecture session. However, you can transfer project standards from the linked model to the host model using the Transfer Project Standards tool. See [Transferring Project Standards](#) on page 446.

Linking Revit Models

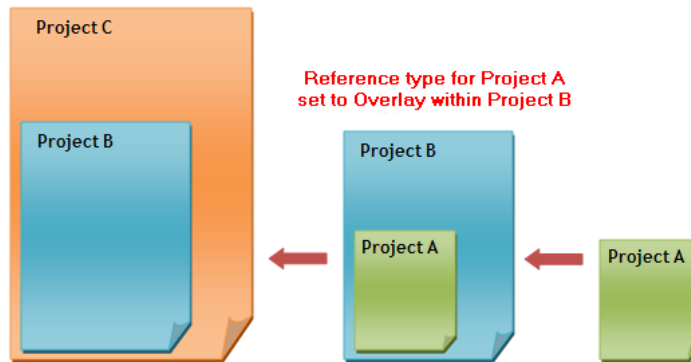
- 1 Click Insert tab ► Link panel ► Link Revit.
- 2 In the Import/Link RVT dialog, navigate to the folder containing the Revit model to link.
- 3 Select the model.
- 4 Specify the desired positioning options. See [Import and Link Options for CAD Formats and Revit Models](#) on page 1392.
- 5 Click Open.

You can select the linked Revit model in a view and drag, copy, paste, move, and rotate it.

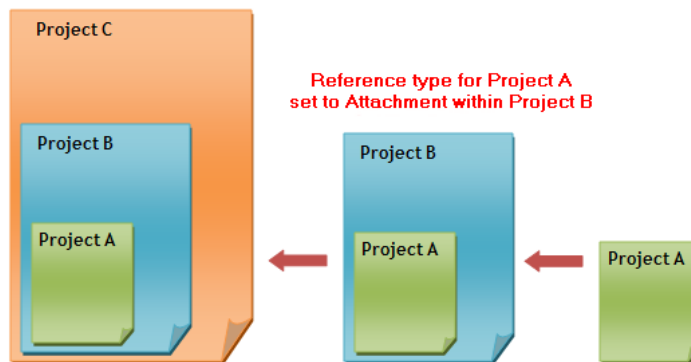
Showing or Hiding Nested Linked Revit Models

When you import a model that contains linked models, the nested links display according to their Reference Type setting in the parent model. Options are Overlay and Attachment. Overlay does not load nested linked models (therefore they do not display in the project) and Attachment displays nested linked models.

The following image shows that Project A is linked into Project B (so Project B is the parent model for Project A). The Reference Type setting for Project A is set to Overlay within its parent model (Project B), therefore when Project B is imported into Project C, Project A does not display.



If you change the Reference Type setting for Project A (within its parent model, Project B) to Attachment, when you import Project B into Project C, the nested link (Project A) displays.



To show or hide nested linked models:

- 1 Open the parent link for the nested model.
- 2 Click Manage tab ► Manage Project panel ► Manage Links.
- 3 In the Manage Links dialog, click the Revit tab.
- 4 In the Reference Type column, change the value for the linked model to one of the following:
 - Attachment makes the linked model visible when its host is linked into another model.
 - Overlay does not load the linked model when its host is linked into another model. This is the default setting. When the Overlay option is selected and you import a model that contains nested links, a message displays indicating that the imported model contains nested links and that they will not be visible in the host model.
- 5 Save and close the file.

Phase Mapping Linked Revit Models

When you link a Revit model that has more than one phase into a project, phases in the host model automatically map to phases in the linked model. When this initial mapping occurs, Revit Architecture maps phases by matching phase names.

You can manually set up a correspondence between phases in the host model and phases in the linked model. To do this you set up a phase map in the properties of the linked model, and then apply the phase map in the host model.

NOTE Phase maps must occur in chronological order. For example, a phase map cannot be set up like the following table. Since phase 1 occurs before phase 3, phase 3 cannot be mapped to phase 1.

Phase	Phase from linked file
Phase 1	Phase 1
Phase 2	Phase 2
Phase 3	Phase 1

Phase mapping is always maintained, unless phases in either the host or linked models are combined. If phases are combined, the existing phase map of the remaining phase is used.

For information on phase maps and rooms in linked models, see [Phase-Specific Rooms and Linked Models](#) on page 1000.

For more information on phasing, see [Project Phasing](#) on page 1331.

To map phases in the linked model:

- 1 In the drawing area, select the linked Revit model.
- 2 Click Modify RVT Links tab ► Element panel ► Element Properties drop-down ► Type Properties.
- 3 In the Type Properties dialog, find the Phase Mapping parameter and click Edit.
- 4 In the Phases dialog, select the appropriate mapping options for each phase, and click OK.
- 5 Click OK to exit the Type Properties dialog.

To apply phase mapping in the host model:

- 1 Click View tab ► Graphics panel ► Visibility/Graphics.
- 2 In the Visibility/Graphics dialog, click the Revit Links tab.
- 3 Click the button in the Display Settings column for the linked Revit model.
- 4 In the RVT Link Display Settings dialog, on the Basics tab, select By Host View or Custom.
If you select Custom, select By Host View for Phase.
- 5 Click OK twice to exit the Visibility/Graphics dialog.

Dimensions and Constraints in Linked Revit Models

You can use elements in the linked model as references for dimensions and aligning. For example, you can create a dimension between a wall in the host project and a wall in the linked model. See [Permanent Dimensions](#) on page 264 and [Aligning Elements](#) on page 377.

You can also create constraints between elements in the host model and elements in a linked model. For example, you can constrain a linked building to a property line in the host model or a linked floor to a level in the host model. Linked models move as an entire entity when the element they are constrained to moves.

Constraints on a linked model (or an element in a linked model) only move the linked model, they do not move elements in the host model. Constraints to links using shared locations are not permitted.

Revit Architecture attempts to retain and rehost dimensions and constraints when you reload (or unload and reload) a link.

Displaying Linked Revit Model Data

Display settings control how a linked model displays its data.

To view or change display settings for a linked model:

- 1 Click the linked model in the drawing area.
- 2 Click View tab ► Graphics panel ► Visibility/Graphics.
- 3 Click the Revit Links tab.
- 4 View or override the Display Settings:
 - By Host View means that the host project's view settings determine how the linked model looks.
 - By Linked View means that the linked model's own view settings govern how it looks.
 - Custom allows more control over how the linked model looks.

For more information, see [Visibility for Linked Revit Models](#) on page 1282.

Copying Linked Revit Models

A linked model can be copied any number of times in a host project. For example, a housing development may have multiple designs that repeat many times throughout the site. For each copy of a linked model that you place in a project, a unique name is automatically generated for the copy. This name helps to identify elements from linked models in a schedule. You can modify the name for a linked model instance through its properties. You can also override visibility and graphics settings for each linked model instance. See [Visibility for Linked Revit Models](#) on page 1282.

You can copy linked Revit models using the standard copy and paste procedures (see [Copying Elements](#) on page 392) or you can drag a linked Revit model from the Project Browser into a project view.

In addition, you can copy a linked Revit model between projects within the same Revit session. When you copy a linked Revit model to another project, the link path, shared positioning settings, visible nested links, and the link instance name are copied to the new project. If the link instance name already exists in the project, the link is automatically renamed. Partially loaded files are maintained as partially loaded. Visibility and graphic override settings are not preserved.

To copy a linked Revit model to another project file:

- 1 Open the project file that contains the link to copy, and open the file to copy it into.
- 2 Select the linked model in the Project Browser (under Revit Links) or in the drawing area.
- 3 If you selected the linked model in the Project Browser, right-click the linked model name and click Copy to Clipboard.

If you selected the linked model in the drawing area, click Modify RVT Links tab ► Clipboard panel ► Copy.
- 4 Click View tab ► Windows panel ► Switch Windows drop-down, and select the project name to copy the linked model into.
- 5 Click Modify tab ► Clipboard panel ► Paste.

6 Click in the drawing area to place the linked model.

NOTE If you selected the link to copy from the Project Browser rather than the drawing area, you may need to right-click the link name in the Project Browser (under Revit Links) and then click Create Instance before you can place the linked model in the drawing area.

7 Click Tools panel ► Finish, to complete the paste operation.

If you want to edit the pasted linked model, click Edit Pasted Elements. See [Editing Pasted Elements](#) on page 395.

Copying Elements from a Linked Revit Model

Elements from linked Revit models can be copied to the clipboard and then pasted into the host model.

To copy and paste elements from linked Revit models:

- 1 In the drawing area, move the cursor over the element in the linked model you want to copy.
- 2 Press *Tab* until the element to copy is highlighted, and click to select it.
- 3 Click Modify RVT Links tab ► Clipboard panel ► Copy.
- 4 Navigate to the location in the project where you want to paste the element.
- 5 Click Modify tab ► Clipboard panel ► Paste.

Alternatively, you can click Modify tab ► Clipboard panel ► Paste Aligned drop-down ► Same Place to paste the element into the same place from where you copied it. For more information on paste options, see [Pasting Elements](#) on page 393.

6 Click in the drawing area to place the element.

Visibility for Linked Revit Models

Parameters that control the visibility and appearance of linked Revit models are grouped under their own tab, Revit Links, in the Visibility/Graphics dialog. This dialog is arranged in a tree structure with the parent nodes referring to separate files (the primary linked model), and the child nodes referring to instances (copies) of the model in the project. Changing the parent node affects all instances, while changing a child node affects only that instance.

The Revit Links tab in the Visibility/Graphics dialog contains the following:

- **Visibility column:** Select the check box to show the linked model in the view, or deselect the check box to hide the linked model.
- **Halftone column:** Select the check box to draw the linked model at halftone. (See [Halftone/Underlay](#) on page 497.)
- **Display Settings column:** View options to override additional settings for each linked model. The button displays the current display setting state (By Host View, By Linked View, or Custom). See [Controlling Visibility and Graphic Override Settings for Linked Revit Models](#) on page 1283.

Visibility for linked Revit models is controlled by view. You can use a view template to save the visibility settings of a particular view and then apply it to other views. For more information, see [View Templates](#) on page 507.

Related topic

[Changing Line Styles in a Linked Model](#) on page 401

Controlling Visibility and Graphic Override Settings for Linked Revit Models

1 Click View tab ► Graphics panel ► Visibility/Graphics.

2 Click the Revit Links tab.

3 Select the linked model or linked model instance to modify.

4 Click the button in the Display Settings column.

The RVT Link Display Settings dialog opens, from which you can access the Basics, Model Categories, Annotation Categories, and Import Categories tabs. The Design Options tab is also available if Design Options are used in the linked file.

5 If you selected a linked model instance, select the Override display settings for this instance check box.

6 From the Basics tab, select one of the following:

- **By Host View.** When you select this option, you cannot override any visibility settings for the linked model, because the host view governs its appearance.

When the primary linked model is set to By Host View, each copy or instance of the linked model can still be overridden on an individual basis by checking the box for Override display settings for this instance. This option appears on the Basics tab when a copy or instance of a primary linked model is selected in the Visibility/Graphics dialog.

- **By Linked View.** When you select this option, you can choose which project view should display for the linked model.

The Linked View drop-down list contains all available plan, RCP, section, elevation, and 3D views from the linked model. The list is dependent on the view you are currently applying visibility and graphic settings for. For example, if you are in an elevation view, only elevation views populate the Linked view list. For 3D views, the type of 3D view you are currently viewing dictates what populates the list (if you are viewing a perspective 3D view in the host model, only perspective 3D views from the linked model display in the Linked View list, and the same applies for orthographic 3D views).

NOTE If the linked model has annotations that you want to display in the project, the annotations must be in either a plan, RCP, parallel section, or parallel elevation view in the linked model. (If you select a section or elevation view that is not parallel, view-specific elements, such as annotations and details, and view specific appearance of non-view specific elements, such as datum extents and leaders, do not display.) You can then select the By Linked View or Custom option to select the view to display in the project.

- **Custom.** When you select this option, you can select override settings on all available tabs. The following options are available on the Basics tab when you select Custom:

- **Linked view:** Select a view in the linked model to display.
- **View range:** Select view range settings.
- **Phase:** Assign the desired phase of the linked model.
- **Phase filter:** Assign the desired phase filter for the linked model.
- **Detail level:** Specify a detail level for a linked model, or categories within the model. Selecting By View for a linked model means that the detail level of the target view is used.
- **Discipline:** Assign the intended discipline filter.
- **Color Fill:** Apply the host model color scheme to rooms and areas in the linked model.
- **Object styles:** Control whether the graphical appearance of objects (colors, line weights, and so on) will be based on the settings in the Object Styles dialog from the host file or from the linked model.

- **Nested links:** Specify the visibility and graphics overrides settings that you want nested linked models to use. For more information, see [Controlling Visibility and Graphic Override Settings for Nested Linked Revit Models](#) on page 1284.

For all other tabs, you can override visibility settings by selecting the tab, and then selecting Custom from the drop-down.

NOTE Filters do not apply to elements that are part of linked models.

Controlling Visibility and Graphic Override Settings for Nested Linked Revit Models

- 1 Click View tab ► Graphics panel ► Visibility/Graphics.
- 2 Click the Revit Links tab.
- 3 Select the linked model or linked model instance to modify.
- 4 Click the button in the Display Settings column.
- 5 If you selected a linked model instance, select the Override display settings for this instance check box.
- 6 In the RVT Links Display Settings dialog, click the Basics tab, and select one of the following:
 - **By Host View.** When you select this option, the nested linked model uses the visibility and graphics override settings specified in the host view.
 - **By Linked View.** When you select this option, the nested linked model uses the visibility and graphics override settings specified in its parent linked model. You can also select the project view to display for the linked model.

The Linked View drop-down list contains all available plan, RCP, section, elevation, and 3D views from the linked model. The list is dependent on the view you are currently applying visibility and graphic settings for. For example, if you are in an elevation view, only elevation views populate the Linked view list. For 3D views, the type of 3D view you are currently viewing dictates what populates the list (if you are viewing a perspective 3D view in the host model, only perspective 3D views from the linked model display in the Linked View list, and the same applies for orthographic 3D views).

NOTE If the linked model has annotations that you want to display in the project, the annotations must be in either a plan, RCP, parallel section, or parallel elevation view in the linked model. (If you select a section or elevation view that is not parallel, view-specific elements, such as annotations and details, and view specific appearance of non-view specific elements, such as datum extents and leaders, do not display.) You can then select the By Linked View or Custom option to select the view to display in the project.

- **Custom.** From the Nested links list, select one of the following:
 - By Parent Link applies the visibility and graphic override settings specified for the parent linked model. In other words, the settings of the parent link control the nested link. For example, if walls in the parent link display as blue, then walls in the nested link will also display as blue.

NOTE It is only possible to control categories in the nested link which also exist in the parent link.

- By Linked View applies the visibility and graphic override settings specified in the top-level nested linked model. The top-level nested linked model is the first nested linked model.

For example, you have the host model, a linked model (the parent link), and then a model that is linked into the parent link (the nested link). The nested link is considered the top-level nested linked model. The nested link will display in the linked model as it does in the parent link. You can open the parent link to have full control of the nested link.

- 7 Click Apply to view your changes.
- 8 Click OK to exit the RVT Link Display Settings dialog.

Controlling Visibility of Linked Models in Schedules

- 1 Right-click in a schedule view, and select View Properties.
- 2 Locate the Visibility/Graphics Overrides instance parameter, and click Edit.

NOTE If you do not see the Visibility/Graphics Overrides instance parameter, click Edit for the Fields parameter. In the Schedule Properties dialog, ensure that the Include Elements in Linked Files option is selected, and click OK. The Visibility/Graphics Overrides instance parameter should now be available.

- 3 In the Visibility for Schedule dialog, click the Revit Links tab.
- 4 Click the button in the Display Settings column.
- 5 In the RVT Link Display Settings dialog, select By Host View, By Linked View, or Custom, and select the display behavior of a linked file for Phase, Phase Filter, and Nested Links.
If Design Options are part of the linked file, an additional tab is available for Design Options. Any one of the available options can be selected to include in the reported schedule data.

Linked Model Properties

You can modify the properties of a linked model, including the name of the linked model instance and the shared positioning settings.

To modify linked model properties, right-click the linked model name in the Project Browser (under Revit Links), and click Properties. Alternatively, you can select the linked model in the drawing area, and click Modify RVT Links tab ► Element panel ► Element Properties.

You can also view the properties of an element contained in a linked Revit model. All properties for elements in linked models are read-only.

To view element properties in a linked Revit model:

- 1 Hover the cursor over the element in the linked file and press *Tab* to highlight the element.
- 2 Click the element, and click Modify RVT Links tab ► Element panel ► Element Properties.

Linked Model Type Properties

Name	Description
Room Bounding	Makes the host project recognize the Room Bounding parameter of elements in the linked model. See Room Boundaries in Linked Models on page 984.
Reference Type	Determines whether this linked model will be shown (Attachment) or hidden (Overlay) when the host model is linked into another model. See Showing or Hiding Nested Linked Revit Models on page 1279.
Phase Mapping	Allows you to set up the phase map for the linked model. See Phase Mapping Linked Revit Models on page 1280.

Linked Model Instance Properties

Name	Description
Name	Specifies the name of the linked model instance. Names are automatically generated when you make a copy of a linked model in the project. You can change the name. Names must be unique; a message appears if you enter a name that already exists in the project. Names of linked models are useful when you have multiple copies of the same linked model in a project and need to add the linked model elements to a schedule. See Including Elements from Linked Models in a Schedule on page 177.
Shared Location	Specifies the shared coordinates for the linked model. See Shared Positioning on page 1296.

Managing Links

If the source file of the link in your project has changed, Revit Architecture automatically updates the link when you open the project. To access tools for link management, click **Manage tab ► Manage Project panel ► Manage Links**.

Identifying and Re-establishing Unresolved References

If you open a file containing unresolved references, the Unresolved References dialog opens. There are two means of determining unresolved references in a file.

- Use the Show details option in the Unresolved References dialog.
- Click **Open Manage Links** to correct the problem from the Unresolved References dialog. Unresolved references will be listed as Not Found in the Status column. Be sure to check each file format tab if multiple file types have been used in the file.

NOTE You can also open the Manage Links dialog from the project. Click **Manage tab ► Manage Project panel ► Manage Links**.

Use the following procedure to re-establish unresolved links.

- 1 To open the Manage Links dialog, click **Manage tab ► Manage Project panel ► Manage Links**.
- 2 Click the file type tab of the unresolved link, either CAD Formats, Revit, or DWF Markups. Unresolved links will be listed as Not Found in the Status column.
- 3 Select the file in the Linked File column.
- 4 Click **Reload From**.
- 5 In the file browser, navigate to the new location of the linked file and select it.
- 6 Click **Open**.
- 7 If possible, it is recommended to set the Path Type to Relative. This will maintain the link in most future cases. Otherwise, select Absolute.
- 8 Repeat steps 2 through 7 for any other unresolved links in the file.
- 9 Click **OK** to close the Manage Links dialog.

Manage Links Dialog

The Manage Links dialog has tabs for CAD Formats, Revit models, and DWF Markups. Under the tabs are columns that provide information about the linked file.

Column	Description
Linked File	Indicates the name of the file being linked.
Status	Indicates whether the linked file is loaded in the host model. The field will display as Loaded, Not Loaded, or Not Found.
Reference Type (Revit models only)	Determines whether this linked model will be shown (Attachment) or hidden (Overlay) when the host file is linked into another model. See Showing or Hiding Nested Linked Revit Models on page 1279.
Locations Not Saved	Indicates if the linked model's location is saved in the shared coordinate system. See Shared Positioning on page 1296 and Defining Named Locations on page 1296.
Size	Size of the linked file.
Saved Path	Location of the linked model on your computer. In worksharing, this is the location of the central file.
Path Type	Indicates whether the linked model's saved path is relative or absolute. See Link Management Options on page 1287.
Local Alias (Revit models only)	Location of the linked model if it is a local copy of a central file. For more information on the central file and worksharing, see Working in a Team on page 1249.

Link Management Options

To manage links in your file, select them in the Manage Links dialog. You can select multiple links to modify by pressing *Ctrl* and clicking on the number of the link in the dialog. The following tools are available to the selected links.

- **Save Location.** Saves the new location of a linked instance.
- **Save Markups.** Saves changes to imported DWF markups. For more information on imported markups, see [Linking DWF Markup Files](#) on page 1403.
- **Remove.** Removes the link from the project.
- **Reload From.** Changes the path of the link if the linked file has been moved. See [Identifying and Re-establishing Unresolved References](#) on page 1286.
- **Unload.** Removes the display of the linked model in the project but continues the link.

- **Reload.** Loads the latest version of the linked model. You can also close the project and reopen it, and the linked model is reloaded.
- **Import.** Embeds the model into the project. This option is not available for Revit models.
- **Located In.** Lists the sheet that contains the DWF markup import symbol.
- **Preserve Graphic Overrides.** Maintains any graphic overrides on DWG, DXF, and DGN links, when the links are reloaded.
- **Reference Type drop-down.** Specifies whether this nested linked model is shown (Attachment) or hidden (Overlay) when the host model is linked into another model. See [Showing or Hiding Nested Linked Revit Models](#) on page 1279.
- **Path Type drop-down.** Specifies whether nested models file path are Relative or Absolute. The default is Relative.

Directory Paths in Linked Models

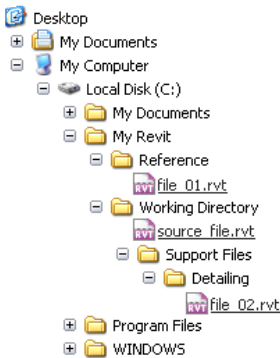
A relative path defines the position of a linked file in a working directory such as a project folder. Its position is defined by its relative location. An absolute path defines the location of a linked file on a disk or network drive.

In general, you should use a relative path instead of an absolute path.

- If you use a relative path and later move the project and the linked file together to a new directory, the link is maintained. Revit tries to find the linked model by its relative position to the working directory.
- If you use an absolute path and later move the project and the linked file to a new directory, the link is broken. Revit tries to find the linked model in the specified directory.

An absolute path may be preferable when you link in a workshared project, such as a central file that other users need to access. This file is likely not to move from its location on disk.

In the following image, a simple directory structure is used as an example.

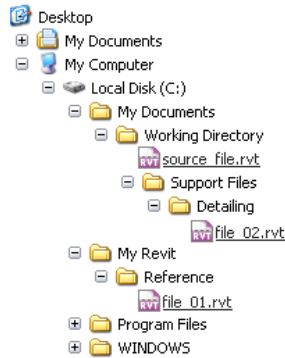


In this instance, absolute and relative paths are defined as follows. Note the folder Working Directory. This has been named as such for illustrative purposes. A working directory can possess any name.

File	Absolute Path	Relative Path
sourcefile.rvt	C:\My Revit\Working Directory\source-file.rvt	source-file.rvt

File	Absolute Path	Relative Path
file_01.rvt	C:\My Revit\Reference\file_01.rvt	..\Reference\file_01.rvt
file_02.rvt	C:\My Revit\Working Directory\Support Files\Detailing\file_02.rvt	Support Files\Detailing\file_02.rvt

If the working directory is moved or renamed, paths can become unresolved (broken). In the following image, the working directory has been moved to the My Documents directory to illustrate this.



Now all of the original absolute paths are unresolved because they point to a specific location. The relative path to file_01.rvt is also broken as it resided outside of the working directory and didn't move with it.

Linking and Worksharing

If you enable worksharing, your links are contained in worksets. If you update a linked file and want to reload the link, the workset in which the link is located must be editable. If it is not, an error message appears indicating that the link could not be updated because of the workset's non-editable status. See [Making Worksets Editable](#) on page 1263.

It is good practice to assign a team member to track links and be sure the appropriate worksets are editable. After updating the link, the team member should synchronize with central so that all team members have the updated link. See [Saving Workshared Files](#) on page 1265.

Also, you may want to create a workset exclusively for links, so that workflow is not interrupted. See [Setting Up Worksets](#) on page 1252.

Multi-Discipline Coordination

Building projects that are worked on by teams of architects and structural engineers require a method for monitoring and coordinating changes between teams from the different disciplines. The Copy/Monitor tool accomplishes this task. Effective monitoring and coordination reduces mistakes and expensive rework. One example where you need monitoring and coordination is if the structural engineer moves a structural column that the architect placed. Revit Architecture can post a warning and then give options on how to proceed with the change.

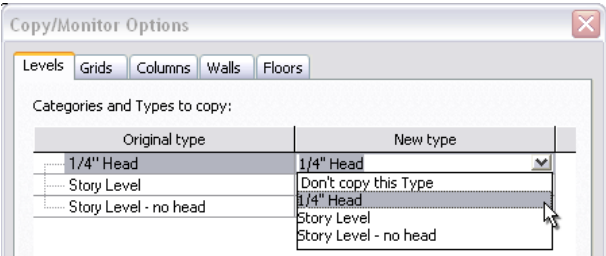
The copy functionality copies grids, levels, columns, walls, floors, and openings from a linked project into a host project. You can modify these copied elements. Copied elements are automatically related to the original elements. The monitoring functionality sets and maintains relationships for grids, levels, columns, walls, floors, and openings that are in the host or linked project.

Copying Elements from a Linked Project

- 1 Open an existing project or start a new project.
- 2 Click Insert tab ► Link panel ► Link Revit.
- 3 In the Import/Link RVT dialog, select the Revit model to link, and click Open.
- 4 Click Collaborate tab ► Coordinate panel ► Copy/Monitor drop-down ► Select Link.
- 5 In the drawing area, select the linked model.
Revit Architecture enters Copy/Monitor mode.

Set options

- 6 Click Copy/Monitor tab ► Tools panel ► Options.
The Copy/Monitor Options dialog opens. Each tab contains various options for that type of element. This makes the copied element different from the original. Also, you can decide which element types to copy. On each tab, there is a heading called Original Type. Under that heading is a list of all element types from the linked project. For example, on the Levels tab, under Original Type, you might see Story Level and Story Level - no head.
By default, the original type in the linked file is mapped to the corresponding default type in the host file. You can change it to another type, which means the copy assumes the new type. You can also choose not to copy the element.
- 7 Double-click in the New type column for the category or type, click the arrow icon, and select Copy original type, Don't copy this Type, the original type (for example, 1/4" Head), or the new type (for example, No Head).



- 8 If necessary, specify Additional Copy Parameters.

Name	Description
Levels	
Offset Level	Offset the copy vertically from the original level by a given value. The Copy/Monitor tool maintains this offset.
Reuse Levels with the same name	When selected, if the target project contains a level with the same name as the copied level, a new level will not be created. The existing level will be relocated and used instead of the copied level (monitoring will be established).
Reuse matching levels	If there is a level at the same elevation in the target project, it will be used instead of the copied level. A copy will not be created.

Name	Description
Add suffix to Level Name	Enter a suffix for the level name.
Add prefix to Level Name	Enter a prefix for the level name.
Grids	
Reuse Grids with the same name	When selected, if the target project contains a grid with the same name as the copied grid, a new grid will not be created. The existing grid will be relocated and used instead of the copied grid (monitoring will be established).
Reuse matching Grids	If there is a grid at the same location in the target project, it will be used instead of the copied grid. A copy will not be created.
Add suffix to Grid Name	Add a suffix for the grid name.
Add prefix to Grid Name	Enter a prefix for the grid name.
Columns	
Split Columns by Levels	Split columns into smaller ones at level lines.
Walls	
Copy windows/doors/openings	Select to copy hosted elements (such as windows, doors, and openings).
Floors	
Copy openings/inserts	Select to copy inserts and openings.
	NOTE If this option is selected, all inserts are copied as openings.

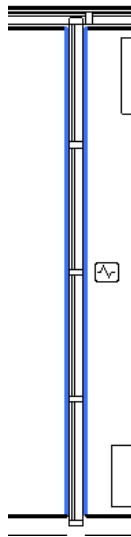
9 Click OK to close the Copy/Monitor Options dialog.

10 Click Copy/Monitor tab ► Tools panel ► Copy.

To select more than one element at a time, on the Options Bar, select Multiple. When you are done selecting elements, click Finish on the Options Bar.

11 Place the cursor on the desired grids, levels, floors, walls and columns to copy, and click to copy them.

After you copy an element, the copy/monitor icon displays next to it to indicate that it has a relationship with the original element.



12 Click Finish.

If you modify a copied element, a warning indicates that a monitored element has changed. You can review those warnings using the Coordination Review tool. See [Coordination Review on Element Relationships](#) on page 1293.

Establish relationships between elements

13 Open an existing project or start a new project.

You can establish and monitor relationships between elements in a host project and linked projects, or between elements in the current project.

14 Click Collaborate tab ► Coordinate panel ► Copy/Monitor drop-down ► Use Current Project or Select Link.

Revit Architecture enters Copy/Monitor mode.

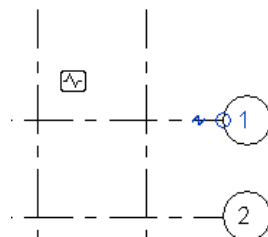
15 Click Copy/Monitor tab ► Tools panel ► Monitor.

You establish relationships between pairs of corresponding elements. For example, you select one grid and then another grid to form a relationship. You cannot monitor unlike pairs, such as a grid and a level. If you select an opening, you can monitor openings or inserts (for example, a window or door).

16 Select a grid, level, floor, wall, opening, or column to monitor, and then select a corresponding element.

17 Continue selecting as many element pairs as desired.

After you select a pair of elements, the copy/monitor icon displays next to the first element to indicate that it has a relationship.



18 Click Finish.

If you modify one of the elements in a pair, a warning indicates that a monitored element has changed. You can review those warnings using the Coordination Review tool. See [Coordination Review on Element Relationships](#) on page 1293.

Stopping Element Monitoring

To stop element monitoring, select a monitored element, and click Modify <element> tab ► Monitor panel ► Stop Monitoring.

Coordination Review on Element Relationships

Whenever you modify monitored elements, a coordination monitor warning displays. You can review these warnings using the Coordination Review tool and decide what action to take.

You can review warnings between elements in the current project, or between elements in a linked project and a host project.

Warnings can occur because of these violations:

- An original monitored element from the linked project has changed.
- A copied monitored element in the host project has changed.
- Both the original monitored element and the copied element have changed.
- The original element in the linked file was deleted.
- The copied element in the host file was deleted.

To review warnings about project changes:

- 1 Click Collaborate tab ► Coordinate panel ► Coordination Review drop-down ► Use Current Project if you want to check warnings between elements in the current project, or click Collaborate tab ► Coordinate panel ► Coordination Review drop-down ► Select Link to check warnings between the linked and the host projects.

If you chose Select Link, click the link in the drawing area.

The Coordination Review dialog displays. If you are running a review on the current project, click the In host project tab. If you are running a review on a link and the host project and linked project are linked, both the In host project tab and the In-a-linked-project tab display. The dialog displays an expandable tree of all the warnings between monitored elements.

- 2 Expand the Message branch to display the element warning groups.
- 3 Continue to expand the branches until you see a value for the Action heading.

On this dialog are several options:

- Do nothing: Take no action on the element. Changes the message status so that it can be filtered out or considered later.
- Reject (in a host project tab only): There is a difference between an element in the host file and its associated monitored element. The change made to the element in the host file is incorrect, and a change must be made to the associated monitored element.
- Accept difference (in a host project tab only): Accepts the change made to the element and updates the relationship. For example, if a pair of grids were 200 mm apart, and one was moved to 300 mm away, the change would be accepted, and the relationship would now be set to 300 mm.

- **Modify, Rename, Move:** The tool name changes based on the action. If the name of the monitored element has changed, the tool reads Rename. If a column or level is moved, the tool is Move. If a grid is changed or moved, the tool is Modify.

NOTE If you select one of these tools on the In-a-linked-project tab, you are changing the element in the current project, not the linked project.

4 Select the appropriate tool next to each warning.

5 If desired, click Add Comment to enter comments on your action. Enter comments into the Edit Comment tool, and click OK.

This is your form of communication to the other cross-functional team members. For example, you (the architect) are communicating to the structural engineer. Your comments become visible in the linked file, when the link is reloaded.

6 When you are finished taking actions, click OK to close the Coordination Review dialog.

Interference Checking

The Interference Check tool finds intersections between elements in a project. These can be a set of selected elements or all elements in the model.

Typical Workflow for Interference Checking

This tool can be used during the design process to coordinate major building elements and systems. It can be used to prevent conflicts and reduce the risk of construction changes and cost overruns.

A common workflow might occur like this:

- An architect meets with a client and creates a basic model.
- The building model is sent to a team that includes members from other disciplines, such as structural engineers. They work on their own version of the model, and then the architect links it in and checks for interferences.
- Team members from other disciplines return the model to the architect.
- The architect runs the Interference Check tool on the existing model.
- A report is generated from the interference check, and undesired intersections are noted.
- The design team discusses the interferences and creates a strategy to address them.
- One or more team members are assigned to fix any conflicts.

Elements Requiring Interference Checking

Some examples of elements that could be checked for interference include:

- Structural girders and purlins
- Structural columns and [Architectural Columns](#) on page 756
- Structural braces and [Walls](#) on page 633
- Structural braces, doors, and windows
- [Roofs](#) on page 675 and [Floors](#) on page 709
- Specialty equipment and [Floors](#) on page 709

- A linked Revit model and elements in the current model

Running an Interference Check

- 1 If desired, select some elements in a view.
- 2 Click Collaborate tab ► Coordinate panel ► Interference Check drop-down ► Run Interference Check.
The Interference Check dialog opens.
If you selected elements in the view, the dialog is filtered to display only those element categories.
If you did not select any elements, the dialog displays all categories from the current project.
- 3 On the left side of the dialog, select a value from the first Categories from drop-down.
For example, select Current Project.

NOTE If you selected a linked Revit model to run a check, you must select its name from this option. For example, if you selected the linked model called Mylink1, select that name from Categories from drop-down. After you select the name, element categories in the linked model are listed.

- 4 Select the desired categories.
For example, select Roofs as the category.
- 5 On the right side of the dialog, select a value from the second Categories from drop-down.
This value could be a current selection of elements, the current project, or a linked Revit model.
- 6 Select the other desired categories.
For example, to complete a roof-floor interference check, select floors as the category.
- 7 Click OK.
If there are no interferences to report, a dialog displays informing you of this.
If there are interferences to report, the Interference Report dialog displays. The dialog lists all elements that are in conflict with one another.
Interferences are grouped according to the way you generated the check. By default, they are grouped as Category 1 (left category column) and Category 2 (right category column). You can change this grouping to Category 2, Category 1. For example, if you ran the roof and floor check, the dialog would list the roof category first, and then which floors are intersecting the roof.
- 8 To see one of the elements that is intersected, select its name in the Interference Report dialog, and click Show.
A view opens that displays the problem.
- 9 To correct a conflict, click in the view and modify the overlapping elements.
The Interference Report dialog remains visible.
- 10 When you have fixed the problem intersection, in the Interference Report dialog, click Refresh.
If the problem has been resolved, the problem elements are removed from the list of conflicts.

NOTE Refresh rechecks only those interferences in the current report. It does not rerun the interference check.

You can continue resolving conflicts in this manner.

If you cannot resolve all conflicts without additional input from team members, you can generate an HTML version of the report.

- 11 In the Interference Report dialog, click Export.

- 12 Enter a name, navigate to the desired folder to save the report, and click Save.
- 13 In the Interference Report dialog, click Close.
- 14 To see the last report generated again, click Collaborate tab ► Coordinate panel ► Interference Check drop-down ► Show Last Report.
This tool does not rerun the interference check.

Interference Check Tips

- Processing time for interference checks can vary greatly. In a large model, checking all categories against each other can take a long time and is **not recommended**. To reduce processing time, select a limited set of elements or a limited number of categories.
- To run a check on all available categories, click All in the Interference Check dialog, and then select one of the check boxes next to a category.
- Click None to clear the selection of any categories.
- Click Invert to change the selection between categories that are currently selected and those that are not.

Shared Positioning

A Revit Architecture project has internal coordinates for all the elements that compose the model in a project. Those coordinates are known to this project only. This is acceptable if you have a standalone model whose position is not relevant to other models or to a site. However, if you want the position of the model to be known to other linked models, you need to share coordinates.

Shared coordinates are used for remembering the mutual positions of multiple interlinked files. Those interlinked files can be all Revit files, or a combination of Revit, DWG, and DXF files.

Recommended Uses for Shared Positioning

If the significant coordinates for a project are in a linked model, such as a building model with a linked site, acquire the coordinates from the linked model.

If the significant coordinates for a project are in the host model, such as a site with linked building models, publish coordinates from the host to the linked models.

TIP You should derive shared coordinates from only one file. That one file defines the coordinates for all other files that compose the project. Acquire coordinates from one file and then publish those coordinates to other files.

Defining Named Locations

Revit Architecture projects can have named locations. A named location is the position of a model instance in a Revit Architecture project. By default, each Revit Architecture project contains at least one named location, called Internal.

If your Revit Architecture project contains a unique structure or a site model, it typically has only one named location.

If your Revit Architecture project contains several identical buildings, it will have many locations in it.

You may want several locations of a building to create a campus look. For example:

- Several identical dormitory buildings on the same site
- Identical condominiums on the same site

You might also want several locations for a unique building. In this case, you could import the building into a site model and then move the building around on the site by choosing different locations.

Locations are modifiable in a project. You can delete, rename, and create new locations, and switch between locations.

Seeing and Creating Named Locations

- 1 Click Manage tab ► Project Location panel ► Location.
- 2 In the Manage Place and Locations dialog, click the Locations tab.
The Manage Place and Locations dialog lists the current named locations in the project. By default, each project has a named location called Internal.
- 3 To create a new named location, click Duplicate.
- 4 Enter a name for the location, and click OK.
- 5 To rename an existing location, click Rename.
- 6 To delete an existing location, click Delete.

NOTE You cannot delete the last location.

- 7 To change the active location of the project, select it and click Make Current.
- 8 Click OK.

Repositioning Named Locations

After you have set up a shared coordinate system between the host model and the linked files, the position of a linked file is determined by its corresponding location in the host model. You can drag the linked file to another position inside the host model. When you do this, you are actually changing the corresponding location in the linked file.

When you reposition the linked file to a new location, you can save that change. There are several ways to do this.

Warning Dialog

After you move the linked file, a warning indicates that the linked file will change. This occurred because you have defined a new position for the named location in the linked file. In the warning dialog, you can choose to save the linked file or save the new location later by clicking Save Locations in the Manage Links dialog. If you click Save Now, Revit Architecture saves the new location to the host model.

Recording a New Location with Manage Links

- 1 Click Manage tab ► Manage Project panel ► Manage Links.
- 2 Click the tab for the model file type that you have linked. For example, if you have linked a Revit model, click the Revit tab.
- 3 Click the linked file name to select it.
- 4 Click Save Locations.
- 5 The Location Position Changed dialog displays the following options:
 - Save. Saves the new position of the host model back to the linked file.
 - Do not save. Changes to positions are discarded, and the linked file returns to its previously saved position when it is reloaded or reopened.

- Disable shared positioning. The linked model keeps its current position. The shared coordinates between the linked file and the host model are disabled. The Shared Location parameter is set to <Not Shared> in the linked file.

6 Click OK to close the Manage Links dialog.

Saving Through the Host Model

If you save or close the host model, you are prompted to save the linked models. The Save Modified Linked Model dialog appears.

Saving When You Unload a Link

If you unload a linked file, the Save Modified Linked Model dialog displays. Again, you are prompted to save changes to the linked model.

Modifying Linked Model Location Through Instance Properties

1 Select a linked instance in the host model.

2 Click Modify RVT Links tab ► Element panel ► Element Properties, and click the button that appears next to the Shared Location parameter.

The Choose Location dialog displays the current location of the linked instance.

NOTE If the Share Coordinates dialog displays, select an option to reconcile the coordinates, click Reconcile, and then the Choose Location dialog will display. For more information, see [Acquiring or Publishing Through Linked Instance Properties](#) on page 1299.

3 Specify how to set the location of the linked instance:

- Select Move Instance To and choose a location name. The listed location names are from the linked model file. When you click OK, the linked instance moves to the recorded position for that named location.
- Select Record Current Position As to record the current location of the linked model instance back to its file. If you want to create a new location name for the instance, click Change to add a new location name that is also saved back to the linked model file.
- Select Do Not Share Location of Selected Instance to place the instance in the desired position and break the share between the linked and model files. If you select this option, you can move the linked instance in the host model without changing the linked model file.

4 Click OK.

Acquiring and Publishing Coordinates

In general, you want to acquire coordinates from a linked model (such as a site) if you are working in a building model file. If you are working in the site model, you want to publish coordinates from the site model to linked building models.

In either case, you publish or acquire coordinates while you are in a host model.

Acquire Coordinates

When you acquire coordinates from a linked Revit project, the shared coordinates of the linked project become the shared coordinates of the host project, based on the location of the linked project instance in the host project. There is no change to the host project's internal coordinates. The host project also acquires

True North from the linked project. The origin of the linked project's shared coordinates becomes the origin of the host project's shared coordinates.

When a Revit Architecture project acquires coordinates from a linked DWG file, the World Coordinate System (WCS) of the selected linked DWG file becomes the shared coordinate system of the host Revit Architecture project, based on the location of the linked DWG instance. The Y axis of the DWG becomes True North, and the origin of the DWG becomes the origin of the shared coordinate system of the Revit Architecture project.

To acquire coordinates:

- 1 Click Manage tab ► Project Location panel ► Coordinates drop-down ► Acquire Coordinates.
- 2 Place the cursor on a linked model instance, and click.

The host model file now has the same shared coordinates as the linked model file. If other loaded linked models share coordinates with the host model, they also acquire the new coordinates.

Publish Coordinates

When you publish shared coordinates from a host project to a linked project, this changes the linked project. The host project's True North and shared origin are recorded in the linked project, based on the current location of the linked instance. This location is now named in both the host project and the linked project. More than one location of the link can be recorded.

When you publish shared coordinates from a host Revit Architecture project to a linked DWG, this changes the linked DWG. The origin of the host Revit Architecture project's shared coordinate system becomes the origin of a new User Coordinate System (UCS) in the DWG file. The Y axis of the new UCS corresponds to the host project's True North. You can name the UCS when you publish coordinates. It is not recommended that you change this name after publishing coordinates.

To publish coordinates:

- 1 Click Manage tab ► Project Location panel ► Coordinates drop-down ► Publish Coordinates.
- 2 Place the cursor on a linked model instance and click.
- 3 Select a named location from the linked model, and click OK.
See [Defining Named Locations](#) on page 1296.

The linked model file now has the same shared coordinates as the host model file.

Acquiring or Publishing Through Linked Instance Properties

This procedure assumes that you have a linked model instance in the host model, and its coordinates are not currently shared with those of the host model.

- 1 Select the linked model in the host model and click Modify RVT Links tab ► Element panel ► Element Properties.
Notice the button in the value box next to the Shared Location parameter. It reads Not Shared, which indicates that there is no coordinate sharing between the linked instance and the host model.
- 2 Click the button.
Because this is the first time that you are setting up shared coordinates between the host and the linked models, a dialog displays, telling you that you need to reconcile the coordinates in favor of the host or the linked model. You need to reconcile the coordinates only once.

3 Select Publish or Acquire:

- You publish the coordinates of the host model to the linked model. The linked model file coordinates change to the host model file's coordinates.
- You acquire the coordinates from the linked model to the host model.

4 The linked model's position in the host model is saved to a location name in the linked model file. If desired, you can change the name of the location by clicking Change and selecting a name from the Select Location dialog.

5 Click Reconcile to confirm changes.

6 Click OK to close the linked model properties.

Tips on Acquiring and Publishing

You cannot acquire coordinates or publish coordinates from a project that has multiple locations, using the Acquire Coordinates or Publish Coordinates tools. You can do it through the properties of the linked model. See [Defining Named Locations](#) on page 1296.

Relocating and Mirroring a Project

To see the results of relocating a project, the host project must contain linked instances at shared locations. The relocate function modifies the position of all elements in the project and any import instances that are not linked. In addition, any linked instances that are not at shared locations move relative to all linked instances at shared locations.

Related topics

- [Project Location and Orientation](#) on page 448
- [Rotating a View to True North](#) on page 449

Relocating a Project

The Relocate this Project tool moves the entire project relative to the shared coordinate system.

1 Click Manage tab ► Project Location panel ► Position drop-down ► Relocate Project.

You use the tool just like the Move tool.

2 Move the project graphically in the view. See [Moving Elements with the Move Tool](#) on page 373.

NOTE If you have set levels or spot elevations to report values from the shared origin, their values update. See [Level Properties](#) on page 1104 and [Changing Elevation Reporting](#) on page 279.

Relocating a Project by Entering Points

You can relocate a project and rotate the project to True North by entering specific coordinates for North/South, East/West, and Elevation. You can also set the angle between True North and Project North. You can click anywhere in a view to set the coordinates. Some coordinates may not be editable depending on where you click. For example, in elevation, if you click on a level line, the only value that you can edit is elevation.

You can use this tool when you have a specific set of coordinates from a surveyor, or if you report shared coordinates and want to relocate the project to the coordinates reported.

To relocate a project by entering points:

- 1 Click Manage tab ► Project Location panel ► Coordinates drop-down ► Specify Coordinates at Point.
- 2 Place the cursor in the view, and click to select a point at which to enter the coordinates.
The Specify Shared Coordinates dialog displays values for the coordinates of the selected point. The dialog displays only values that it can infer from the point.
- 3 Enter coordinate values for the selected point.
- 4 If you want to rotate the project from Project North to True North, enter a value and direction.
- 5 Click OK to save the new coordinates for the selected point.

Mirroring a Project

Mirroring a project allows you to mirror (reflect the position and shape of) all elements in a project around an axis you select (North - South, East - West, Northeast - Southwest, or Northwest - Southeast). When you mirror a project, model elements, all views, and annotations are mirrored. Orientation of annotations is preserved when necessary, for example text does not mirror in order to retain readability.

To mirror a project:

- 1 Click Manage tab ► Project Location panel ► Position drop-down ► Mirror Project.
- 2 In the Mirror Project dialog, select an option.
- 3 Click OK.

In some cases when you mirror a project, relationships between elements are not supported as in the original orientation of the project. This can lead to unexpected results and errors, for example some elements may deviate from exact reflection. After you mirror the project, a message displays to indicate any errors encountered. You can export errors to review and correct them.

For information on exporting errors, see [Exporting Warnings to a File](#) on page 1416. For information on finding elements in the project that are associated with errors, see [Diagnostic Tool](#) on page 1413. For information on the tools you can use to correct errors, see [Editing Elements](#) on page 339.



Reporting Shared Coordinates

You can report the shared coordinates of a linked model within a host model. The coordinates returned are with respect to the shared coordinates between the models.

- 1 Click Manage tab ► Project Location panel ► Coordinates drop-down ► Report Shared Coordinates.
- 2 Place the cursor on a reference point of the linked model.
A reference point can be an edge of an element (such as a roof) or the corner of 2 walls.
- 3 Click the reference.
The coordinates of the reference display on the Options Bar. The reference's elevation also displays.

NOTE If you click somewhere in a plan view (other than a reference), you see the North, South, East, and West coordinates of that point. In a section or elevation view, you see only the elevation of the point.

Project Base Points and Survey Points

Every project has a project base point  and a survey point  , although they might not be visible in all views, because of visibility settings and view clippings. They cannot be deleted.


The project base point defines the origin (0,0,0) of the project coordinate system. It also can be used to position the building on the site and for locating the design elements of a building during construction. Spot coordinates and spot elevations that reference the project coordinate system are displayed relative to this point.

The survey point represents a known point in the physical world, such as a geodetic survey marker. The survey point is used to correctly orient the building geometry in another coordinate system, such as the coordinate system used in a civil engineering application.



Making Project Base Points and Survey Points Visible

To turn on the visibility of the project base point and survey point in a view:

- 1 Click View tab ► Graphics panel ► Visibility/Graphics.
- 2 On the Model Categories tab of the Visibility/Graphics dialog, scroll down to Site, and expand it.
- 3 To display the project base point, select Project Base Point.
- 4 To display the survey point, select Survey Point.

You can also click  (Reveal Hidden Elements) on the View Control bar to turn on the visibility of the project base point and survey point in a view.

Moving Project Base Points and Survey Points

The project base point and the survey point can be  (clipped) or  (unclipped). By default, they are clipped in all views. To switch between the clipped and unclipped states, first click the point, and then the icon. The following table describes how clipping and unclipping affects these points when you move them in a view.

Clipped	Unclipped
Project Base Point	
Moving a clipped project base point is the same as using the Relocate Project tool. See Relocating a Project on page 1300.	Moving an unclipped project base point repositions the project coordinate system relative to both the model geometry and shared coordinate system.
■ Project coordinates do not change for the model elements.	■ Project coordinates change for the model elements.
■ Shared coordinates change for the model elements.	■ The shared coordinates of the project base point change in the shared coordinate system. (The project coordinates of the project base point never change.)
	■ Shared coordinates do not change for the model elements.

Clipped	Unclipped
Project Survey Point	
Moving a clipped survey point repositions the shared coordinate system relative to the model geometry and the project coordinate system.	Moving an unclipped survey point moves only the survey point relative to the shared coordinate and the project coordinate systems.
<ul style="list-style-type: none"> ■ Project coordinates do not change for the model elements. ■ Shared coordinates change for the model elements. 	<ul style="list-style-type: none"> ■ Project coordinates do not change for the model elements. ■ Shared coordinates do not change for the model elements. ■ Only the shared coordinates of the survey point itself change.

To move the project base point or survey point in a view, do one of the following:

- Drag the point to the desired position.
- Click the point and then click the desired coordinate to open the text box. Enter the new coordinates. For a project base point,

NOTE changing the value of the Angle to True North is another way of rotating a project to true north. See [Rotating a View to True North](#) on page 449.

The startup location is the original position of the project base point in a new project. To return the project base point to its startup location:

- 1 Unclip the project base point.
- 2 Right-click the project base point, and click Move to Startup Location.

Pinning Project Base Points and Survey Points

You cannot move a pinned project base point or survey point. Pinning the project base point disables the Relocate Project and the Rotate Project North tools. Pinning the survey point disables the Rotate True North, Acquire Coordinates, and Specify Coordinates tools. See [Preventing Elements from Moving](#) on page 382.

Tips for Working with Project Base Points and Survey Points

Consider the following when working with project base points and survey points:

- To ensure accuracy of the model, be sure the model geometry is less than 1 mile from the startup location of the project base point. To check this measurement:
 - 1 Use Move to Startup Location from the shortcut menu to move the project base point back to its startup location.
 - 2 Use the Measure tool on the Modify tab to measure the distance from the project base point to the model geometry.
 - 3 If the distance is more than 1 mile, move the model geometry within 1 mile of the startup location of the project base point.

- Before you export a building site to a civil engineering application that accepts ADSK files, such as Civil 3D:
 - 1 Move the unclipped survey point to the location agreed upon with the civil engineer.
 - 2 Use the Specify Coordinates at a Point tool or enter the coordinates on the Location tab of the Building Site Export dialog, using the coordinates provided by the civil engineer.
- To ensure that an imported DWG site is positioned correctly in the project:
 - 1 Using the coordinates you received from the civil engineer, specify the shared coordinates of the survey point.
 - 2 Specify the correct angle for True North.
 - 3 Specify Positioning-Auto by Shared Coordinates to link the DWG file.

Design Options

22

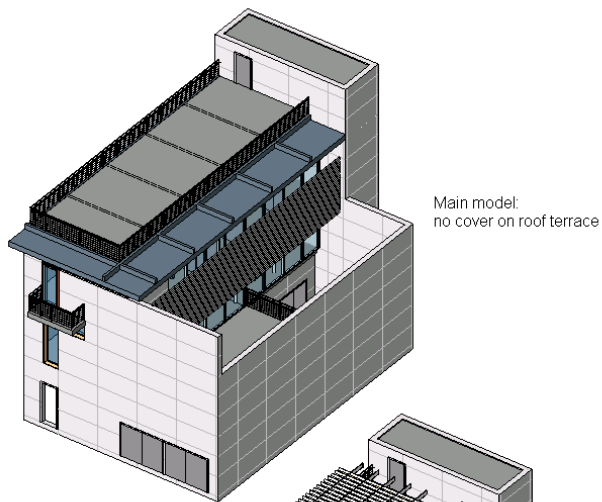
After designing the majority of a project, use design options to develop alternative designs in the project. For example, you can use design options to adapt to changes in project scope, review other designs, or show variations to a client.

With design options, a team can develop, evaluate, and redesign building components and rooms within a single project file. Some team members can work on specific options, such as variations of a lobby, while the rest of the team continues with the main model.

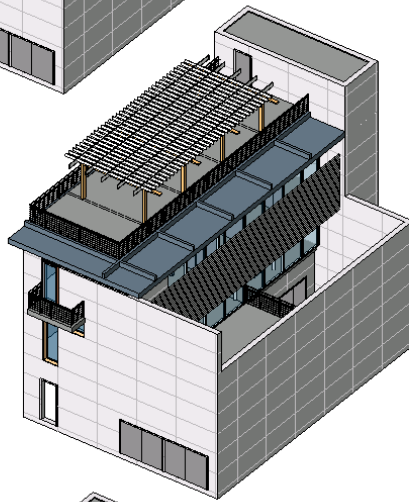
Design options can vary in complexity. For example, a designer may want to explore alternatives for entry designs or structural systems for a roof. Design options tend to become more focused and simplified as a project progresses. They are typically used as follows:

- Changing the entry design
- Exploring different layouts for rooms or furniture
- Trying different window configurations
- Developing sustainable design alternatives

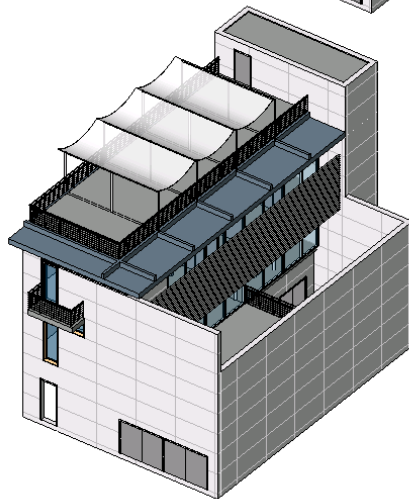
You can use design options to explore multiple designs as the project develops. At any time in the design process, you can have multiple sets of design options. Typically, each set of design options addresses a particular issue or area. For example, to explore possibilities for a pergola and sunshade for a roof terrace, you can create an option set called Roofing with multiple roofing designs (Sunscreen or Louvers). In addition, you can create an option set called Roof Structure with multiple structural designs (Brackets or Beams). After the final design is chosen, you can incorporate the chosen options into the main model and remove the alternatives.



Main model:
no cover on roof terrace



Primary options:
Roof Structure = Beams
Roofing = Louvers



Secondary options:
Roof Structure = Brackets
Roofing = Sunscreen

Design Option Workflow

In general, the process of using design options is as follows:

- 1 Decide on the areas for which you want to develop design options.

Example: You want to create one set of design options for the entry of a building and a second set of design options for the roof.

- 2 Create the building model, including all elements that will be common to all of the design options. (This is the main model.)

Example: Create the building first, including the foundation, floor, walls, and other parts of the building. Do not include any elements that will belong to the entry or the roof; those elements will be added using design options.

NOTE If you add elements to a building and later decide that those elements should be part of a design option, you can move them to the design option. See [Moving Elements from the Main Model to a Design Option Set](#) on page 1313.

- 3 Create a design option set for each area.

Example: You create one design option set named Entry and another design option set named Roof. For instructions, see [Creating Design Option Sets](#) on page 1309.

- 4 For each design option set, edit the primary option.

When you create a design option set, Revit Architecture also creates a primary option for the set. The primary option is typically the preferred design or the design that you think will be chosen. It will be displayed in project views by default. Other design options will appear in views only when you specify.

Edit the primary option to add elements to the design as desired. (See [Editing a Design Option](#) on page 1311.) For an alternative approach, see [Viewing the Main Model Without Design Options](#) on page 1320.

- 5 Create secondary options for each design option set.

You can create one or more secondary options for each set. See [Adding Design Options](#) on page 1310.

Example: For the Entry option set, you create secondary options named Revolving Door and Two Double Doors.

In general, any elements that will be modified or referenced in an option should belong to the design option instead of the main model. See [Referencing Elements in Design Options](#) on page 1321 and [Moving Elements from the Main Model to a Design Option Set](#) on page 1313.

- 6 Create views that display each design option.

By default, all project views display the main model with primary design options only. To see secondary options, create project views that show them. (These are called dedicated views.) You can then place these views on sheets to present the designs to clients. See [Dedicating Views to Design Options](#) on page 1318.

- 7 Incorporate a design option into the main model.

After the client has selected the desired option for each option set, you can incorporate the selected designs into the main model. This process deletes the design option set, so the other options in the set are no longer available, and the selected option becomes part of the building model. See [Incorporating a Design Option into the Main Model](#) on page 1318.

Design Options Terminology

Term	Description
Main model	The parts of the building model that are not defined using design options. The main model is the entire building model, excluding any design options.
Design option set	A collection of alternatives that addresses a particular design problem, such as a lobby or a floor layout. See Creating Design Option Sets on page 1309.

Term	Description
Design option	One possible solution to the design problem. See Adding Design Options on page 1310 and Working with Design Options on page 1311.
Primary option	The preferred design option in the design option set. The primary option has a closer relationship to the main model than secondary options. Elements in the main model and in the primary option can reference each other. Only one design option in a set can be the primary option. All other options are secondary. By default, each project view displays both the main model and the primary option for each set. See Promoting a Secondary Option to the Primary Option on page 1312.
Secondary option	A design option that is an alternative to the primary option in the set. Elements in a secondary option can reference elements in the main model. However, elements in the main model cannot reference elements in a secondary option. See Referencing Elements in Design Options on page 1321.
Active option	The design option that you are currently editing. See Editing a Design Option on page 1311 and Determining the Active Option on page 1312.
Dedicated view	A view that is dedicated to a specific design option. When this view is active or added to a sheet, Revit Architecture shows the design option along with the main model. See Dedicating Views to Design Options on page 1318.

Best Practices for Design Options

When implementing design options, consider the following strategies:

To prepare the main model for design options

In the main model create as much of the model as possible before adding any design options. Include elements that will be common to all design options. Use design options for only those parts of the model that will vary.

To create a design option

- 1 Create a design option set. See [Creating Design Option Sets](#) on page 1309.
- 2 Add the design option. See [Adding Design Options](#) on page 1310.
- 3 Add elements to the design option. See [Editing a Design Option](#) on page 1311.

To facilitate cleanup

If main model elements need to clean up connections with secondary design option elements, move those elements from the main model to one or more design options in the set. You cannot join the geometry of elements that are part of a secondary option with elements that are part of the main model. For example, if walls in the main model need to attach to a roof in Roof Option 2, move the walls from the main model into Roof Option 2.

See [Design Options and Wall Joins](#) on page 1325, [Referencing Elements in Design Options](#) on page 1321, and [Moving Elements from the Main Model to a Design Option Set](#) on page 1313.

To see and compare design options

Do either of the following:

- Change the design option settings for a view. See [Checking the Design Option Settings for a View](#) on page 1320.
- For each design option that you want to compare, dedicate a view to the option. You can place these views on sheets for side-by-side comparisons or to show the design options to clients. See [Dedicating Views to Design Options](#) on page 1318 and [Viewing Multiple Design Options](#) on page 1320.

To detail or annotate a design option

Dedicate a view to the option. Then add details or annotations to the view. Details and annotations are view-specific; they belong to a view, not to a design option. See [Annotating and Detailing Design Options](#) on page 1315.

To create schedules for design options

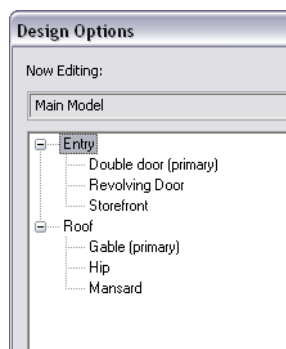
Create the desired schedule, duplicate it, and dedicate one schedule to each design option. Each schedule lists elements from the main model and elements from the specified design option. You create schedules that are dedicated to design options in the same way that you create dedicated views. See [Dedicating Views to Design Options](#) on page 1318.

To incorporate a design option

After a design option is selected for implementation, incorporate it into the main model and delete all other options using the Accept Primary function. See [Incorporating a Design Option into the Main Model](#) on page 1318.

Creating Design Option Sets

You begin the design option process by creating design option sets. A design option set is a collection of alternatives that address a particular design problem. For example, you can create one design option set to show different designs for the entry of a building. You can create another design option set for alternative roof configurations. Each design option set contains one primary option and one or more secondary options.



To create a design option set

- 1 Click Manage tab ► Design Options panel ► Design Options.
- 2 In the Design Options dialog, under Option Set, click New.

By default, Revit Architecture names the new set Option Set 1 and creates a primary option in the set.

- 3 To rename the option set, select the option set name, and under Option Set, click Rename. Enter a name, and click OK.
- 4 To rename the primary option, select its name, and under Option, click Rename. Enter a name, and click OK.
- 5 Click Close.

Now you can edit the primary design option to add elements to it, and create secondary options for the design option set. See [Editing a Design Option](#) on page 1311 and [Adding Design Options](#) on page 1310.

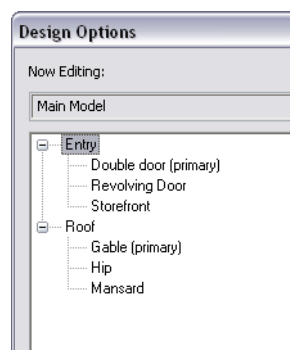
By default, project views show the main model with the primary option for each set. If you want project views to show the main model only, with no design options, see [Viewing the Main Model Without Design Options](#) on page 1320. To see a list of design option sets and design options defined for a project, click Manage tab ► Design Options panel, and display the drop-down list.

Adding Design Options

A design option is one possible solution for a particular design issue. Each design option set contains one primary option and one or more secondary options. When you create a set, Revit Architecture also creates a primary option, which you must edit to add its elements. (See [Editing a Design Option](#) on page 1311.) Use the following procedure to add secondary design options.

To add a design option

- 1 Click Manage tab ► Design Options panel ► Design Options.
- 2 In the Design Options dialog, in the left-hand list, select the design option set to which you want to add an option.
- 3 Under Option, click New.
The default option name displays under the option set.
- 4 To rename the option, select the option name, and under Option, click Rename. Enter a name, and click OK.



- 5 If you want this design option to be the primary option for the design set, click Make Primary.
The Make Primary button promotes a secondary option to the primary option. The former primary option becomes a secondary option.

NOTE Use caution with Make Primary, because references from the main model to the former primary option can be lost. After using Make Primary, check dimension references and tags to be sure they are referencing the correct elements. See [Referencing Elements in Design Options](#) on page 1321.

- 6 To open the design option for editing, do the following:
 - a Select the design option in the list, and click Edit Selected.

- b** Click Close.

In the current view, elements in the main model display in halftone to distinguish them from the design option that you are editing. For further instructions, see [Editing a Design Option](#) on page 1311.

TIP If the current view does not show the active option, check its design option settings. (See [Checking the Design Option Settings for a View](#) on page 1320.) For the appropriate design option set, specify Automatic, or select the desired design option.

If the design option that you just created is a primary option, by default it displays in all project views that are not dedicated to other design options. If the option is secondary, it does not appear in any project views by default. See [Viewing Design Options](#) on page 1318.

Working with Design Options

The following topics describe how to modify and work with design options.

Editing a Design Option

- 1** In the Project Browser, open a view where you can add the desired elements for the design option.
- 2** Prepare the view to show the active design option:
 - a** On the keyboard, type **VG** (for Visibility/Graphics).
 - b** On the Visibility/Graphics dialog, click the Design Options tab.
 - c** For the appropriate design option set, in the Design Option column, select Automatic.
 - d** Click OK.
- 3** Open the design option for editing, using one of the following methods:
 - Click Manage tab ► Design Options panel ► Design Options. In the Design Options dialog, select the design option from the list, click Edit Selected, and click Close.
 - Click Manage tab ► Design Options panel, and select the desired design option from the drop-down list.
 - Click Manage tab ► Design Options panel ► Pick to Edit, and select an element contained in the design option. Revit Architecture determines the design option to which the selected element belongs, and makes that design option active for editing.
- 4** Edit the design option as desired.

The model elements that you add now belong to the active option. For tips on using design options in various ways, see [Considerations When Using Design Options](#) on page 1321.

NOTE You cannot add view-specific elements (such as keynotes, dimensions, and tags) to a design option. Instead, dedicate a view to the design option, and add the view-specific elements to the dedicated view. See [Annotating and Detailing Design Options](#) on page 1315.

While you are editing the design option, you can move among project views as needed. When you change to a different view, you may need to change the design option settings for the view to see the active option. (See [Checking the Design Option Settings for a View](#) on page 1320.)

- 5 When you are finished editing the design option, click Manage tab ► Design Options panel, and select Main Model from the drop-down list.

Related topics

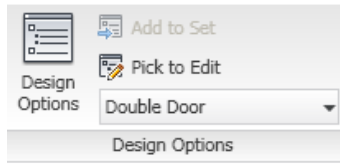
- [Viewing Design Options](#) on page 1318
- [Working with Design Options](#) on page 1311
- [Best Practices for Design Options](#) on page 1308
- [Considerations When Using Design Options](#) on page 1321

Determining the Active Option

The active option is the design option that is currently being edited. If you are editing an option, the current view displays the main model and the active option.

TIP If the current view does not show the active option, check its design option settings. (See [Checking the Design Option Settings for a View](#) on page 1320.) For the appropriate design option set, specify Automatic, or select the desired design option.

To determine whether you are currently editing a design option, click Manage tab ► Design Options panel. The drop-down list indicates the design option that is currently being edited. Changes that you make will affect the active option.



If the drop-down list displays Main Model, you are not currently editing a design option.

Promoting a Secondary Option to the Primary Option

The primary option is the preferred design option in the set. Elements in the main model and in the primary option can reference each other. (See [Referencing Elements in Design Options](#) on page 1321.)

Only one design option in a set can be the primary option. All other options are secondary. By default, each project view displays both the main model and the primary option for each set.

If you want to promote a secondary option to be the primary option, be aware that Revit Architecture attempts to move relationships from the former primary option to the new primary option. For example, suppose you create a dimension from a main model wall to a primary option wall. In a secondary option, the same wall has been moved slightly. When you promote the secondary option to be the primary option, Revit Architecture displays the same dimension between the main model wall and the moved wall. The dimension is updated to show the correct distance between the walls.

To promote a secondary option to be the primary option

- 1 Click Manage tab ► Design Options panel ► Design Options.
- 2 In the Design Options dialog, select the secondary design option to promote.
- 3 Under Option, click Make Primary.

Revit Architecture promotes the selected secondary option to be the primary option. The Design Options dialog lists the design option with **(primary)** after its name. The former primary option is now a secondary option.

NOTE If you encounter the error message Elements in main model will be deleted, see [Troubleshooting Issues with Design Options](#) on page 1326 for instructions.

4 Click Close.

5 In project views that display the main model with the new primary option, check dimension references and tags to be sure they are referencing the correct elements.

Moving Elements from the Main Model to a Design Option Set

The main model consists of the entire building model, excluding elements in any design options.

Elements in the main model cannot host or reference elements in secondary options. Therefore, elements in the main model do not change their shape or properties when you are looking at a view for a secondary option. For example:

- If you sketch 4 walls in the main model and then sketch a roof in a secondary option, you cannot attach the walls to the roof.
- To add a door or window to a design option, the host wall must also be part of the design option.
- To add a skylight to a design option, the host roof must also be part of the design option.

If main model elements need to reference and update with elements in a secondary option, you must move the main model elements into that design option. Then you can edit the design option to modify those elements as desired. (See [Referencing Elements in Design Options](#) on page 1321.)

To move elements from the main model to a design option set

1 Open a project view that shows the elements to be moved.

2 Click Manage tab ► Design Options panel, and select Main Model from the drop-down list.

3 Select the main model elements to move.

4 Click Manage tab ► Design Options panel ► Add to Set.

5 In the Add to Design Option Set dialog, for Add selection to, select the desired set.

Revit Architecture lists the design options for the selected set.

6 Select one or more design options to which you want to add the elements.

If you clear a check box, the elements are not added to the corresponding design option.

7 Click OK.

Copies of the original elements are now in all selected design options in the set. The original elements are no longer part of the main model.

TIP You can also add elements to a single design option by cutting the elements from the main model and pasting them into the same place in the design option. Use the Cut and Paste Aligned tools, as described in [Moving Elements from One Design Option to Another](#) on page 1314.

Moving Elements from One Design Option to Another

NOTE You can also use this technique to move an element from the main model to a design option, as an alternative to the method described in [Moving Elements from the Main Model to a Design Option Set](#) on page 1313.

- 1 Open a project view that will show the elements to move.
If the elements belong to a secondary option, they may not be visible yet.
- 2 Prepare the view to show the active design option:
 - a On the keyboard, type **VG** (for Visibility/Graphics).
 - b On the Visibility/Graphics dialog, click the Design Options tab.
 - c For the appropriate design option set, in the Design Option column, select Automatic.
 - d Click OK.
- 3 Click Manage tab ► Design Options panel. From the drop-down list, select the design option in which the elements reside.
- 4 In the drawing area, select one or more elements, and press Ctrl+X (Cut).
See [Selecting Elements in Design Options and the Main Model](#) on page 1314 and [Selecting Elements](#) on page 339.
- 5 Click Manage tab ► Design Options panel. From the drop-down list, select the design option to which you want to add the elements.
- 6 Click Modify tab ► Clipboard panel ► Paste Aligned drop-down ► Same Place.
Revit Architecture moves the selected elements to the active option.
- 7 To finish editing the active option, click Manage tab ► Design Options panel, and select Main Model from the drop-down list.

Selecting Elements in Design Options and the Main Model

To avoid unintended results or confusion, when you are editing a design option, Revit Architecture prevents you from selecting elements in the main model. Similarly, when you are editing the main model, the software prevents you from selecting elements in a design option. However, you can explicitly allow these functions, if needed (for example, to add dimensions between a main model element and a design option element).

To select elements in design options when editing the main model

- On the status bar, clear Exclude Options. Now you can select the desired elements from the design option.



This option is available when you are [viewing the main model and a design option](#) but not editing the design option.

To select elements in the main model when editing a design option

- On the status bar, clear Active Only. Now you can select elements in the main model and other option sets.



This option is available when you are [editing a design option](#).

To determine the design option to which an element belongs

- 1 Move the cursor over the element to highlight it.
- 2 If the element does not highlight when you move the cursor over it, on the status bar, clear Exclude Options or Active Only. Then move the cursor over it again.

The status bar and tooltip for the highlighted element indicate the category, family, and type of the element. If the element belongs to a design option, they also indicate the design option set and the design option to which the element belongs, using the following format:

(<design option set> : <design option>) : <category> : <family> : <type>

If the element belongs to the main model, the status bar and the tooltip do not show design option information.

Duplicating a Design Option

Suppose you are creating a series of design options, and several elements will be common to many of them. In this case, you can create a design option that contains all of the common elements, then create copies of it, and modify the individual design options to develop each design further. This strategy can streamline the process of developing design options and reduce duplication of effort.

To duplicate a design option

- 1 Create the design option and add the elements that will be common to multiple design options. See [Adding Design Options](#) on page 1310.
- 2 Click Manage tab ► Design Options panel ► Design Options.
- 3 In the Design Options dialog, select the design option from the list.
- 4 Under Option, click Duplicate.
Revit Architecture creates a copy of the selected design option named Copy of <design option>.
- 5 To rename the duplicate design option, select the option name, and under Option, click Rename. Enter a name, and click OK.
- 6 If needed, repeat steps 4 and 5 to create more copies of the design option.

Now you can edit the duplicate design options to modify them as desired. Changes made to a duplicate design option affect only that design option. See [Editing a Design Option](#) on page 1311.

Annotating and Detailing Design Options

Annotations and details (such as keynotes, dimensions, and tags) are view-specific elements. They cannot be part of a design option. To document a design option, first dedicate one or more views to the option. (See [Dedicating Views to Design Options](#) on page 1318.) Then add the desired annotations and details to the dedicated views. (See [Annotating and Detailing](#) on page 1087.)

If you want similar views for each option to have similar documentation and details, use the following procedure.

To create duplicate detailed views for design options

- 1 In a view that shows the main model and a design option, add the annotations and details that you want to appear in similar views for all design options.
- 2 In the Project Browser, right-click the view name, and click Duplicate View ► Duplicate with Detailing.

This tool creates a copy of the view, including annotations and details. Repeat this step to create a copy of the view for each design option.

- 3 Dedicate each duplicate view to a different design option. (See [Dedicating Views to Design Options](#) on page 1318.)
- 4 Rename each duplicate view to indicate the design option that it displays. (See [Renaming Views](#) on page 259.)
- 5 In the view for each design option, modify the annotations and details as appropriate.
If you add a new annotation or detail to a dedicated view, it displays in that view only.
- 6 (Optional) For side-by-side comparisons of the design options, add a sheet, and add the views to the sheet.
See [Sheets](#) on page 1030.

Deleting Design Options and Option Sets

When you delete a single design option, Revit Architecture removes the following from the project:

- All elements that belong to the design option.
- All views whose Visible in Option parameter specifies the design option. (See [Deleting Views Associated with Design Options](#) on page 1317.)
- (Optional) Views that are dedicated to the design option; that is, views whose design option settings include the design option. (See [Checking the Design Option Settings for a View](#) on page 1320.) When you delete a design option, Revit Architecture displays a list of these dedicated views. You can instruct Revit Architecture to delete these views or to preserve them.

When you delete a design option set, Revit Architecture removes all of its design options, their elements, and associated views (as for deleting a design option).

If you are ready to incorporate a design option into the main model, do not use these Delete procedures for the undesired options. Instead, see [Incorporating a Design Option into the Main Model](#) on page 1318 for instructions.

NOTE You cannot delete a primary option. If you want to delete a primary option, you must first demote it to a secondary option (by promoting a secondary option to be primary). When the undesired option is a secondary option, you can then delete it. See [Promoting a Secondary Option to the Primary Option](#) on page 1312. If you want to delete a primary option, and it is the only option in the set, delete the design option set.

To delete a design option

- 1 Click Manage tab ► Design Options panel ► Design Options.
- 2 If you are currently editing a design option, click Finish Editing.
- 3 In the Design Options dialog, select the design option to delete.
- 4 Under Option, click Delete.
- 5 If the design option has one or more dedicated views (or views for which the Visible in Option parameter is set), the Delete Dedicated Option Views dialog lists the associated views. Do the following:
 - a Clear the check boxes for any views that you do not want to delete.
For these views, the design option settings on the Visibility/Graphics dialog will be changed to Automatic for the related design option set.

NOTE If the Visible in Option parameter for a view specifies the unwanted design option, you cannot clear its check box in the Delete Dedicated Option Views dialog. If you do not want to delete this view when deleting the design option, cancel the delete operation. Change the Visible in Option parameter for that view to specify another design option or All. (See [Deleting Views Associated with Design Options](#) on page 1317.) Then repeat this procedure to delete the unwanted design option.

- b** Click Delete to delete the design option and the selected views.

Revit Architecture deletes the selected design option and the selected views.

To delete a design option set

- 1** Click Manage tab ► Design Options panel ► Design Options.
- 2** If you are currently editing a design option, click Finish Editing.
- 3** In the Design Options dialog, select the design option set to delete.
- 4** Under Option Set, click Delete.
- 5** At the confirmation prompt, click Yes.
- 6** If the design options in the set have dedicated views (or views for which the Visible in Option parameter is turned on), the Delete Dedicated Option Views dialog lists the associated views. Do the following:
 - a** Clear the check boxes for any views that you do not want to delete.
 - b** Click Delete to delete the design options in the set and the selected views.

Revit Architecture deletes the entire design option set, including all of its design options, their elements, and the selected views.

Deleting Views Associated with Design Options

To indicate that a view should be deleted when a design option is deleted, specify the Visible in Option parameter for the view. The Visible in Option parameter provides a way to associate a view with a particular design option, even when the view's design option settings specify multiple design options (one for each set).

When you delete a design option, Revit Architecture displays a list of the views to be deleted. See [Deleting Design Options and Option Sets](#) on page 1316.

To set the Visible in Option parameter for a view

- 1** In the Project Browser, right-click the view name, and click Properties.
- 2** In the Instance Properties dialog for the view, under Graphics, locate the Visible in Option parameter.
- 3** For Visible in Option, click in the Value column, and select the desired design option from the list.

You can select only one design option for one set.
- 4** Click OK.

Incorporating a Design Option into the Main Model

After choosing a design option to implement, you can incorporate it into the main model and delete other options that are no longer necessary.

NOTE Accepting the primary option deletes all secondary options and the design option set. You can undo this action, but you should be sure that you do not need any other options. Consider making a backup copy of the project before proceeding.

To incorporate a design option into the main model

- 1 Click Manage tab ► Design Options panel ► Design Options.
- 2 If you are currently editing a design option, click Finish Editing.
- 3 In the Design Options dialog, select the design option set that includes the desired option.
- 4 If the desired option is secondary, select the design option in the list, and click Make Primary to promote it to the primary option.
- 5 Under Option Set, click Accept Primary to incorporate the primary option into the main model. Revit Architecture prompts you to confirm this action.
- 6 Click Yes.
Revit Architecture incorporates the primary option into the main model and deletes the design option set.
- 7 Click Close.

If you need to undo this action, on the Quick Access toolbar, click  (Undo).

Viewing Design Options

When you create a design option set, Revit Architecture displays the main model and the primary option in all project views by default. To see secondary options with the main model, you must do one of the following:

- [Edit the option.](#)
- [Change a view's display option settings.](#)
- [Dedicate views to the design option.](#)

Dedicating Views to Design Options

To see secondary options with the main model, create duplicate views that are dedicated to those options. These views are called dedicated views. A dedicated view typically displays a specified design option for each set.

You can dedicate all kinds of views (including schedules) to a specified design option. For example, you can create one beam schedule for the primary option and another beam schedule for a secondary option. Each schedule lists beams that are in the main model as well as beams that are in the specified design option.

To create a dedicated view

- 1 Open a view that you want to dedicate to a design option.
By default, the view displays the primary option with the main model.

2 In the Project Browser, right-click the view name, and do the following.

If you want the duplicate view to...

then...

include model elements only, with no annotations or detailing,

click Duplicate View ► Duplicate.

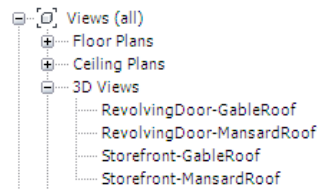
include model elements as well as annotations and details from the original view,

click Duplicate View ► Duplicate with Detailing.

Revit Architecture creates a duplicate view.

3 Rename the duplicate view, using a name that indicates the design options displayed in the view.

For example, the following 3D view names indicate the design options that will be displayed in each view. (See [Renaming Views](#) on page 259.)



4 Specify design options for the view, as follows:

- a In the Project Browser, right-click the duplicate view name, and click Properties.
- b In the Instance Properties dialog for the view, for Visibility/Graphics Overrides, click Edit. The Visibility dialog displays the Design Options tab. It lists each design option set, and, for each set, the design option that the view is currently displaying. A value of Automatic indicates the following:
 - When no design option is being edited, the view displays the primary option.
 - When a design option is being edited, the view displays the active option.
- c For each design option set, select the design option to display in this view. If you have created multiple design option sets, the view displays one option for each set.
- d Click OK.

The view displays the main model and a selected design option for each set.

5 Repeat Steps 2–4 for each combination of design options that you want to show in individual views.

For each dedicated view, you can now do the following:

- Modify the view, for example, to add annotations and details for design options. See [Annotating and Detailing](#) on page 1087.
- Modify a design option. See [Editing a Design Option](#) on page 1311.
- Place the view on a sheet to share the design options with clients. See [Sheets](#) on page 1030.

Related topics

- [View Tags in Dedicated Views for Design Options](#) on page 1320
- [Deleting Views Associated with Design Options](#) on page 1317

Viewing the Main Model Without Design Options

If you want to be able to view the main model only, with no design options, create an empty design option and make it the primary option. (See [Adding Design Options](#) on page 1310.) If you are using multiple design option sets, create an empty option for each set, and make it the primary option for each set.

By default, all project views will then display the main model only. To display other design options, see [Viewing Design Options](#) on page 1318.

Viewing Multiple Design Options

A project view can display only one design option for each set. To view and compare design options side-by-side, dedicate a view to each design option. (See [Dedicating Views to Design Options](#) on page 1318.) Then place the views on a sheet. (See [Adding Views to a Sheet](#) on page 1033.)

Checking the Design Option Settings for a View

1 Open a project view in which you want to see or edit a design option.

2 On the keyboard, type **VG** (for Visibility/Graphics).

3 In the Visibility/Graphics dialog, click the Design Options tab.

The tab lists each design option set, and, for each set, the option that the view is currently displaying.

A value of Automatic indicates the following:

- When no design option is being edited, the view displays the primary option.
- When a design option is being edited, the view displays the active option.

4 If the desired design options are not selected, select the appropriate design option for each set, and click OK.

The view is now dedicated to the selected design options.

View Tags in Dedicated Views for Design Options

View tags are the symbols that represent other views or drawings, such as elevations, callouts, and sections. For example, in a floor plan, the following symbol indicates an elevation. (For more information about view tags, see [Section, Elevation, and Callout View Tag Setup](#) on page 245.)



You can control whether these tags are visible in views based on design options. For example, if a section view applies only to Option 1, the section tag should not appear in a view that is dedicated to Option 2.

The visibility of a view tag is determined by a parameter called Visible in Option.

- If you create a view while editing the main model, Visible in Option (for the view tag) is set to All. The tag is visible in the view for all design options.
- If you create a view while you are editing a design option, the view tag's Visible in Option parameter is set to the active option. If you change the value of Visible in Option, the view tag is visible in views for the specified option only.

For example, if you create an elevation to display a particular design option, you may want to specify that its elevation tag is visible in a floor plan that is dedicated to the design option.

Changing the Visibility of a View Tag for Design Options

- 1 Open a project view in which the view tag displays.
- 2 Check the design option settings for the view. (See [Checking the Design Option Settings for a View](#) on page 1320.) For the design option set, select the design option that you plan to assign to the view tag.
- 3 In the project view, right-click the view tag, and click Element Properties.

NOTE If the Visible in Option parameter does not display in the Instance Properties dialog, you may not have selected the entire view tag. See [Selecting View Tags](#) on page 246.

- 4 In the Instance Properties dialog, for Visible in Option, do the following:

If you want to...	then...
make the view tag visible for all design options	select All.
make the view tag visible for one option only	select that design option.

- 5 Click OK.

Considerations When Using Design Options

The following topics describe important considerations when working with design options.

Unsupported Elements for Design Options

Levels: You cannot add levels to a design option. If you add a level to a building model while you are editing a design option, Revit Architecture adds the level to the main model. The level displays in halftone, indicating that it is not part of the design option. (See [Halftone/Underlay](#) on page 497.)

Views: You cannot add views to a design option. However, you can [dedicate views to design options](#).

Annotations and details: You cannot add view-specific elements (such as annotations and details) to a design option. View-specific elements belong to the views in which they are created.

If you add a view-specific element while you are editing a design option, Revit Architecture adds the element to the current view, not to the design option. The view-specific element displays in halftone, indicating that it is not part of the design option. To see the view-specific element and the design option, change the design option settings for the view. (See [Checking the Design Option Settings for a View](#) on page 1320.)

To annotate or detail a design option, dedicate a view to the option. Then add annotations and details to the view. (See [Annotating and Detailing Design Options](#) on page 1315.) View-specific elements can reference elements in a design option. For example, you can dimension elements in a design option.

Referencing Elements in Design Options

In Revit Architecture, elements can reference each other in many ways, including the following:

- Explicit constraints (such as locked alignments and dimensions) guarantee that the defined relationships will be maintained. Conflicts cause errors and must be resolved.

- Looser constraints (such as dimensions and alignments that are not locked) are often maintained unless a conflict occurs, in which case these constraints may be removed without notice.
- Implied constraints (such as a wall attached to a roof, or 2 walls joined at a corner) are also maintained unless a conflict occurs.

These explicit and implied constraints require that each element knows about the other. That is, one element must reference the other element.

When you are referencing elements in design options, consider the following guidelines:

- Elements in the main model and in the primary option can reference each other.
- Elements in a secondary option can reference elements in the main model. See [Selecting Elements in Design Options and the Main Model](#) on page 1314.
- Elements in the main model cannot reference elements in a secondary option. Therefore, elements in the main model do not change their shape or properties when you are editing a secondary option. For example, if you sketch 4 walls in the main model and then sketch a roof in a secondary option, the walls do not regenerate and attach to the roof.
- If main model elements need to update with and reference elements in secondary options, move the main model elements into each design option (or selected options) in the design option set. Then edit each design option to modify those elements as desired for each design. See [Moving Elements from the Main Model to a Design Option Set](#) on page 1313.
- View-specific elements can reference elements in design options. For example, you can dimension elements in a view that is dedicated to a design option. See [Annotating and Detailing Design Options](#) on page 1315.

Interdependent Elements in Design Options

Elements that depend on another element must be in the same design option. Interdependent elements include the following:

- Inserts that cut their hosts (such as windows in walls or skylights in roofs)
- Host sweeps and their hosts (such as wall sweeps and walls)
- Topographical surfaces and building pads
- Curtain panels, mullions, and grids

If you add the host to a design option, the hosted element is automatically included. If you try to add the hosted element without the host, Revit Architecture warns you that the host must also be added.

When you create groups or arrays, selected elements must be in the active option. If no design option is active, they must be in the main model.

If you add elements to a group, the elements must be in the same design option as the group.

Design Options and Rooms

A room is a model element, so you can add rooms to a design option. As a general rule, the perimeter, area, and volume of the room are defined by the room-bounding elements available to that option. These room-bounding elements include elements in the main model, elements in primary options of other option sets, and elements in the secondary option itself. However, a room in a secondary option cannot reference elements that are defined in other secondary options.

Room-bounding elements can include walls, room separation lines, roofs, floors, ceilings, columns, and curtain systems whose Room Bounding parameter is turned on. (See [Rooms](#) on page 977 and [Room-Bounding Elements](#) on page 981.)

For information about errors regarding rooms in design options, see [Option Conflict Between Rooms](#) on page 1328 and [Room Option Conflict](#) on page 1328.

Room Areas and Perimeters for Design Options

When determining the perimeter and area of a room, Revit Architecture uses the following rules:

- A room placed in the main model is defined by room-bounding elements in the main model and all primary options. The room ignores walls and room separation lines that belong to secondary options.
- A room placed in a design option is defined by room-bounding elements in that option, in the main model, and in primary options of other option sets. The room ignores walls and room separation lines that belong to secondary options of other option sets.

If the shape, size, or location of the room is the same in different options, and you want properties assigned to the room to be the same for all options, keep the room in the main model.

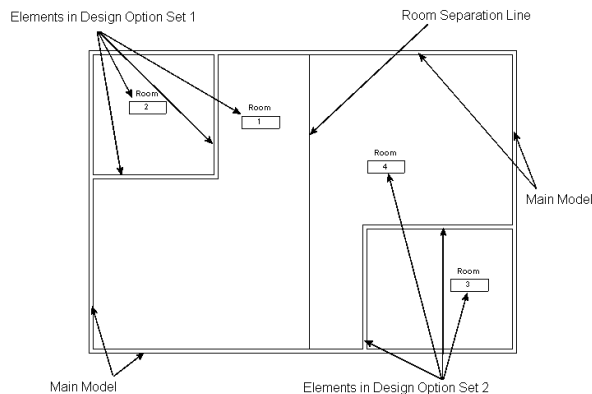
If you want a room to vary in shape, size, or location in each design option, or to have different room properties (such as occupancy) in each design option, add the room to each design option in the set. To do this, you can use either of the following methods:

- Move an existing room from the main model to one or more design options in the set. (See [Moving Elements from the Main Model to a Design Option Set](#) on page 1313.)
- Use the Copy and Paste Aligned tools to copy a room between design options (similar to the technique described in [Moving Elements from One Design Option to Another](#) on page 1314).

If you want the shape, size, or location of a room to vary among different options of multiple option sets, do the following:

- 1 In the main model, use room separation lines to divide the space into rooms. (Do not, however, add room elements to the main model.)
- 2 Create one option set for each of these rooms.
- 3 In the design options for a set, add the rooms.

You can then create dedicated views to display different combinations of the design options from each set. (See [Dedicating Views to Design Options](#) on page 1318.)



Room Schedules for Design Options

When you create a new view, such as a room schedule, by default its design option settings are set to Automatic. (See [Checking the Design Option Settings for a View](#) on page 1320.) As a result, the room schedule lists all rooms in the main model and all primary options.

To create a room schedule for a design option, create a schedule view and dedicate it to the design option. (See [Dedicating Views to Design Options](#) on page 1318 and [Creating a Schedule or Quantity](#) on page 173.) The room schedule will then list all rooms in the main model and in the specified design options for each option set.

Room Tags for Design Options

A room is a model element. You can add a room to a design option. A room tag, however, is a view-specific annotation element. When you tag a room that is part of a design option, the room tag is part of the view, not part of the design option.

By default Revit Architecture displays room tags for rooms that you add to a design option. If you later create a dedicated view for that design option, room tags display if you create the view using View tab ► Create panel ► Duplicate View drop-down ► Duplicate with Detailing.

If room tags do not display in a dedicated view (for example, because you created the view using View tab ► Create panel ► Duplicate View drop-down ► Duplicate), you can add room tags to the view. See [Tagging a Room](#) on page 985.

Room Volumes for Design Options

When you use design options, Revit Architecture [computes room volumes](#) using the following rules:

- To define the perimeter of the room, Revit Architecture uses the walls and room separation lines that are room-bounding for the design option. (See [Design Options and Rooms](#) on page 1322.)
- To define the upper and lower boundaries of the room, Revit Architecture uses ceilings and floors defined in the current design option, in primary options of other option sets, and in the main model.

Design Options and Worksets

You can enable worksharing so that team members can work on different parts of a project at the same time. For a workshared project, all design options and design option sets are included in a Project Standards workset called Design Options. (See [Setting Up Worksets](#) on page 1252.)

To edit an element in a design option, the element and its design option must be editable. See [Borrowing Elements](#) on page 1259.

Design Options and Area Analysis

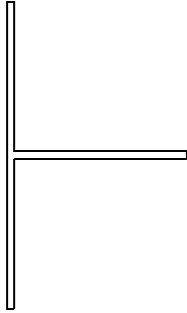
You cannot add area schemes to design options. To perform area analysis with different design options, create multiple area schemes. Create an area plan for each area scheme, and set the area plan view visibility to show the desired options. While editing the main model, create all area calculation boundaries and tags in that area plan view.

For more information about area analysis, see [Area Schemes](#) on page 1008.

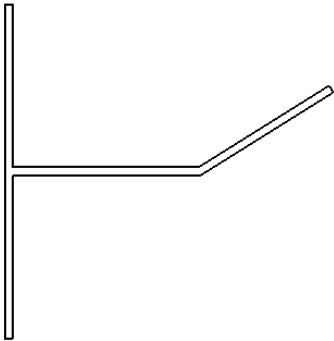
Design Options and Wall Joins

The cleanup of joins between walls in the main model and walls in the primary option works the same way as when all walls are in the main model. To avoid incorrect wall joins between the main model and secondary options, move the wall from the main model to the design option set. See [Moving Elements from the Main Model to a Design Option Set](#) on page 1313.

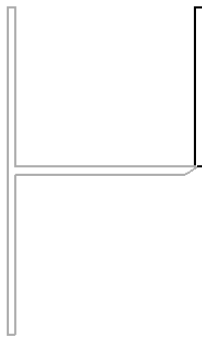
Walls in the main model



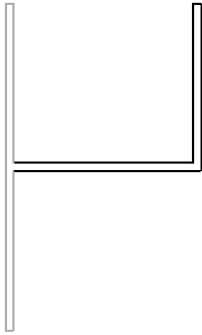
A wall added in the primary option; join cleans up properly



A wall in a secondary option joined to the main model



To avoid the above problem with wall joins in a secondary option, add the horizontal wall to that option. The wall join then cleans up properly, as shown. See [Wall Joins](#) on page 651.



Troubleshooting Issues with Design Options

The following topics provide information about issues, errors, and warnings that you may encounter when working with design options.

Elements in Main Model Will Be Deleted

Issue: This error may occur when you attempt to promote a secondary option to be the primary option. An element (or dimension or other object) in the main model conflicts with an object in the secondary option that is being promoted.

Solution:

- 1 In the error dialog, click Expand, and then expand the error messages until you can identify the objects that are causing the error.
- 2 Select the check boxes for the objects.
- 3 At the bottom of the error dialog, click Delete and Make Primary.

Following this procedure usually resolves the conflicts by deleting the objects and replacing them with the same or similar objects defined in the newly promoted design option. If you continue to have problems, contact customer support.

Highlighted Elements Overlap

Issue: This warning may occur when you copy an element from the main model to a design option. In this case, the element exists in the main model and in the design option. As a result, these 2 elements overlap.

Solution: To resolve the issue, delete the element from the main model or from the design option.

If you tried to move an element from the main model to a design option, cut the element from the model (instead of copying the element), or use the Add to Set tool. See [Moving Elements from One Design Option to Another](#) on page 1314 or [Moving Elements from the Main Model to a Design Option Set](#) on page 1313.

Incorrect Wall Joins

Issue: Walls in the main model can join with walls in a primary option. However, main model walls cannot join with walls in a secondary option.

Solution: If wall joins are not behaving as expected, consider whether the walls need to be moved from the main model to one or more secondary options.

See [Design Options and Wall Joins](#) on page 1325 and [Moving Elements from the Main Model to a Design Option Set](#) on page 1313.

Inserts in Design Options

Issue: The following message displays: An insert in a design option cannot be hosted by an element in the main model.

This error occurs when you try to add a hosted component to a design option without its host. In order for a hosted component to be part of a design option, its host must also be part of the design option. The host cannot belong to the main model. For example, you cannot add a window to a design option unless the host wall is also part of the design option. You cannot add a skylight to a design option unless the host roof is also part of the design option.

The error can also appear when you try to move a hosted component from the main model to a design option without its host. (See [Interdependent Elements in Design Options](#) on page 1322 and [Hosted Components](#) on page 796.)

Solution: To resolve the issue, move the host element to the design option. Then you will be able to add the hosted component to the design option. See [Moving Elements from the Main Model to a Design Option Set](#) on page 1313.

If you later incorporate the selected design option into the main model, the host element again becomes part of the main model. See [Incorporating a Design Option into the Main Model](#) on page 1318.

None of the Created Elements Are Visible in This View

Issue: This error occurs when you add an element to a design option, but the element will not be visible in the current view. This may be due to visibility of elements for the view or design option settings for the view.

Solution: To resolve the issue, try the following:

- Check visibility of elements in the view.
Click View tab ► Graphics panel ► Visibility/Graphics. On the Model Categories tab and Annotation Categories tab, check the Visibility settings for the types of elements that you added. If visibility for these elements is turned off, select the Visibility check box to make them visible. See [Visibility and Graphic Display in Project Views](#) on page 198.
- Check design option settings for the view.
Click View tab ► Graphics panel ► Visibility/Graphics. On the Design Options tab, check the settings for each design option set. If they are not set to Automatic or to the active option, change the settings. See [Checking the Design Option Settings for a View](#) on page 1320.

None of the Selected Elements Can Be Added to This Option Set

Issue: This error appears when you have attempted to move an element from the main model to one or more design options.

Solution: Expand the error message to determine a more specific cause and possible solutions.

Option Conflict Between Rooms

Issue: This warning appears when either of the following occurs:

- You add a room to the primary option, and the main model already contains a room in the same space.
- You add a room to the main model, and the primary option already contains a room in the same space.

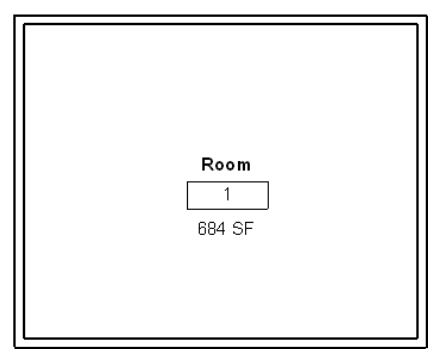
Solution: To resolve the issue, delete the room from the main model or from the primary option. If the room should be defined in the primary option instead of the main model, see [Moving Elements from the Main Model to a Design Option Set](#) on page 1313.

Room Option Conflict

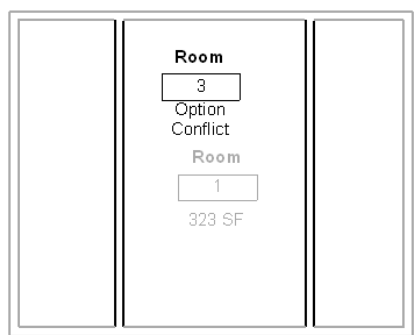
Issue: This message appears in a drawing when conflicts occur between rooms in the main model and rooms in a secondary design option.

For example, if the main model contains rooms, and you place rooms into the same space in a design option, the boundaries of the rooms in the main model might overlap the boundaries of the rooms in the design option.

For example, suppose the main model contains the following room.



When a room is added to a design option, the room tag reports an option conflict.



NOTE If you have created a room schedule, the Room Area column in the schedule also displays an Option Conflict.

To learn the cause of the option conflict, select the room tag in the plan view, or, in a room schedule, select a cell in a row that shows a conflict. Then click Modify Room Tags tab ► Error panel ► Explain Error. A warning dialog displays, which you can expand to read about the conflict and learn possible remedies for it.

Solution: In general, to correct room option conflicts, add the conflicting main model room to the design option set. This removes the room from the main model and resolves the conflict. See [Moving Elements from the Main Model to a Design Option Set](#) on page 1313.

Project Phasing

23

Many projects, such as renovations, proceed in phases, each representing a distinct time period in the life of the project.

Revit Architecture tracks the phase in which views or elements are created or demolished. It lets you create phases and phase filters that you can apply to views, which define how the project appears during various stages of work. You can also use phase filters to control the flow of building model information into views and schedules. This allows you to create phase-specific project documentation, complete with schedules.

You can apply phases to schedules. For example, in a large renovation project, a door schedule would usually list all doors created in the project. In a building with hundreds of doors, the schedule could become difficult to work with, because the demolished doors would be listed with the post-renovation doors. Instead of working with a schedule in which half of the doors are eventually demolished, you could create one pre-demolition schedule and one post-renovation schedule, applying the appropriate phase to each. See [Applying a Phase to a Schedule](#) on page 189.

Related topic

- [Phase-Specific Rooms and Boundaries](#) on page 998

Phase Properties

You can create as many phases as necessary and assign building model elements to specific phases. You can also make multiple copies of a view and apply different phases and phase filters to the different copies.

Phase Properties for Views

Each view in Revit Architecture has a Phase property and a Phase Filter property.

- The Phase property is the name of the view phase. When a view is opened or created, it automatically has a Phase value. You can copy a view and then select a different phase value for that view. For example, the original view has Phase 1; the copy has Phase 2. You create an element in Phase 1 and demolish it in Phase 2. The element displays as new in the original and as demolished in the copy. See [Creating Phases](#) on page 1332.
- The Phase Filter property lets you control the display of elements in a view. For example, demolished walls may display in blue dashed lines, while existing elements display in solid black lines. You can apply a phase filter to a view to see elements from one or more specified phases. See [Phase Filters](#) on page 1333.

Phase Properties for Elements

Each element that you add to a project has a Phase Created property and a Phase Demolished property.

- The Phase Created property identifies the phase in which the element was added to the building model. The default value for this property is the same as the Phase value for the current view. You can specify a different value as needed.
- The Phase Demolished property identifies the phase in which the element was demolished. The default value is None. When you demolish an element, this property updates to the current phase of the view in which you demolished the element. You can also demolish an element by setting the Phase Demolished property to a different value. See [Demolishing Elements](#) on page 1338.

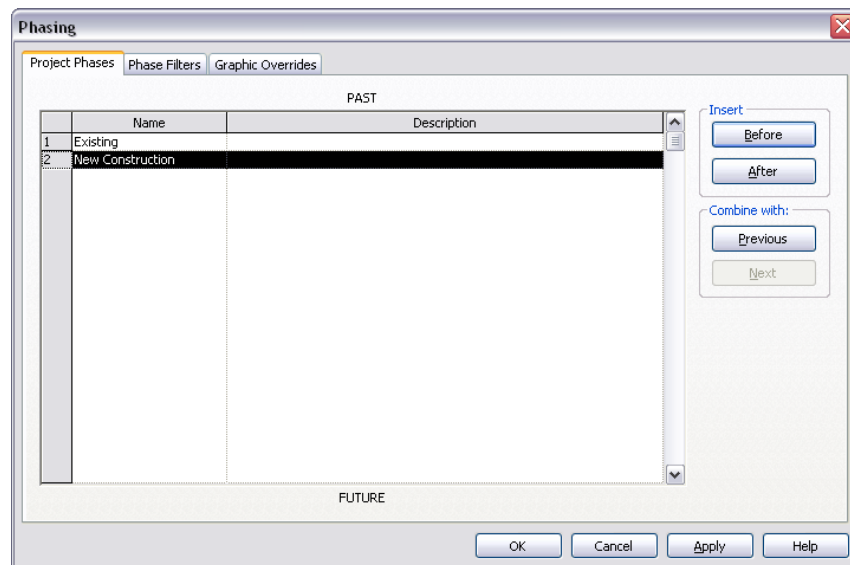
Creating Phases

- 1 Click Manage tab ► Manage Project panel ► Phases.

The Phasing dialog opens, displaying the Project Phases tab. By default, each project has phases called Existing and New Construction.

- 2 Click the number box adjacent to a phase.

Revit Architecture selects the entire phase row. The following image shows the New Construction phase selected.



- 3 Insert a phase.

IMPORTANT You cannot rearrange the order of phases after you add them, so be aware of placement.

To insert a phase before or after the selected phase, under Insert, click Before or After.

Revit Architecture names the phases sequentially as you add them. For example: Phase 1, Phase 2, Phase 3, and so on.

- 4 If desired, click the Name text box of a phase to rename it. Similarly, click the Description text box to edit the description.
- 5 Click OK.

Related topics

- [Combining Phases](#) on page 1333
- [Phase Filters](#) on page 1333
- [Phase Properties](#) on page 1331

Combining Phases

When you combine phases, the selected phase is deleted. All elements with that phase value for their Phase Created and Phase Demolished properties update to show the new combined phase value.

To combine phases

- 1 Click Manage tab ► Manage Project panel ► Phases.
- 2 Click the number box adjacent to the phase to combine with another phase.
- 3 Under Combine with, click Next or Previous.
- 4 Click OK.

Phase Filters

A phase filter is a rule that you apply to a view to control the display of elements based on their phase status: new, existing, demolished, or temporary.

Default Phase Filters

Each Revit Architecture project contains the following default phase filters:

- **Show All.** Shows new elements (using the graphics settings defined for that category of elements) and existing, demolished, and temporary elements (using the Graphic Overrides settings for each phase defined using Manage tab ► Manage Project panel ► Phases ► Graphic Overrides tab).
- **Show Demo + New.** Shows demolished elements and all new elements added to the building model.
- **Show New.** Shows all new elements added to the building model.
- **Show Previous + Demo.** Shows existing elements and demolished elements.
- **Show Previous + New.** Shows all original elements that were not demolished (Show Previous) and all new elements added to the building model (+ New).
- **Show Previous Phase.** Shows all elements from the previous phase. In the first phase of a project, existing elements are new to that phase, so applying the Show Previous Phase filter causes no elements to be displayed.

NOTE To show all elements from all phases, do not apply a phase filter to the view.

Phase Status

Each view can show one or more phases of the construction. You can specify different graphic overrides for each phase status.

- **New.** Element was created in the phase of the current view.
- **Existing.** Element was created in an earlier phase and continues to exist in the current phase.

- **Demolished.** Element was created in an earlier phase and demolished in the current phase.
- **Temporary.** Element was created and demolished during the current phase.

Creating Phase Filters

- 1 Click Manage tab ► Manage Project panel ► Phases.
- 2 In the Phasing dialog, click the Phase Filters tab.
- 3 Click New to insert a new phase filter. The filter is assigned a default name.
- 4 (Optional) Click in the Filter Name box to edit the name.
- 5 For each phase status column (New, Existing, Demolished, and Temporary), specify how you want to display the elements:
 - **By Category.** Displays elements as defined in the Object Styles dialog. See [Object Styles](#) on page 493.
 - **Overridden.** Displays elements as specified in the Graphic Overrides tab of the Phasing dialog. See [Defining the Graphic Display for Phase Statuses](#) on page 1335.
 - **Not Displayed.** Does not display the elements.
- 6 Click OK.

Applying Phase Filters

- 1 In the Project Browser, right-click the view to which you want to apply a phase filter, and click Properties.
- 2 In the Instance Properties dialog, for Phase Filter, select one of the following:
 - A default phase filter. See [Default Phase Filters](#) on page 1333.
 - A phase filter that you created. See [Creating Phase Filters](#) on page 1334.
 - None to apply no phase filter to the view. (All elements are shown in the view without any graphic overrides.)
- 3 Click OK.

Defining the Graphic Display for Phase Filters

You define graphic overrides to change the display of elements in views that use phase filters.

To define the graphic display for phases

- 1 Click Manage tab ► Manage Project panel ► Phases.
- 2 In the Phasing dialog, click the Graphic Overrides tab.
- 3 Click the appropriate boxes to define the display for new, temporary, demolished, and existing elements. See [Defining the Graphic Display for Phase Statuses](#) on page 1335.
- 4 Click the Phase Filters tab.
- 5 For each filter, specify how you want to display the elements for each phase status (New, Existing, Demolished, and Temporary). For phases that use the graphic override settings, select Overridden. See [Creating Phase Filters](#) on page 1334.
- 6 Click OK.

Defining the Graphic Display for Phase Statuses

You can apply a different graphic display or override to the elements in a phase status.

To specify a graphic override to the elements in a phase status

- 1 Click Manage tab ► Manage Project panel ► Phases.
- 2 In the Phasing dialog, click the Graphic Overrides tab.
- 3 Click Lines to specify the weight, color, and line pattern for projection lines and cut lines.
- 4 Click Patterns to specify color, and fill pattern for surface and cut patterns, and to turn the visibility of the pattern on or off.
 - To display no fill pattern for the Phase Status, clear the Visibility selection.
 - To display the fill pattern according to the Object Styles defined under Settings, select No Override.
- 5 Click Halftone to blend the line color with the background color of the view. See [Halftone/Underlay](#) on page 497.
 - When you select this option, all line graphics (including fill patterns) and solid fills are drawn with halftone.
 - Halftone has no effect on material color in shaded views.
- 6 Click Material to specify the shading for shaded views and for the render appearance on the Graphics tab.

NOTE Shading and Render Appearance are the only valid options you can select from the Graphics tab of the Material dialog. The surface pattern and cut pattern are settings you specified on the Graphics Overrides tab of the Phasing dialog.

- 7 Click OK.

Infill Elements for Phasing

If an insert (such as a window) and its host (such as a wall) do not have the same values for the Phase Created and Phase Demolished properties, Revit Architecture automatically places an infill element in the host to patch the hole created by the demolished insert.

The infill element lets you place inserts in one phase, demolish them, and then place new inserts in the same location. The infill element assumes the same structure as its host. In certain cases, you can modify the structure of the infill element by changing its type.

Infill elements for roofs and floors project down from the top face, and infill elements for ceilings project up from the bottom face.

You cannot drag, move, mirror, rotate, copy, or paste an infill element.

Infill Elements for Earlier Phases

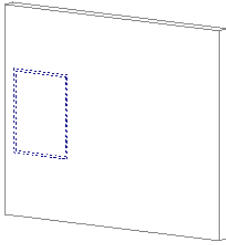
If you place an insert into a host in a phase later than the host's creation phase, Revit Architecture creates an infill element for earlier phases.

For example, you create a roof in Phase 1. You add a skylight to the roof in Phase 2. You look at the roof and skylight in a 3D view. If you set the 3D view's phase to Phase 1, an infill element replaces the skylight. You can view this infill element in a section view.

Infill Elements for Demolished Host Elements

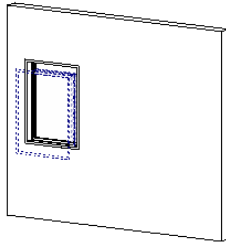
When you demolish an insert in a host element, the insert becomes an infill element.

Demolished window becomes infill element



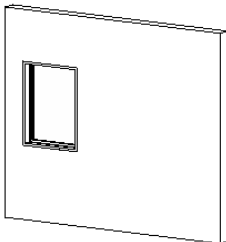
Next, you place a new insert near the demolished insert.

New window placed near demolished window



Then, if you apply a phase filter to the view that does not show demolished elements (such as Show Previous + New), you see only the new insert.

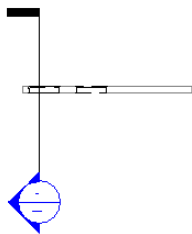
New window only



Viewing Infill Elements

To see an infill element, create a section view whose cut plane runs through the demolished insert and the host.

Sample section passing through wall and demolished window



Changing the Structure of Infill Elements

If you demolish an insert in a phase later than the host's creation phase, you can change the structure of the infill element. You can use this technique to represent different materials and thicknesses in the host.

NOTE You cannot change the structure of an infill element created for phases earlier than the insert's phase.

To change the structure of an infill element

1 Open a section view that passes through the demolished insert.

2 Right-click in the view, and click View Properties.

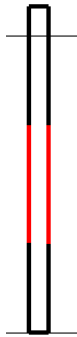
3 In the Instance Properties dialog, for Phase Filter, select Show Previous + New.

This filter shows all original elements that were not demolished and all new elements added to the building model.

4 Click OK.

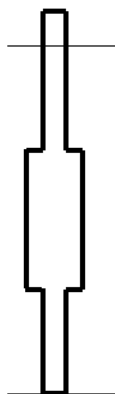
5 Select the infill element in the view.

You may need to move the cursor along a face of the element until it highlights. (Watch the status bar for information about highlighted elements.) The following image shows a selected infill element.



6 Click Modify <element> tab ► Element panel, and select the desired host element type from the Type Selector.

The infill element updates accordingly, as shown in the following section view.



Demolishing Elements

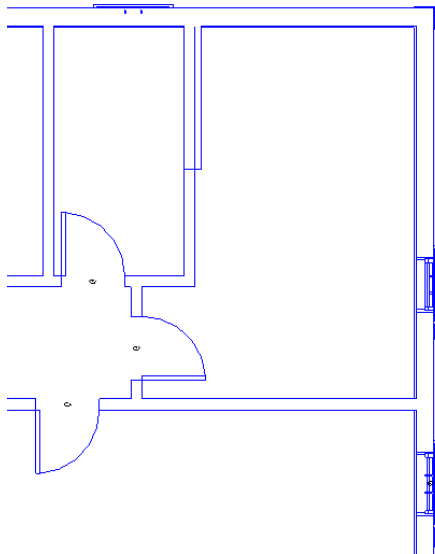
Use the Demolish tool to mark elements as demolished in the current phase. If you demolish an element in one view, it is marked as demolished in all views that have the same phase.

When you demolish an element, its display changes based on the phase filter setting for the view. See [Phase Filters](#) on page 1333. For example, if you apply the Show Demo + New phase filter to the view, any demolished elements display as black, dashed lines. If you turn off the display of the demolished elements in that phase filter, then demolished elements are hidden in the view when you click them.

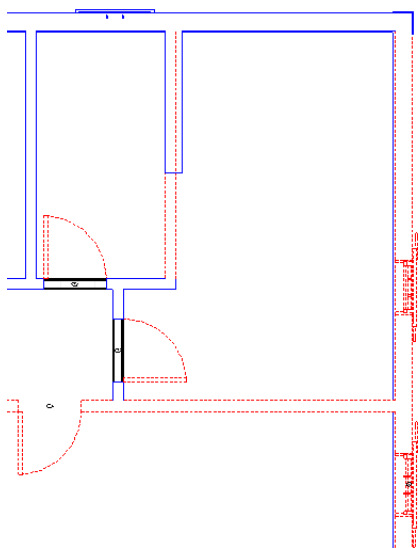
NOTE If you build and demolish an element in the same phase, it is considered to be a temporary element. It displays in the view according to the phase filter's setting for temporary elements.

The following images show a view whose phase filter determines that existing elements display as blue solid lines and demolished elements display as red dashed lines.

View before demolition; existing elements display as solid blue lines



View after demolition; demolished elements display as dashed red lines



Using the Demolish Tool

1 Open the view in which you want to demolish elements.

2 Click Modify tab ► Phasing panel ► Demolish.

The cursor changes to a hammer.

3 Click the elements to demolish.

Elements that can be demolished highlight as you move the cursor over them.

The graphical display of demolished elements updates based on the phase filter setting. See [Phase Filters](#) on page 1333.

4 To exit the Demolish tool, click Modify tab ► Selection panel ► Modify.

Related topics

■ [Demolishing Elements](#) on page 1338

■ [Phase Filters](#) on page 1333

■ [Project Phasing](#) on page 1331

This topic contains information on interoperability between Revit Architecture and other products. It describes how to export Revit drawings for use with other software, and how to import or link files into Revit Architecture. It also includes information on coordination among different building and construction disciplines.

Export

Exporting converts one or more Revit Architecture views (or sheets) to various formats for use with other software.

Related topics

- [Exporting a Walkthrough](#) on page 168
- [Exporting a Solar Study](#) on page 1246
- [Exporting a Schedule](#) on page 192

Exporting to CAD Formats

Revit Architecture supports exporting to CAD (DWG and DXF), ACIS (SAT), and MicroStation® (DGN) file formats.

- DWG (drawing) format is supported by AutoCAD and other CAD applications.
- DXF (data transfer) is an open format that is supported by many CAD applications. A DXF file is a text file that describes a 2D drawing. The text is not encoded or compressed, so DXF files are generally large. If you use DXF for 3D drawings, you may need to perform some cleanup to make the drawing display correctly.
- SAT is the format for ACIS, a solid modeling technology that is supported by many CAD applications.
- DGN is the file format supported by MicroStation of Bentley Systems, Inc.

If you use the Export tool while in a 3D view, Revit Architecture exports the actual 3D model, not a 2D representation of the model. Exporting in 3D ignores all view settings, including hidden line mode. To export a 2D representation of the 3D model, add the 3D view to a sheet and export the sheet view. You can then open a 2D version of the view in AutoCAD.

Before exporting a Revit model, you may want to do the following:

- Reduce the amount of model geometry to be exported. See [Limiting Model Geometry Before Exporting](#) on page 1342.
- Create a layer mapping file to control the export process.
To preserve information about a project, Revit Architecture automatically maps categories and subcategories to preconfigured layer names. These layers are used by AutoCAD and other applications. Before exporting a Revit Architecture project, you may want to change the mappings to the desired layer names. See [Exporting Layers](#) on page 1360.

Limiting Model Geometry Before Exporting

In Revit Architecture, a view of the building model contains many objects and lots of data. When exporting a file for use in another software application, Revit Architecture exports only the objects that are visible in the view (or views) being exported. By reducing the amount of model geometry (and its underlying data) that is exported, you can achieve the following:

- Improve performance of the export process.
- Reduce the size of the exported file.
- Improve performance of the importing application.
- Reduce clutter (non-essential items) in the exported file, and hence the amount of work required to delete these objects from the file in the importing application.

Use the following techniques to reduce the amount of geometry to be exported.

Turn off visibility of graphics

To turn off visibility of graphics in a view, click View tab ► Graphics panel ► Visibility/Graphics. See [Visibility and Graphic Display in Project Views](#) on page 198.

Turn off visibility for categories of elements in the view, as appropriate. For example, you might want to omit rooms, areas, and topography from a 3D view to be exported. If you want to render an exterior scene, turn off any elements that appear in the interior of the building. This reduces the number of objects and the amount of data that is exported from Revit Architecture and imported into another application, thus improving performance.

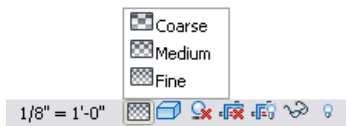
Use a section box or crop region

To define the specific part of the project to export, use a section box in a 3D view or a crop region in a 2D view. Elements that are completely outside the section box or crop region are not included in the export file. This technique is particularly useful on large models. For example, for an interior rendering of a conference room in an office building, use a section box to export a 3D view of the conference room and omit the rest of the building.

See [Using a Section Box in a 3D View](#) on page 159 and [Exporting Part of a 2D View](#) on page 1353.

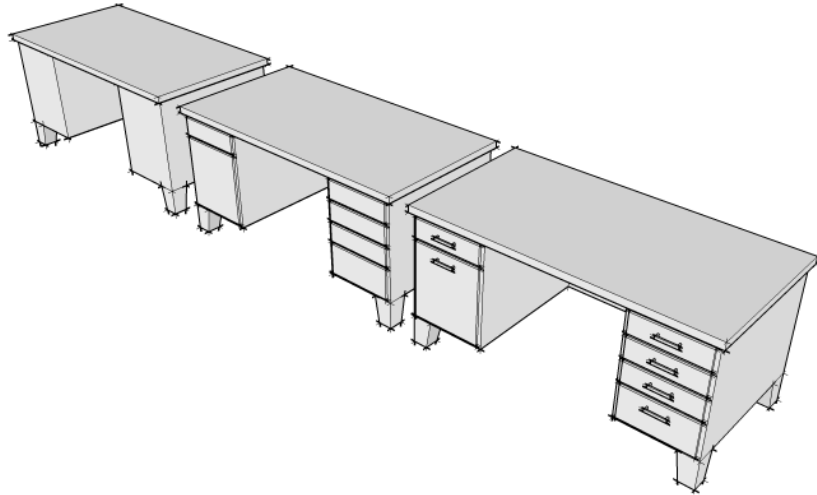
Set the detail level

To set the detail level for a view, on the View Control Bar at the bottom of the drawing area, click the Detail Level button, and select the desired detail level: coarse, medium, or fine. For more information, see [Detail Level](#) on page 511.




Set the view's detail level to coarse or medium. By reducing the amount of detail in the Revit view, you reduce the number of objects exported, and the size of the resulting file. This results in better performance in the importing application.

A desk exported to Google™ SketchUp® in coarse, medium, and fine detail levels



Exporting to DWG

- 1 Click  ➤ Export ➤ CAD Formats ➤ DWG. The Export CAD Formats dialog opens.
- 2 Determine which views and sheets are to be exported to the DWG file.

If you are exporting a single view, select Current View/Sheet Only from the Export list on the View/Sheet Set tab of the dialog.

If you are exporting multiple views and sheets, do the following:

 - a Select In session view/sheet set from the Export list on the View/Sheet Set tab of the dialog.
 - b Select the views and sheets to export. See [Creating View and Sheet Sets](#) on page 1346 and [Selecting Views to Print](#) on page 1084.
- 3 To specify export options, click the DWG Properties tab of the Export CAD Formats dialog. The following options are available.
 - [Layers and Properties](#) on page 1349
 - [Linetype Scaling](#) on page 1350
 - [Coordinate System Basis](#) on page 1351
 - [One DWG Unit Is](#) on page 1352
 - [Solids \(3D Views Only\)](#) on page 1352
 - [Export Rooms and Areas as Polylines](#) on page 1353

4 Click Export.

NOTE Click OK to save the current export settings and close the dialog without exporting.

5 Navigate to the target folder for the exported files.

6 Select an AutoCAD version of the exported DWG file from the Files of type list.

7 Select Automatic - Long (Specify prefix) or Automatic - Short from the Naming list to define the automatically generated file name. See [File Names for Exported Files](#) on page 1353.

8 Optionally, to prohibit Revit Architecture from creating external references, select Xref views on sheets. Any Revit or DWG links in the project are exported to a single file rather than several files that reference each other.

9 Click Export.

Revit Architecture exports the selected views and sheets to DWG files and places them in the target folder.

When you export a 2D view to a DWG file, lines are treated as follows:

- If 2 lines overlap in the drawing, the thicker of the lines is retained. The thinner line is shortened or removed.
- If a thick line is shorter than a thin line and its start point and endpoint fall within the thin line, no action occurs.
- If 2 colinear lines with the same visual parameters overlap, they are merged into one.
- When walls become lines in the DWG file, no short colinear lines are produced.

Exporting to DXF

1 Click  ➤ Export ➤ CAD Formats ➤ DXF. The Export CAD Formats dialog opens.

2 Determine which views and sheets are to be exported to the DXF file.

If you are exporting a single view, select Current View/Sheet Only from the Export list on the View/Sheet Set tab of the dialog.

If you are exporting multiple views or sheets, do the following:

- a Select In session view/sheet set from the Export list on the View/Sheet Set tab of the dialog.
- b Select the views or sheets to export. See [Creating View and Sheet Sets](#) on page 1346 and [Selecting Views to Print](#) on page 1084.

3 To specify export options, click the DXF Properties tab of the Export CAD Formats dialog. The following options are available.

- [Layers and Properties](#) on page 1349
- [Linetype Scaling](#) on page 1350
- [Coordinate System Basis](#) on page 1351
- [One DWG Unit Is](#) on page 1352
- [Solids \(3D Views Only\)](#) on page 1352
- [Export Rooms and Areas as Polylines](#) on page 1353

4 Click Export.

NOTE Click OK to save the current export settings and close the dialog without exporting.

- 5 Navigate to the target folder for the exported files.
- 6 Select an AutoCAD version of the exported DXF file from the Files of type list.
- 7 Select Automatic - Long (Specify prefix) or Automatic - Short from the Naming list to define the automatically generated file name. See [File Names for Exported Files](#) on page 1353.
- 8 Click Export.

Revit Architecture exports the selected views and sheets to DXF files and places them in the target folder.

Exporting to DGN

- 1 Click  ➤ Export ➤ CAD Formats ➤ DGN. The Export CAD Formats dialog opens.

NOTE The DGN file format supports MicroStation version 7. If you are using a later version, export to DWG format. See [Exporting to DWG](#) on page 1343.

- 2 Determine which views and sheets are to be exported to the DGN file.
If you are exporting a single view, select Current View/Sheet Only from the Export list on the View/Sheet Set tab of the dialog.
If you are exporting multiple views and sheets, do the following:
 - a Select In session view/sheet set from the Export list on the View/Sheet Set tab of the dialog.
 - b Select the views and sheets to export. See [Creating View and Sheet Sets](#) on page 1346 and [Selecting Views to Print](#) on page 1084.
- 3 To specify export options, click the DGN Properties tab of the Export CAD Formats dialog. The following options are available.
 - [Layer Settings](#) on page 1349
 - [Enable DGN Template File](#) on page 1353

NOTE When you export (to DGN format) a 3D view that contains solid geometry, the geometry always exports as a polymesh.


- 4 Click Export.

NOTE Click OK to save the current export settings and close the dialog without exporting.

- 5 Navigate to the target folder for the exported files.
- 6 Select Automatic - Long (Specify prefix) or Automatic - Short from the Naming list to define the automatically generated file name. See [File Names for Exported Files](#) on page 1353.
- 7 Click Export.

Revit Architecture exports the selected views and sheets to DGN files and places them in the target folder.

Exporting to SAT

- 1 Click  ➤ Export ➤ CAD Formats ➤ SAT. The Export CAD Formats dialog opens.
- 2 Determine which views and sheets are to be exported to the SAT file.

If you are exporting a single view, select Current View/Sheet Only from the Export list on the View/Sheet Set tab of the dialog.

If you are exporting multiple views and sheets, do the following:

- a Select In session view/sheet set from the Export list on the View/Sheet Set tab of the dialog.
- b Select the views and sheets to export. See [Creating View and Sheet Sets](#) on page 1346 and [Selecting Views to Print](#) on page 1084.

NOTE When you export (to SAT format) a 3D view that contains solid geometry, the geometry always exports as ACIS solids.

3 Click Export.

NOTE Click OK to save the current export settings and close the dialog without exporting.

4 Navigate to the target folder for the exported files.

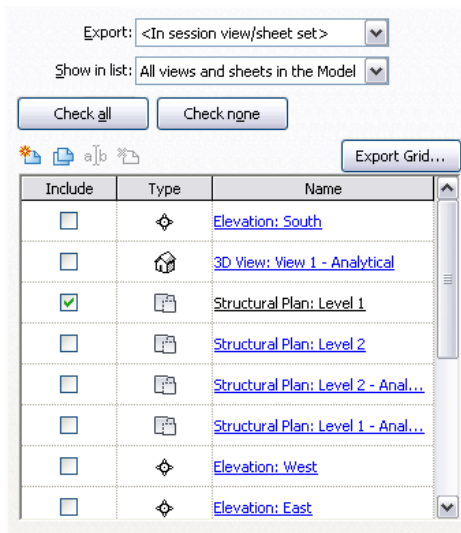
5 Select Automatic - Long (Specify prefix) or Automatic - Short from the Naming list to define the automatically generated file name. See [File Names for Exported Files](#) on page 1353.

6 Click Export.

Revit Architecture exports the selected views and sheets to SAT files and places them in the target folder.

Creating View and Sheet Sets

When you export to various formats, you use the View/Sheet Set tab from the appropriate Export/Publish Settings dialogs to specify which project views and sheets to output. This tab consists of the following tools, which you can use to create and select views and sheets to include in the output file. These selected views can be saved as a set for future use.







■ **Export.** Selects the set that will display in the View/Sheet list. This list contains all user-defined sets and the following default sets.

■ **<Current View/Sheet Only>.** Displays the currently active view or sheet.

■ **<In session view/sheet set>.** Enables Show in list, so you can filter views and sheets for the entire project or established set.

- **Show in list.** This list selects filters to broaden and narrow the available views and sheets of the selected set to output. These filters include the following:
 - Views in the Set
 - Sheets in the Set
 - All views and sheets in the Set
 - Views in the Model
 - Sheets in the Model
 - All views and sheets in the Model

The model-based filters list views and sheets from the project, disregarding the chosen set.

- **Check all/Check none.** These buttons select and deselect the include column check boxes for the listed views and sheets.
- **Set Manager Tools.** The Set Manager tools create, modify, and delete sets. The tools consist of the following buttons:
 -  **(New Set).** Creates a new empty set.
 -  **(Duplicate Set).** Creates a copy of the currently active set.
 -  **(Rename Set).** Prompts to rename the currently active set.
 -  **(Delete Set).** Deletes the currently active set.
- **Export Grid.** This button saves the View/Sheet list as a tab-delimited text file. The file contains the include status, type, and name of all currently visible views in the list.
- **View/Sheet List.** This table contains the views and sheets that have been filtered by the Export and Show in list options detailed above. The table consists of sortable columns that define the view list.

NOTE Click the column headers to sort the list by Include status, Type, or Name.

- **Include.** When checked, the associated view will be output with the new file.
- **Type.** Displays an icon representing the view type. These include plan views, sections, elevations, 3D views, sheets, and schedules.
- **Name.** The name of the view as recognized by Revit Architecture. Double click the name to see a thumbnail of the view in the preview pane to the left of the View/Sheet Set tab.

NOTE To save a PNG file of the preview, click Capture below the preview pane.

Defining View and Sheet Sets


Using the tools available in the [View/Sheet Set tab](#) on page 1346, you can identify views and sheets to include in the exported file.

To use the current view to export


For Export, select <Current View/Sheet Only>. Notice the only view listed and selected is the currently active view. The view is selected by default and will be output with the exported file.

NOTE Sets do not need to be saved or validated. They maintain their last configured status at all times.

To create a new set to export

- 1 Click  (New Set).
 - 2 Enter a name in the New Set dialog and click OK. The new set will be displayed in the Export drop-down list.
 - 3 To filter your view choices, for Show in list, select Views in the Model, Sheets in the Model, or All views and sheets in the Model.
 - 4 Select views for the set by clicking their associated Include box. A check mark indicates that a view has been selected.
- The set is now available for use and may be selected from the Export drop-down list at any time.

To create a new set by duplicating another

- 1 For Export, select the set to be duplicated.
 - 2 Click  (Duplicate Set).
 - 3 Enter a name in the Duplicate Set dialog and click OK. The new set will be displayed in the Export drop-down list.
- The set is now available for use and may be selected from the Export drop-down list at any time. If the set is to be adjusted with different views and sheets, proceed with the following steps.
- 4 To filter your view choices, for Show in list, select Views in the Set, Sheets in the Set, or All views and sheets in the Set.
 - 5 Select and deselect views for the set by clicking their associated Include box. A check mark indicates that a view has been selected.


Modifying View and Sheet Sets

Modifying the views and sheets in an existing set is a matter of adjusting their Include status in the list.


- 1 On the [View/Sheet Set tab](#) on page 1346, for Export, select the set to be modified.
- 2 For Show in list, select from the Set and Model filters to narrow and broaden your choices.
- 3 Select and deselect views for the set by clicking their associated Include box. A check mark indicates that a view has been selected.

NOTE When modifying view and sheet sets, changes are immediate and do not need to be saved or validated. They maintain their last configured status at all times.

To rename a set

- 1 For Export, select the set to be renamed.
 - 2 Click  (Rename Set).
 - 3 Enter a name in the Rename Set dialog and click OK.
- The renamed set is immediately changed in the Export drop-down list.

To delete a set

- 1 For Export, select the set to be deleted.
- 2 Click  (Delete Set).

The set is immediately removed from the Export drop-down list.



Exporting to CAD Format Properties

When exporting to a CAD format, you can use the format properties tab on the Export CAD Formats dialog to specify various options. Each format properties tab is named by its specific format, such as DWG Properties.

Related Topic

- [Exporting to CAD Formats](#) on page 1341

Layer Settings

- 1 Click  ➤ Export ➤ CAD Formats ➤ DWG, DXF, or DGN. The Export CAD Formats dialog opens.
- 2 Click the <Format> Properties tab.
- 3 Click  (Browse) or Layer Settings to access the Export Layers dialog.
From this dialog, you load an existing layer mapping file, create a standard layer mapping file, or customize layer mappings. For more information, see [Exporting Layers](#) on page 1360.

Layers and Properties

Select a value from the Layers and Properties list to control how to export object styles from Revit Architecture to AutoCAD (or other CAD applications).

NOTE You can define layers and properties when exporting to DXF or DWG. These options are not available when exporting to DGN or SAT.

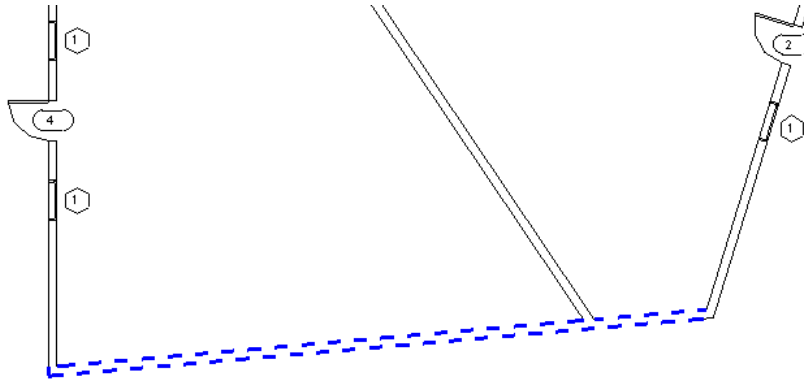
When you export a Revit view to DWG or DXF, each Revit category is mapped to an AutoCAD layer, as specified in the Export Layer dialog. In AutoCAD, the layer controls the display of the entities (Revit elements), including their colors, line weights, and line styles. In Revit Architecture, you define object styles in the Object Styles dialog. (See [Object Styles](#) on page 493.) The Layers and Properties setting determines what happens to a Revit element if it has attributes (object styles) that differ from those defined for its category. In AutoCAD and in Revit Architecture, view-specific element graphics are referred to as overrides.

Select one of the following values:

- **Category properties BYLAYER, overrides BYENTITY.** When a Revit element with view-specific graphics is exported, in AutoCAD those differences (overrides) are applied to the individual entity, but the entity resides on the same layer as other entities in the same Revit category or AutoCAD layer.
- **All properties BYLAYER, no overrides.** When a Revit element with view-specific graphics is exported, in AutoCAD those differences (overrides) are ignored. The entity resides on the same layer as other entities in the same Revit category or AutoCAD layer, and it loses its unique attributes. This option forces all entities to follow visual properties as defined by their layer. It produces the least number of layers and provides by-layer control over the exported DWG file.

- **All properties BYLAYER, new layers for overrides.** When a Revit element with view-specific graphics is exported, in AutoCAD the entity is placed on its own layer. This option provides by-layer control over the exported DWG file, and preserves graphical intent. However, it increases the number of layers in the exported DWG file.

For example, suppose that, in a Revit Architecture project, most walls display with solid black lines, with a line weight of 5. In a floor plan, however, you have changed the view-specific element graphics for one wall to use dashed blue lines, with a line weight of 7.



When you export this view to DWG or DXF and, for Layers and Properties, select:

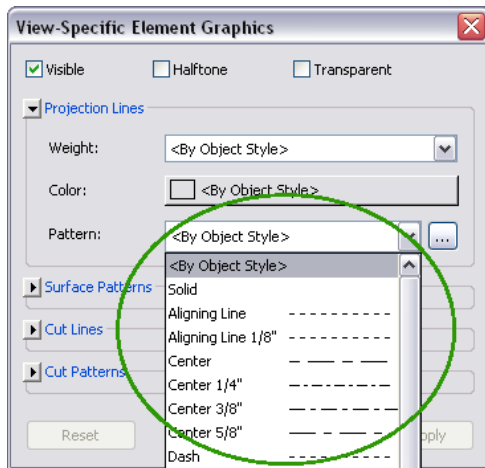
- **Category properties BYLAYER, overrides BYENTITY:** All walls in this Revit category, including the blue wall, are assigned to one layer in AutoCAD. The blue wall, however, retains its unique attributes (blue, dashed, line weight = 7) because AutoCAD defines them *by entity* for that wall.
- **All properties BYLAYER, no overrides:** All walls in this Revit category, including the blue wall, are assigned to one layer in AutoCAD, and the blue wall does not retain its unique characteristics. In AutoCAD, it looks the same as the other walls in the layer.
- **All properties BYLAYER, new layers for overrides:** All walls in this Revit category, except for the blue wall, are assigned to one layer in AutoCAD. The blue wall retains its unique attributes, but it is assigned to its own layer.

Linetype Scaling

Select a value from the Linetype Scaling list to control the LTSCALE and PSLTSCALE settings in AutoCAD and how linetype definitions are exported from Revit Architecture.

NOTE You can define Linetype Scaling when exporting to DXF or DWG. This option is not available when exporting to DGN or SAT.

Linetypes determine the particular dash-dot sequence, the relative lengths of dashes and blank spaces, and the characteristics of any included text or shapes in lines. In Revit Architecture, these are defined by object styles for categories (Manage tab ► Project Settings panel ► Settings drop-down ► Object Styles) or as view-specific element graphics for individual elements. (See [Object Styles](#) on page 493 or [Overriding Visibility and Graphic Display of Individual Elements](#) on page 199.)



In AutoCAD, the PSLTSCALE parameter controls paper space linetype scaling. A value of 0 indicates no special linetype scaling. Linetype dash lengths are based on the drawing units of the space (model or paper) in which the objects were created. A value of 1 indicates that viewport scaling governs linetype scaling.

In Revit Architecture, the Linetype Scaling setting changes the default behavior of the exported DWG files. Some lines that you would expect to be dashed may now appear solid or in a different scale in either Model or Sheet View in AutoCAD. Regardless of the option you choose, the DWG linetype definitions are created so that a dashed line always begins and ends with a dash.

Select one of the following values:

- **Scaled Linetype definitions.** This option exports linetypes the same as they were previously scaled by view scale. This option preserves graphical intent.
- **Modelspace (PSLTSCALE = 0).** This option specifies the LTSCALE parameter to view scale and the PSLTSCALE to 0.
- **Paperspace (PSLTSCALE = 1).** This option specifies the value 1 for both LTSCALE and PSLTSCALE. Revit Architecture linetype definitions are scaled to reflect project units, but otherwise they are exported as is.

Coordinate System Basis

Select a value from the Coordinate System Basis list to indicate whether the exported file will use the internal coordinates of the Revit project, or coordinates that are shared with other linked models. See [Linking Revit Models](#) on page 1277 and [Shared Positioning](#) on page 1296.

NOTE You can define the Coordinate System Basis when exporting to DXF or DWG. This option is not available when exporting to DGN or SAT.

Select one of the following values:

- **Project internal.** This option sets the origin of the exported file to the internal coordinates of the Revit project. Use this option when the Revit project is a stand-alone project that is not linked to other models, or when its particular position is irrelevant for the intended use of the exported file.
- **Shared.** This option sets the origin (0,0,0) of the exported file to the shared location of the Revit project. All geometry is exported relative to the shared coordinates. Use this option when you want to maintain the specific position of the project being exported.
When exporting to DWG, it is necessary to specify views and not sheets for shared coordinates to work correctly.

One DWG Unit Is

Select a default unit of measurement for the exported drawing: foot, inch, meter, centimeter, or millimeter. For imperial projects, the default unit is inches. For metric projects, the default unit is meters.

NOTE You can define One DWG Unit Is when exporting to DXF or DWG. This option is not available when exporting to DGN or SAT.

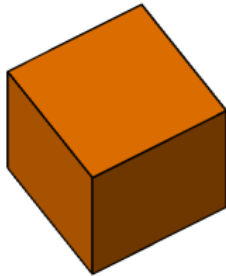
Solids (3D Views Only)

Indicate how solid geometry is to be exported. This option is available only when you are exporting a 3D view.

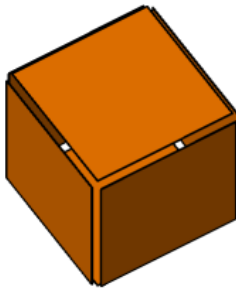
NOTE You can define Solids (3D Views Only) when exporting to DXF or DWG. When exporting to SAT, geometry always exports as ACIS solids. When exporting to DGN, geometry always exports as polymeshes.

Modeling programs generally represent 3D shapes using either of the following technologies:

- ACIS is a solid modeling technology. For example, ACIS represents a cube as a single object or shape with 6 sides.



- A polymesh is a 3D shape consisting of multiple polygons that are meshed (joined) together. For example, a polymesh cube consists of 6 square surfaces that are joined together to form the cube shape. This is referred to as face-based geometry.



Select one of the following values:

- **Export as polymesh.** This option exports all visible Revit geometry as polymeshes.
- **Export as ACIS solids.** This option exports all visible Revit geometry as ACIS 3D solids. Any elements that are already polymeshes remain as polymeshes, such as toposurfaces and import symbols that contain polymeshes.

Export Rooms and Areas as Polylines

The Export Rooms and Areas as Polylines option indicates whether rooms and areas are exported as closed polylines. You can use this option only when rooms or areas are defined in the views to be exported.


- Area polylines are generated from area plan views only. See [Area Analysis](#) on page 1008.
- Room polylines are generated from floor plan views or ceiling plan views only. See [Rooms](#) on page 977.

For rooms, the exported polylines match the boundaries of rooms in Revit Architecture. The room boundaries are exported onto a single layer, and that layer is turned off by default in the AutoCAD file. The polylines include the following XDATA information for room boundaries: Name, Number, Occupancy, Occupant, Department, and Comments.

For areas, the polylines include the following information for area boundaries: Name and Comments.

NOTE You can select Export Rooms and Areas as Polylines when exporting to DXF or DWG. This option is not available when exporting to DGN or SAT.

Enable DGN Template File

Select Enable DGN Template File when you want to use a template (a MicroStation seed file) for the exported DGN file. Then click  (Browse) to navigate to and load the template. Revit Architecture exports the project to a DGN file using the settings in the specified template.

If you do not use a DGN template file, Revit Architecture exports the project to a DGN file using default settings.

NOTE You can select Enable DGN Template File when exporting to DGN only. This option is not available when exporting to DWG, DXF, or SAT.

File Names for Exported Files

When exporting to a CAD format or DWF, you can specify a name or prefix for the exported files. In the Export dialog, under File Naming, use the options to name the exported files, as follows:

- **Automatic - Short.** Revit Architecture determines the name automatically and adds a prefix to the file name of the current view or multiple views and sheets. The format is:
Revit Sheet: Sheet Name or Revit View: View Type-View Name
- **Automatic - Long (Specify prefix).** Manually specify a prefix in the File name/prefix field or accept the default, which uses the format:
Revit Sheet/View: Project Name-View Type-View Name

When exporting multiple files, for File Name, enter a common prefix for the exported files. For example, if you are exporting the Level 1 floor plan and north elevation views to DWG files and you enter the prefix Country House, the resulting exported file names are Country House Elevation North.dwg and Country House Floor Plan Level 1.dwg.

Exporting Part of a 2D View

To export part of a 2D view, copy the view and use a crop region to show the desired portion, as described in the following procedure. Then export the view to the appropriate format.

To export part of a 2D view


- 1 In the Project Browser, right-click the view to export, and click Duplicate View ► Duplicate or Duplicate with Detailing.

The Duplicate tool copies the view. The Duplicate with Detailing tool copies the view and includes view-specific elements, such as detail components and dimensions.

The duplicate view displays in the drawing area. In the Project Browser, the duplicate view is named Copy of <View Name>.

- 2 Rename the duplicate view: in the Project Browser, right-click the duplicate view, and click Rename. Enter a new name, and click OK.


Add a crop region

- 3 On the View Control Bar, click  (Show Crop Region).

In the drawing area, the crop region appears as a box around the view.

- 4 To crop the view to show the desired portion, click the crop region box, and drag the handles. You may need to zoom out to see the borders and handles of the crop region box.

Export the 2D view defined by the crop box

- 5 Click  ► Export, and select an export option. See [Export](#) on page 1341.

Exporting Part of a 3D View

To export part of a 3D view, use a section box to define the part of the 3D view to export. By applying a section box, you are limiting the amount of the model that is exported. Elements that are completely outside the section box are not included in the export file.

The section box is particularly useful for large models. For example, for an interior rendering of a conference room in an office building, use a section box to export the conference room and omit the rest of the building.

NOTE For 3D views, crop region boundaries are not exported, and so you cannot use crop regions to limit model geometry. Instead, use section boxes as described here. (You can, however, use crop regions to export part of a 2D view.)

To export part of a 3D view

- 1 In the Project Browser, right-click the 3D view to export, and click Duplicate View ► Duplicate. The duplicate view displays in the drawing area. In the Project Browser, the duplicate view is named Copy of <View Name>.

- 2 Rename the duplicate view: in the Project Browser, right-click the duplicate view, and click Rename. Enter a new name, and click OK.

This is the 3D view that you will export. Saving the view allows you to easily export it again later if you make revisions to the model.

Add a section box

- 3 Click View tab ► Graphics panel ► View Properties.

- 4 In the Instance Properties dialog, locate the Extents section of the instance parameters. Select Section Box, and click OK.

The section box appears in the drawing area.

5 Select the section box to see its handles. Drag the handles to change the shape and size of the box.

It may be easier to control the size, shape, and position of the section box from another view (such as a floor plan), as follows:


- a** Open the floor plan view.
- b** In the Project Browser, right-click the 3D view's name, and click Show Section Box.
The section box displays in the floor plan view.
- c** Select the section box in the floor plan view, and drag the handles to change its size and shape.

6 Return to the 3D view and make any further adjustments required.

7 Hide the section box so that it does not appear in the exported file:

- a** Click View tab ► Graphics panel ► Visibility/Graphics.
- b** In the Visibility/Graphics dialog, click the Annotation Categories tab.
- c** Clear the check box for Section Boxes.
- d** Click OK.

Export the 3D view defined by the section box

8 Click  ► Export, and select an export option. See [Export](#) on page 1341.

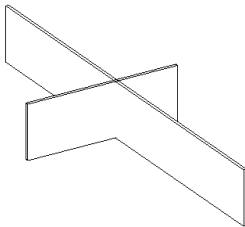
For more information about section boxes, see [Using a Section Box in a 3D View](#) on page 159.

Exporting Intersecting Geometry

If the model includes intersecting geometry (such as an extrusion passing through a wall surface), Revit Architecture does not create new edges along the lines of the intersection. As a result, Revit Architecture may incorrectly remove hidden lines during export. If you export a view of the design with hidden lines turned on, you may see unexpected results when you open the view in another CAD application. See [Hidden Line Model Graphics Style](#) on page 252.

To see all visible lines, create an opening in one surface before passing another surface through it, or join geometry to create an edge.

Intersected wall and extrusion in hidden line mode (no edges at the intersection of the surfaces)



Exporting to Design Web Format

Design Web Format™ (DWF™) is the Autodesk method of publishing design data. It offers an alternative to printing to PDF (Portable Document Format).

DWF files allow you to share design information securely and easily. Using the DWF format, you can avoid unintended changes to project files, and you can share project files with clients and others who do not have Revit Architecture. DWF files are significantly smaller than the original RVT files, making them easy to send by electronic mail or post to a web site.

DWF files can be viewed by recipients using Autodesk® Design Review, which is available for free download from <http://www.autodesk.com/designreview>.

About DWFx

The meaning of the term DWF has expanded to include DWFx. DWFx is based on the XML Paper Specification (XPS) from Microsoft, making it easier to share design data with reviewers who do not have Design Review installed. DWF and DWFx files contain the same data (2D and 3D), the only difference is the file format.

DWFx files can be opened and printed using the free Microsoft XPS Viewer, which comes pre-installed on computers using the Microsoft Windows Vista™ operating system. (For the Windows XP operating system, the Microsoft XPS Viewer can be downloaded directly from Microsoft.) Unlike DWF files, DWFx files include additional information to display design data in the Microsoft XPS Viewer. As a result, DWFx files are larger than corresponding DWF files.

Currently, the Microsoft XPS Viewer does not support views containing 3D content, password-protected content, restricted content, or georeferenced map coordinates. In the Microsoft XPS Viewer, when attempting to open views containing any of these unsupported features, a warning directs you to view the DWFx file in Design Review.

NOTE All references to DWF in this documentation implicitly include DWFx, unless specified otherwise.

2D DWF Files

You can export all Revit views or sheets to 2D DWF files. If you export multiple views in a project to one DWF, in Autodesk DWF Viewer you can click a link to jump to a related view.

3D DWF Files

You can export 3D views to 3D DWF files. Using Autodesk Design Review, you can open a 3D DWF file and manipulate the 3D representation of the building. You can rotate the building, zoom in on a portion of it, select an element (such as a roof), make it transparent to see what is beneath or behind it, and so on.

Object Data and Exported 2D or 3D DWF Files

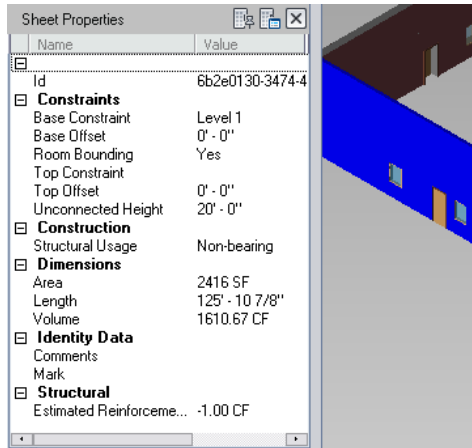
When you export to 2D or 3D DWF, a unique, consistent ID is generated for each object. This ID consists of the GUID (Globally Unique Identifier) and the element ID. This ID scheme virtually eliminates duplicate element IDs when DWF files are merged from multiple sources outside Revit Architecture.

When you export object data to 2D DWF, any property with an assigned unit of measurement exports user-visible and invisible information. This information is available when you import 2D DWF into Autodesk® FMDesktop™. User-visible information consists of formatted values. Invisible information consists of 2 additional fields: an unformatted, raw value, and a field that describes the unit type or data type.

Viewing Object Data in a DWF file

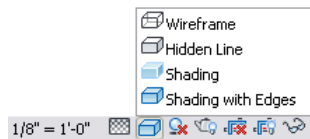
When viewing a DWF file, you can access information (object data) about elements in the design.

In DWF Viewer, viewing properties for a selected wall



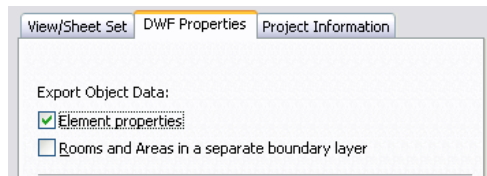
Revit Architecture automatically includes object data for elements in 3D DWF files. To include this element-specific information in a 2D DWF file, you must do the following:

- Ensure that the model graphics style for selected views is set to Hidden Line or Wireframe (not Shading or Shading with Edges). See [Model Graphics Styles](#) on page 250.




When exported to DWF, views set to Shading or Shading with Edges use raster processing for images, so you cannot select individual elements in the DWF file.

- When exporting to DWF, select the option to export object data for Element properties.



Exporting to DWF

1 Click  ➤ Export ➤ DWF.

2 Determine which views and sheets are to be exported to the DWG file.

If you are exporting a single view, select Current View/Sheet Only from the Export list on the View/Sheet Set tab of the dialog.

If you are exporting multiple views and sheets, do the following:

- Select In session view/sheet set from the Export list on the View/Sheet Set tab of the dialog.
- Select the views and sheets to export. See [Creating View and Sheet Sets](#) on page 1346 and [Selecting Views to Print](#) on page 1084.

- 3 To specify export options, click the DWF Properties tab of the DWF Export Settings dialog. See [Exporting to DWF Options](#) on page 1358.
- 4 To edit or add project related metadata, click the Project Information tab of the DWF Export Settings dialog. If this information is changed, the data is saved to the exported DWF files and the project. See [Specifying Project Information](#) on page 447.
- 5 Click Export.

NOTE Click OK to save the current export settings and close the dialog without exporting.

- 6 Navigate to the target folder for the exported files.
- 7 Select DWF or DWFX from the Files of type list.
- 8 Select Manual (Specify file name), Automatic - Long (Specify prefix), or Automatic - Short from the Naming list to define the file name. See [File Names for Exported Files](#) on page 1353.
- 9 Click Export.

Revit Architecture exports the selected views and sheets to DWF files and places them in the target folder.

Exporting to DWF Options

When exporting to DWF format, you use the DWF Properties tab on the DWF Export Settings dialog to specify various options.

Export Object Data

Select the following object data information to export to the DWF file.

- **Element properties.** Exports the instance and type properties of the objects in the exported views.
- **Rooms and Areas in a separate boundary layer.** Exports the room and area properties to a layer separate from the geometric representation. With this option, you can view individual rooms and room data when you are exporting a project or a view for use with facility management software (such as Autodesk® FMDesktop), or DWF markup software (such as Autodesk® Design Review).

You can export object data only for views whose model graphics style is set to Wireframe or Hidden Line, not Shading or Shading with Edges. See [Viewing Object Data in a DWF file](#) on page 1356.

Graphics Settings

Select either of the following graphic formats for the export of images.

- **Use standard format.** This default setting exports images as PNG files.
- **Use compressed raster format.** Exports images using a compressed JPG format. Limiting image quality reduces image file size in most cases.

Print Setup

The Print Setup Name displays the name of the current Revit DWF Exporter settings. Click the Print Setup button to modify settings. See [Print Setup](#) on page 1081.

Linking DWF Markups

When creating construction documents, a typical workflow is to print out a sheet, have it reviewed and marked up by the project architect or other professional, and then return it to the originator of the sheet to have the requested changes made.


Revit Architecture enhances this process by allowing you to export sheet views as DWF files. The DWF files can be marked up electronically using a program such as Autodesk® Design Review. Then the markups can be linked back into Revit Architecture to see the desired changes. Because they are linked, the Revit Architecture file and the DWF file remain synchronized with regard to the markups.

Autodesk® Design Review is available for download from <http://www.autodesk.com/designreview>.

The following steps outline the process for handing off the Revit Architecture sheet view, marking it up, and then bringing it back into Revit Architecture. This process is often referred to as round-tripping.

NOTE To use the markup functionality, you must export Revit Architecture *sheet* views. See [Sheets](#) on page 1030.

To link DWF markups

- 1 In Revit Architecture, open a sheet view and export it to DWF by clicking  ► Export ► DWF. See [Exporting to DWF](#) on page 1357.
- 2 Use a DWF-compatible program (such as Autodesk® Design Review) to mark up the DWF file. When you mark up the DWF file, you are marking on top of the plotted views from Revit Architecture, as if you used a red marker on a printout. After you have marked up the DWF, you can link it back into Revit Architecture.

Link the markups in Revit Architecture

- 3 Return to Revit Architecture.
- 4 Click Insert tab ► Link panel ► DWF Markup.
- 5 In the Import/Link DWF File dialog, navigate to the marked-up DWF file, select it, and click Open.

The Link Markup Page to Revit Sheets dialog displays. Under the DWF View column, the dialog displays the sheet view names that are marked up in the DWF file. The Revit View column displays the corresponding sheet view. If the sheet name from the DWF file is the same as the sheet name from the Revit Architecture file, then the Revit Architecture sheet name is automatically filled in the Revit View column.

If the Revit Architecture sheet view name has changed since it was exported to DWF, the Revit View column displays <Not linked> next to the DWF sheet view.
- 6 If the Revit View value is <Not linked>, select a Revit Architecture sheet view. (Click the box below the Revit View column, and select a name from the list.)

NOTE You might also do this if you have several other sheet views in the Revit Architecture file, and you want to apply the markups to one of the other sheet views. This would make sense only if the other sheet view title blocks were the same size as the original.

- 7 Click OK.

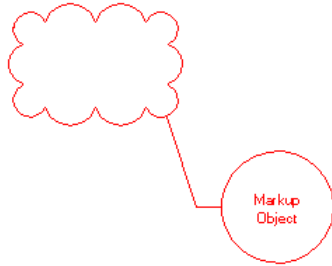
The DWF markups are placed on the sheet view as an import symbol. The markups are pinned, which means that you cannot modify their position, and you cannot copy, rotate, mirror, delete, or group them.

If markups were created in Design Review using its markup tools, then you can modify some markup properties in Revit Architecture.

Change status and add notes for markup

- 8 Select a markup object that was created in Design Review.

A markup object might look as follows.



- 9 Click Modify Sheet tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 10 In the Instance Properties dialog, modify the Status and Notes properties if desired.
- 11 Click OK to save your changes.
- 12 Save the Revit Architecture file.

The changes are saved to the linked DWF file. The changes can be viewed in the DWF file by selecting the corresponding markup object.

Managing DWF Markup Links

- 1 Click Manage tab ► Manage Project panel ► Manage Links.
- 2 In the Manage Links dialog, click the DWF Markups tab.
The tab lists all the linked, marked-up DWF files.
- 3 Select a linked DWF file.
- 4 Click Save Markups.
The next time the DWF file is opened, it will contain the changes to the markup objects.
- 5 Click Located In to see the sheet view to which the DWF file is linked.
Other tools on this tab work similarly to the tools on the other Manage Links tabs. For more information, see [Managing Links](#) on page 1286.

Exporting Layers

When exporting a project to another format (such as DWG or DGN), you want the exported file to contain as much information about the project as possible. Revit Architecture stores a wealth of project information in its categories and subcategories. In CAD software, this type of information is stored in layers (or levels in MicroStation). To ensure that information about Revit categories is properly converted to CAD layer names, use the Export Layers tool to define a layer mapping file.

The layer mapping file is a text file that maps each Revit category or subcategory to a preconfigured layer name for the CAD software. For example, a Revit door object automatically maps to A-DOOR layer in AutoCAD. The layer names are preconfigured in the text file, but you can change them.

You can load an existing layer mapping file and manually change values for it, or you can generate a file using any of the following mapping standards:

- American Institute of Architects (AIA)
- ISO standard 13567
- Singapore standard 83
- British standard 1192


When you use the Export Layers tool to generate a layer mapping file, by default the file is named as follows:

exportlayers-<format>-<standard>.txt

where <format> is DWG or DGN (to indicate the selected export format), and <standard> reflects the selected Export Layers standard (such as AIA or BS1192).

The layer mapping file resides in the Data folder of the Revit Architecture installation directory. When you export a project, its layer mapping file is exported (along with the project) into the appropriate format for the target CAD program.

Creating or Modifying a Layer Mapping File

- 1 Click  ➤ Export ➤ Options ➤ Export Layers DWG/DXF (for AutoCAD) or Export Layers DGN (for MicroStation).
In the Export Layers dialog, Revit Architecture displays values from a layer mapping file, using the appropriate standard for the current locale.
 - 2 If you want to use a different standard or edit an existing mapping file, do one of the following:
 - To load an existing mapping file, click Load, navigate to the file, and click Open.
 - To create a new mapping file, click Standard, select a standard from the dialog, and click OK.
 - 3 Edit mapping values as desired.
To change a Cut or Projection value, click in the Layer Name or Color ID column for the appropriate category and enter the new value.
-
- NOTE** Color ID corresponds to an AutoCAD or MicroStation color ID. For Export Layers DGN, the columns are labeled Level Number (corresponding to MicroStation levels, instead of AutoCAD layers) and Color ID.
-
- 4 To save the settings, do one of the following:
 - To save the settings in a new layer mapping file, click Save As, navigate to the target folder, and enter a new file name.
 - To save the changed settings in the existing layer mapping file (whose file name appears in the dialog's title bar), click OK.

When exporting a project from Revit Architecture, you specify the layer mapping file to use on the <Format> Properties tab of the Export dialog. See [Exporting to CAD Format Properties](#) on page 1349.


Related topics

- [Exporting Layers](#) on page 1360
- [Custom Layer Mapping Files](#) on page 1361
- [Exporting to CAD Formats](#) on page 1341

Custom Layer Mapping Files

You can use the Export Layers tool to create a layer mapping file for various consultant office standards.

To create a custom layer mapping file, follow the procedure in [Creating or Modifying a Layer Mapping File](#)

on page 1361, and use the  ► Save As feature to save the file with a unique name.

Exporting to ODBC

You can export model component data to an ODBC (Open Database Connectivity) database. The exported data can include project parameters that have been assigned to one or more element categories in the project. For each element category, Revit Architecture exports a database table for model types and another table for model instances. For example, Revit Architecture creates a table listing all door types and another table listing all door instances.

ODBC export uses metric units only. If a project uses Imperial units, Revit Architecture converts all measurements to metric units before exporting to ODBC. When you use data from the resulting database, remember that the measurements reflect metric units. Use a database function to convert the measurements back to Imperial units if necessary.

Using ODBC, Revit Architecture creates tables for the following elements:

- Model Objects: Types and Instances
- Levels and Rooms: Instances only
- Key Schedules
- Assembly Codes: A single table containing assembly code data for the entire project

ODBC export creates specific relationships between tables in the database using primary keys and reference values. See [Table Relationships Within the Database](#) on page 1364.

Revit Architecture can export to the same database multiple times. When exporting to an empty database, Revit Architecture creates new tables. When you export a project to a populated database, Revit Architecture updates table information to match the project. This allows you to customize the database and re-export data as the project changes.

IMPORTANT Do not export different projects to the same database. Use a unique database for each project.

Supported ODBC Drivers

ODBC is a general export tool that works in conjunction with many software drivers. Revit Architecture has been tested with the following ODBC drivers:

- Microsoft® Access
- Microsoft® Excel
 - An ODBC export to Excel creates one table per worksheet.
 - You can export to an Excel file only once. Multiple exports to Excel are not supported.
- Microsoft® SQL Server
 - The Microsoft® Text Driver is not supported by Revit Architecture.

Revit Architecture may be able to work with other ODBC drivers, depending on the features supported by the driver. If you need assistance with a particular software driver, contact your local IT department or Autodesk Product Support.

Exporting to an ODBC Database

The first time that you export a Revit project to an ODBC database, use the following procedure. If you have already exported the project and want to re-export it, see [Exporting Multiple Times to the Same ODBC Database](#) on page 1363.

To export to an ODBC database

1 In Revit Architecture, open the project to export.

2 Click  ➤ Export ➤ ODBC Database.

3 Click New to create a new Data Source Name (DSN).

4 In the Create New Data Source dialog, do the following:

a Select a driver and click Next.

This driver is associated with the software program you export to (for example, Microsoft® Access, dBase, or Paradox).

b Enter a DSN name, or navigate to the target folder and specify a file name. Click Next.

c A confirmation dialog displays. If any information is incorrect, click Back and correct it.

d Click Finish.

5 Create the database file.

Depending on the driver selected, a dialog displays, requesting information about the database file to export to. Use the dialog to specify the database to use or to create a new one. For example:

- For Microsoft® Access, click Select to select an existing database, or click Create to create a new, empty database to export data to.
- For Microsoft® Excel, first use Excel to create a new, empty workbook with the desired name. Then on the dialog, click Select Workbook, and navigate to the new workbook.

6 In the Select Data Source dialog, click OK.

7 In the ODBC Setup dialog, click OK.


NOTE If the export fails with an error regarding a read-only database, click Options in the ODBC Microsoft Setup dialog. Clear the Read Only check box. Then try the export again.

Related topics

- [Exporting to ODBC](#) on page 1362
- [Supported ODBC Drivers](#) on page 1362
- [Editing the Database After Export](#) on page 1364
- [Table Relationships Within the Database](#) on page 1364

Exporting Multiple Times to the Same ODBC Database

1 In Revit Architecture, open the project to export.

2 Click  ➤ Export ➤ ODBC Database.

3 In the Select Data Source dialog, select the desired data source, and click OK.

4 In the ODBC Setup dialog, click OK to export to the same database.

Editing the Database After Export

Do not edit data in the database columns exported by Revit Architecture. Any changes to those columns are overwritten the next time the project is exported.

However, you can add columns to the tables created by Revit Architecture. The next time the project is exported, any data in the added columns is preserved.

Table Relationships Within the Database

When Revit Architecture creates database tables during ODBC export, it adds relationships to the data tables using primary keys and reference values. In relational databases, a primary key is a unique value that identifies a record (row) in a table of the database. Reference values are columns in a table that refer to other tables.

NOTE Database programs (such as Microsoft® Access) can interpret the table relationships. In spreadsheet programs like Microsoft® Excel, relationships are not supported, so Revit Architecture creates simple, unrelated tables.

The primary key in each element table is the column labeled “Id”. The following table illustrates how primary keys and reference values create relationships among tables in the database.

Column (Field) of a Door Instance Table	Corresponds to...
Id	None. This is the unique identifier for this instance of a door.
Type Id	Id column of the door Types table
Level	Id column of the Levels table
Room	Id column of the Rooms table
Key schedule	Id column of the Key Schedules table

The primary key in the Assembly Codes table is the Assembly Code column. The Assembly Code column in type tables references the Assembly Code column in the Assembly Codes table.


Revit Architecture does not create a reference for the Host Id column because the host may be a wall, floor, roof, or other such host, so there is no unique table to reference.

The relationships between tables are established only when Revit Architecture first creates the tables; if you use Revit Architecture to re-export to an existing database, no new relationships are created.

Exporting a View to an Image File

When you export an image, Revit Architecture prints any view directly to a raster image file. You can then use this image for online presentations or printed materials.

To export a view to an image file

- 1  ➤ Export ➤ Images and Animations ➤ Image.
- 2 In the Export Image dialog, click Change to change the default path and file name for the image, if desired.


- 3 Under Export Range, indicate the images to export:
 - **Current window.** This option exports the entire contents of the drawing area, including parts that are outside the current viewing area.
 - **Visible portion of current window.** This option exports whatever is currently visible in the drawing area.
 - **Selected views/sheets.** This option exports the specified sheets and views. Click Select. In the View/Sheet Set dialog, select the views and sheets to export, and click OK.
- 4 Under Image Size, specify image display properties, as follows:
 - To specify a print size and orientation for the image, select Fit To and enter a pixel value. For Direction, select Horizontal or Vertical. Revit Architecture fits the image horizontally or vertically into the specified number of pixels.
 - To magnify or reduce the image, select Zoom To and enter a percentage. Revit Architecture prints the image at the specified zoom setting.
- 5 Under Options, select the desired print options:
 - By default, links in the exported image display in black. To display blue links, select View Links in Blue.
 - To hide unwanted parts of the drawing in the exported view, select any of the following: Hide Ref/Work Planes, Hide Scope Boxes, Hide Crop Boundaries, and Hide Unreferenced View Tags.
- 6 Under Format, select an output format for shaded views and non-shaded views. If you specified a Zoom To percentage for Image Size, select a DPI (dots per inch) value for Raster Image Quality.
- 7 Click OK.

The selected sheets or views are exported as images in the specified file.

Exporting Project Views to HTML

You can create a web page that links HTML versions of views and sheets in a Revit project.

To export project views to HTML

- 1 Click  ► Export ► Images and Animations ► Image.
- 2 In the Export Image dialog, under Export Range, select Selected Views/Sheets.
- 3 Click Select.
- 4 In the View/Sheet Set dialog, select the views and sheets to export, and click OK.
- 5 Under Output, do the following:
 - For Name, specify the desired path and a prefix for resulting file names.
 - Select Create Browsable Web Site with a Linked HTML Page for Each View.
- 6 Specify Image Size, Options, and Format settings as desired.
For details about these settings, see [Exporting a View to an Image File](#) on page 1364.
- 7 Click OK.

Revit Architecture creates a web page. From the web page, you can open the views from a table of contents. View tags are hyperlinks. For example, suppose you export the Level 1 view and the North Elevation view. In the web page, when viewing the North Elevation view, you can click the Level view tag to link to the Level 1 view.

In the folder where the web page resides, Revit Architecture creates a folder containing the source HTML files and images. The folder also contains a cascading style sheet (CSS file). Edit this file to change the format of the web page.

Creating Room/Area Reports

You can create a detailed report that describes areas defined in plan views (floor plans and area plans). For a floor plan, Revit Architecture generates a room report. For an area plan, Revit Architecture generates an area report. These reports contain information about all rooms or areas with floors on the corresponding level. Each report is generated as an HTML file.

When creating a room/area report, you can choose from the following formats:

- **Revit room area triangulation report.** For each room or area in the selected plan, the report contains images of room boundaries or area boundaries, which are triangulated and annotated. Following each image, a table shows calculations for the triangulated areas, as well as total room area and total window area.
- **Revit room area numerical integration report.** For each room or area in the selected plan, the report contains a table that lists segments, sub-areas, and their dimensions. Each table is followed by the total room area and total window area.

You can create triangulation reports that exclude areas bounded by multiple curve loops (such as a room with columns or closets in the middle). When a room/area report excludes these areas, triangulation is performed, reported, and displayed separately for each bounding loop. (This option only applies to Revit room area triangulation reports; it is ignored for Revit room area numerical integration reports.)

This functionality is primarily intended for European users.

Exporting a View as a Room/Area Report

- 1 Click  ➤ Export ➤ Reports ➤ Room/Area Report.

The Export Room Area Report dialog displays.

- 2 For Files of Type, select the type of report to create: triangulation or numerical integration.

- 3 If you are exporting a single view, do the following:

- a Under Range, select Current View.

NOTE If you have a 3D view currently displayed in the drawing area, the Current View option will not be available.

- b If the current view is a floor plan or an area plan, the File Name text box displays a default file name. If desired, change the file name, and navigate to a target folder.

- 4 If you are exporting multiple views, do the following:

- a Under Range, click Select Views.
 - b In the Views dialog, select the views to export, and click OK.
 - c For File Name, enter a prefix for the names of the exported files.

- 5 Click Options.

- 6 In the Area Report Settings dialog, do the following:

- a If desired, change settings for text format, label prefixes for triangles and arc sectors, line colors, unit format, and image sizes.
- b For a triangulation report, select Use Triangulation with Exclusions if you want to exclude areas bounded by multiple curve loops. (This setting has no effect for numerical integration reports.)
- c To report window area as a percentage of total area, select Report Window Area as a Percentage of Room Area. By default, the report calculates the total window area.
- d Click OK.

7 Click Save.

Revit Architecture generates the report as an HTML file and places it in the target folder.

Related topics

- [Creating Room/Area Reports](#) on page 1366
- [Rooms and Areas](#) on page 975

Exporting to Industry Foundation Classes (IFC)

You can export Revit building modeling information to the Industry Foundation Classes (IFC) file format.

About the IFC File Format

The Industry Foundation Classes (IFC) file format was developed by the International Alliance of Interoperability (IAI). IFC provides an interoperability solution between different software applications. The format has established, international standards to import and export building objects and their properties.

IFC improves communication, productivity, delivery time, and quality throughout the life cycle of a building. It reduces the loss of information during transmission from one application to another, with established standards for common objects in the building industry.

For more information about the IFC file format, visit <http://www.iai-international.org>.

Revit Architecture and IFC

Revit Architecture provides IFC import and fully certified export based on the latest IAI IFC2x3 data exchange standard. When you export a Revit building information model to IFC format, the information can be used directly by other building specialists, such as structural and building services engineers.

For example, building information models developed with Revit Architecture are saved to the RVT file format. You can export the building model using the IFC format to an IFC-certified application that does not use the RVT file format. The drawing can be opened and worked on in the non-native application. Similarly, in Revit Architecture you can import an IFC file, create a RVT file, and work on the building model in Revit Architecture.

IFC uses architecturally meaningful containers to describe real-world building objects. Those containers include parameters that have meaningful values. Many standard Revit elements have corresponding IFC containers. These do not require any specific user action to export them. (For example, Revit walls export as IFCwalls.) Other Revit families (such as escalators) require that you map them to IFC containers before exporting. See [Loading and Modifying an IFC Mapping File](#) on page 1368.

Revit Architecture makes available the following IFC-specific files to assist you:

- IFC Metric Template.rte. This file allows you to create new projects that are already set to the IFC standard.

- IFC Parameter Upgrade.rvt. This file enables you to upgrade an existing project to contain IFC parameters by reading the instructions contained in the IFC Parameter Upgrade.rvt file.
- IFC Shared Parameters.txt. This file contains the shared IFC parameters if you want to manually update an existing project to contain all or some of these parameters.

NOTE It is recommended to use the IFC Parameter Upgrade.rvt file instead, for performance reasons.

See [IFC-Specific Files](#) on page 1371 for more information about these files.


Related topic

- [Opening Industry Foundation Class \(IFC\) Files](#) on page 1397

Supported IFC Classes

Before exporting a Revit project to IFC, make sure that Revit Architecture supports the desired IFC classes. To see a complete list of classes, use the following procedure.

To see a list of supported IFC classes


- 1 Click  ➤ Export ➤ Options ➤ IFC Options.
- 2 In the IFC Export Classes dialog, click Standard.

The IFC Class Name column lists the supported IFC classes.

Loading and Modifying an IFC Mapping File

Before exporting a Revit project to IFC, you may need to map generic family instances to IFC containers (element types). You do this by creating a new IFC mapping file or editing an existing one. Also, you can use the following procedure to load the desired IFC mapping file before exporting a Revit project to IFC.

To load and modify an IFC mapping file

- 1 Click  ➤ Export ➤ Options ➤ IFC Options.
- 2 Do either of the following:
 - To create a new IFC mapping file based on the IAI standard, click Standard. Revit Architecture creates an IFC mapping file named exportlayers-ifc-IAI.txt.
 - To load an existing IFC mapping file, click Load, navigate to the file, and click Open.

In the IFC Export Classes dialog, each row represents an element category or subcategory. For standard building elements, an assigned class name appears in the IFC Class Name column. For building elements that do not have automatic mapping to IFC export classes, "Not Exported" appears in the IFC Class Name column.

- 3 For each category or subcategory to export, do the following:
 - For IFC Class Name, enter the name of the IFC class for the particular category/sub-category pair.
 - For Type, enter the type of object within that subclass.

Appropriate values are set according to the IFC standard definition. Selecting Not Exported prevents elements of that category or sub-category from being exported.

If the values for a category or subcategory are blank, Revit Architecture will try to determine the appropriate category. If it cannot make a match and the object has geometry, it is exported as a proxy object.

4 To save the settings, do one of the following:

- To save the settings in a new IFC mapping file, click Save As, navigate to a target folder, and enter a new file name. Click OK.
- To save the changed settings in the existing IFC mapping file (whose file name appears in the dialog's title bar), click OK.

When you export a Revit project to IFC, Revit Architecture automatically uses the appropriate IFC mapping file.

Exporting a Project to IFC

1 Load the IFC mapping file that you want to use for the export to IFC.

See [Loading and Modifying an IFC Mapping File](#) on page 1368. You can also use this procedure to modify the mapping file or to map non-standard Revit Architecture families to IFC containers.

2 Click  > Export > IFC.

3 In the Export IFC dialog, for Save In, navigate to the target folder for the IFC file.

4 For Files of Type, select the desired file type:

- IFC 2x2 (*.ifc)
- IFC 2x3 (*.ifc): This is the default certified version of export, and the latest version generally supported by other systems.
- IFC BCA ePlan Check (*.ifc): This is a certified variant of IFC 2x2 used for submitting files to the Singapore BCA ePlan Check Server. When exporting to this file type, you should make sure that all room-bounding elements are selected.

5 Select export options:

- **Current view only** allows you to export elements that are visible in the current view. Visible elements include those that are hidden by hidden line or shaded mode, any underlays in the view, and elements that are cropped from view by the crop region. Elements temporarily hidden using temporary hide/isolate will not be exported. Categories marked as Not Exported in the IFC Export Classes dialog will not be exported. See [Loading and Modifying an IFC Mapping File](#) on page 1368.
- **Split walls and columns by level** allows you to divide multi-level walls and columns by level.
- **Export base quantities** includes base quantities for model elements in the export data. Base quantities are generated from model geometry to reflect actual physical quantity values, independent of measurement rules or methods.

6 For File Name, enter a name for the IFC file.

7 Click Save.

Related topics

- [Exporting to Industry Foundation Classes \(IFC\)](#) on page 1367
- [Supported IFC Classes](#) on page 1368

- [Specifying IFC Entities for Families](#) on page 1370
- [Opening Industry Foundation Class \(IFC\) Files](#) on page 1397

Specifying IFC Entities for Families

Revit Architecture exports building elements to an IFC file based on the categories (and subcategories) to which the elements belong. For example, Revit Architecture exports a wall to the IFC entity `IfcWallStandardCase`, because the wall is an element from the wall category. In many cases, exporting elements from Revit Architecture to IFC is straightforward and simple, and the default settings make sense.

In some cases, however, you may want to specify the IFC entity to which elements from a particular family should belong. For example, suppose you design an escalator family. It belongs to the Generic Model category, and you create for it a subcategory called Escalator. You want to ensure that when you export a project to IFC, an escalator is properly (and automatically) mapped to the class `IfcTransportElement` and the type `IfcTransportElementType`.

To map a family to an IFC entity

- 1 Create shared parameters named `IFCExportAs` and `IFCExportType`. See [Shared Parameters](#) on page 451.

Save these shared parameters to a file that resides in a network location, so that you can add the parameters to other families and projects. You can also use the shared parameter file that Revit Architecture makes available (`IFC Shared Parameters.txt`). See [IFC-Specific Files](#) on page 1371 for information on how to access this file.

For example, in a folder where you store other corporate standard files, create a parameter file named `IFCexportParameters.txt`. You only need to create these shared parameters once. You can reuse them in multiple families.

- 2 Use the Family Editor to create a new family or to modify an existing family. See [Revit Families](#) on page 415.

Add the shared parameters to the family

- 3 In the Family Editor, click **Create** tab ► **Family Properties** panel ► **Types**.
- 4 In the Family Types dialog, for **Name**, select a family type.
- 5 Under **Parameters**, click **Add**.
- 6 In the Parameter Properties dialog, under **Parameter Type**, click **Shared parameter**, and click **Select**.
- 7 Navigate to the shared parameters file that defines `IFCExportAs` and `IFCExportType` (for example, `IFCexportParameters.txt`), and open the file.
- 8 In the Shared Parameters dialog, under **Parameters**, select `IFCExportAs`, and click **OK**.
- 9 In the Parameter Properties dialog, under **Parameter Data**, for **Group parameter** under, select **IFC Parameters**.
- 10 Make sure that **Type** is selected, and click **OK**.
In the Family Types dialog, `IFCExportAs` displays in the parameter list.
- 11 Under **Parameters**, click **Add**.
- 12 In the Parameter Properties dialog, under **Parameter Type**, click **Shared parameter**, and click **Select**.
- 13 In the Shared Parameters dialog, under **Parameters**, select `IFCExportType`, and click **OK**.
- 14 In the Parameter Properties dialog, under **Parameter Data**, for **Group parameter** under, select **IFC Parameters**.
- 15 Make sure that **Type** is selected, and click **OK**.

In the Family Types dialog, IFCExportType appears in the parameter list.

Specify values for IFCExportAs and IFCExportType

When you add the shared parameters to one family type, Revit Architecture automatically adds them to all types in that family. Next, you can specify values for each parameter in each family type.

16 In the Family Types dialog, do the following:

- a** For Name, select a family type.
- b** For IFCExportAs, specify the desired IFC class.
- c** For IFCExportType, specify the desired IFC type.
- d** Click Apply.

17 Repeat Step 16 for each of the remaining types in this family.

18 When you have defined values for all family types, click OK.

19 Save changes to the family.

20 If you want to load the updated family into a project, open the project. Then return to the Family Editor, and click Create tab ► Family Editor panel ► Load into Project.

Check parameter values in a project (optional)

You can verify the IFC export parameter values assigned to an element in a project.

21 In the project, select an element that belongs to a family to which you added the shared parameters IFCExportAs and IFCExportType.

22 Click Modify <Element> tab ► Element panel ► Element Properties drop-down ► Type Properties.

23 Under Type Parameters, scroll down to the IFC Parameters group.

The IFCExportAs and IFCExportType parameters display the values that you specified for the family type. When you export the project to IFC, elements in this family will be mapped to the specified IFC class and type.

IFC-Specific Files

Revit Architecture makes available the following IFC-specific files:

- IFC Metric Template.rte. This file allows you to create new projects that are already set to the IFC standard.
- IFC Parameter Upgrade.rvt. This file enables you to upgrade an existing project to contain IFC parameters by reading the instructions contained in the IFC Parameter Upgrade.rvt file.
- IFC Shared Parameters.txt. This file contains the shared IFC parameters if you want to manually update an existing project to contain all or some of these parameters.

NOTE It is recommended to use the IFC Parameter Upgrade.rvt file instead, for performance reasons.

To access the IFC-specific files

- 1** In a web browser, go to <http://revit.autodesk.com/library/html/index.html>.
- 2** Click Revit Instruction and Help Samples.
- 3** Click IFC.

The web page displays a list of the available IFC files.


- 4 To download the IFC files, click Download Directory. On the File Download dialog, click Save, and navigate to the target folder.
- 5 In Windows Explorer, navigate to the target folder, and double-click IFC.exe to extract the downloaded files.

The downloaded files include parameter upgrade instructions.

Exporting Your Design to gbXML

After you have placed room components in all the areas in a plan, you can export your design as a gbXML file and use a third-party load analysis software application to perform a load analysis.


NOTE The gbXML file contains all of the heating and cooling information for a project according to the gbXML file structure which is based on a gbXML schema. The gbXML schema was created to help building designers get information about the energy consumption characteristics of their building projects. Refer to [Appendix A - gbXML Schema Support](#) on page 1555 for more information about gbXML elements and attributes that are supported by Revit Architecture. You can also visit <http://www.gbxml.org> for more information about the gbXML schema.

- 1 Click  ► Export ► gbXML.
If asked to turn on the Areas and Volumes setting, click Yes.
Revit Architecture opens the Export gbXML dialog.

Examine the volume in the analytical model

- 2 In the Export gbXML dialog, click the Details tab.
- 3 In the right pane, expand the Building Model, levels and rooms.

TIP You can right-click a level to expand all or select all rooms on the level.

- 4 If warnings display for the building, a level, or a room, select the item, and click  (Show Related Warnings) to learn the cause. Then cancel the Export gbXML dialog and correct the problem in the building model. Review and correct warnings until all of the warnings have been resolved throughout the model.
- 5 In the preview of the Export gbXML dialog, zoom in, pan and spin the analytical model to examine the volume for the rooms in the building.

An effective energy analysis can only be performed if the entire volume of the building model is included in exported data. Color should completely fill the volume for all of the rooms in the model. If you detect rooms without fill, you should cancel the Export gbXML dialog, and resolve the unshaded areas. When areas are too small to place a room, merge the volume for cavities, shafts, and chases with a tangent room.

NOTE Sliver spaces display (as shaded) in the analytical model. Sliver spaces do not display in plan or section views.


- 6 On the Details tab, specify energy data as needed.
See [Specifying Energy Analysis \(gbXML\) Settings](#) on page 447 for parameter definitions.

Examine analytical surfaces

- 7 In the preview of the Export gbXML dialog, on the Details tab, click Analytical Surfaces, and expand the levels and rooms in the building model.
The hierarchy expands to display Roofs, Interior and Exterior Walls, Floors and Slabs, Windows, Doors and Openings. These can be further expanded to display the individual surfaces and

openings for a room. See [Surface Element](#) on page 1561 for information about surface and opening names.

TIP You can right-click a level to expand all or select all spaces in the zone.

- 8 In one of the rooms, select a surface type (for example, Interior Walls), and click  (Isolate). You can also select individual surfaces from within the surface type folder for a room.
- 9 Zoom in, pan, and spin the analytical model as needed to examine all surfaces in the model, checking to be sure that each surface is correctly identified.
For example, interior walls should only display for walls that are actually interior. A wall is considered to be interior if rooms are placed on both sides of the wall or if its Function type property is specified as Interior or Core/Shaft. If you detect surfaces that are incorrectly identified, you must cancel the gbXML Export dialog, and fix the problem in the building model.
- 10 If you are satisfied with the integrity of the analytical model, click Export.
- 11 In the Export gbXML dialog, navigate to a folder where you want to save the gbXML file.
- 12 Enter a name for the gbXML file, and click Save.

Specifying the Building Type and Postal Code for a Project

You can specify the building type and postal code for projects that export to gbXML. When importing gbXML files, several analysis software packages use this information to add default design values for energy use and costs, thermal loads, and construction.

NOTE In the United States, a postal code is called a zip code.

To specify the building type and postal code

- 1 Click Manage tab ► Project Settings panel ► Project Information.
- 2 In the Instance Properties dialog, for Energy Data, click Edit.
- 3 In the Type Properties dialog, select the building type, and enter the postal code.
- 4 Click OK.

Exporting to 3ds Max

When you have completed the initial design, layout, and modeling of a project in Revit Architecture, you can use Autodesk® 3ds Max® or Autodesk® 3ds Max® Design to produce high-end renderings and add final details.

- **3ds Max** is a professional 3D animation package that provides additional animation, modeling, and workflow functionality for the most complex problems in design visualization and visual effects.
- **3ds Max Design** is a 3D design visualization solution for architects, engineers, designers, and visualization specialists. It is designed for interoperability with FBX® files from Revit Architecture, preserving model geometry, lights, materials, camera settings, and other metadata from a Revit project. With Revit Architecture and 3ds Max Design working together, designers can extend the building information modeling process to include design visualization.

NOTE For simplicity, the following topics refer to 3ds Max, but this information also applies to 3ds Max Design.

You can export a 3D view from a Revit project to an FBX file, and import the file into 3ds Max. In 3ds Max, you can then create sophisticated renderings of the design to share with clients. The FBX file format passes

rendering information to 3ds Max, including lights, render appearances, sky settings, and material assignments for the 3D view. By preserving this information during the export process, Revit Architecture maintains a high degree of fidelity and reduces the amount of work required in 3ds Max.

Before Exporting a 3D View to 3ds Max

Revit Architecture is designed to provide a high degree of interoperability with 3ds Max. However, you can take steps to further improve performance and ensure satisfactory results. Before exporting a 3D view from a Revit project for import to 3ds Max, use the following strategies.

TIP To export a 2D view, first create a 3D view that is oriented to a 2D view (such as a section view or elevation view). In a 3D view, right-click the ViewCube and click Orient to View ► <view type> ► <view name>. For details, see [Specifying Camera Position in a 3D View](#) on page 161.

Complete the Design Work in Revit Architecture

To ensure that Revit Architecture remains the single repository of data for the project, make all changes to the building model in the Revit project. Do not make changes to the building model in 3ds Max.

If you update the project in Revit Architecture, export the 3D view to an FBX file. Then import it into 3ds Max, and regenerate the rendered image.

Limit Model Geometry

To limit the model geometry that is exported to 3ds Max, consider doing any or all of the following in the 3D view that you plan to export from Revit Architecture:

- Hide elements that are not required in the view.
- Use a section box.
- Set the detail level.

For more information about these strategies, see [Limiting Model Geometry Before Exporting](#) on page 1342.

Prepare the 3D View for Rendering

Before exporting a 3D view to FBX, apply materials to model elements, and specify the desired render appearances. See [Materials](#) on page 468.

Also, check the placement of lights in the view, and dim or turn lights on or off to achieve the desired result. See [Using Lighting Fixtures in a Building Model](#) on page 1190 and [Turning Lights On and Off](#) on page 1202.

In addition, follow best practices for rendering to optimize the results. See [Rendering Best Practices](#) on page 1233. Before exporting to FBX to render in 3ds Max, you may want to generate an initial rendering using the native Revit rendering engine. By rendering in Revit Architecture first, you can check lighting and material render appearances, and refine them as needed before exporting. See [Rendering an Image](#) on page 1220.

Read 3ds Max Documentation


Read the 3ds Max FBX Plug-In Help for information about importing Revit projects. That documentation includes suggested settings for importing Revit projects and other tips. By reading this information before

exporting a Revit project, you may be able to take advantage of 3ds Max functions that will streamline the process and help you achieve the desired results faster and with less effort.

Exporting to FBX

1 In Revit Architecture, open a 3D view, and prepare it for export.

See [Before Exporting a 3D View to 3ds Max](#) on page 1374.

2 Click  ► Export ► FBX.

TIP If FBX displays as gray, open a 3D view of the project. Then try again.

3 On the Export 3ds Max (FBX) dialog, for Save in, navigate to the target folder for the exported file.

4 For Naming, do one of the following:

- To specify a file name manually, select Manual (Specify file name). For File name/prefix, specify the name of the output file.
- To use an automatically generated file name, select Automatic – Long (Specify prefix), or Automatic – Short. See [File Names for Exported Files](#) on page 1353.

5 Click Save.

Revit Architecture generates the FBX file and places it in the target location.

You can now import the FBX file into 3ds Max, using the 3ds Max FBX plug-in. For more information, refer to the 3ds Max Plug-in documentation.

3ds Max provides additional control over materials, beyond the capabilities of Revit Architecture. To activate the Revit material assignments and lights in 3ds Max, specify mental ray® as the rendering engine. This is the default render setting for 3ds Max Design. For more information, refer to the 3ds Max documentation.

Troubleshooting Exports to 3ds Max

When you export a 3D view from Revit Architecture and import it to 3ds Max, you may encounter the following issues.

Slow performance when exporting from Revit Architecture and importing to 3ds Max

Performance may be slow for large projects that contain lots of objects and their data. To improve performance, limit the model geometry being exported. In Revit Architecture you can use a section box, hide categories of model elements that you do not need for the scene, and set the detail level as appropriate. See [Limiting Model Geometry Before Exporting](#) on page 1342 and [Rendering Best Practices](#) on page 1233.

Multiple cameras not exported to 3ds Max

Revit Architecture exports to FBX only one camera, which corresponds to the active 3D view. As a result, only the current Revit 3D view or camera will be imported into 3ds Max as a 3D camera view.

Incorrect camera angle in 3ds Max

Symptom: When you export a Revit 3D view to FBX and import it into 3ds Max, the camera angle may not reflect the angle of the Revit view.

Issue: 3ds Max does not support the cropping region and optical center of Revit cameras. However, the field of view (FOV) or perspective of the Revit cameras will be correct in 3ds Max. If you modify the Revit camera

by resizing or offsetting the cropping region of the 3D view in Revit Architecture, 3ds Max does not translate the change precisely.

Solution: In 3ds Max, adjust the camera angle as needed to achieve the desired result.

Exporting Building Sites

Architects can design buildings in Revit Architecture, then export the relevant building content as a 3D model to civil engineering applications that accept Autodesk Exchange (ADSK) files, such as AutoCAD® Civil 3D®.

To export a 3D building site to an ADSK file

1 Prepare the building site for export.

- Create a 3D view and reduce the complexity of the model in this view so that only the relevant elements are visible. See [Preparing the Building Site for Export](#) on page 1376.
- Create one or more area plans, and optionally, property lines for the building site. One of the area plans must be designated as the gross building plan that is exported as the building footprint. See [Creating Gross Building Areas and Property Lines](#) on page 1378.
- Create relevant site utilities with host connectors that are functional in the civil engineering application.

NOTE Only those site utilities with connectors that have the Utility parameter selected are exported.

See [Creating Site Utilities for Export](#) on page 1378.

2 Click  ➤ Export ➤ Building Site.

To export a building site, you must specify a gross building area. If you did not create a gross building area previously, you are given the option of creating one now.

3 Review the export settings in the Building Site Export Settings dialog. See [Export Settings for a Building Site](#) on page 1378.

4 Click Export to save the building site as an ADSK file.

In the Export Building Site dialog, verify that View Export Report in Default Browser is selected. This option lets you view the export report in your default Web browser.

5 Review the Export Building Site report. See [Reviewing the Export Report and Delivering the Results](#) on page 1381.

6 Deliver the ADSK file to the civil engineer.

Preparing the Building Site for Export

To prepare the building site for optimum performance and to ensure satisfactory results when [exporting it as an ADSK file](#) on page 1376, do the following:

- Reduce the number of elements displayed in the 3D view you intend to export. See [Simplifying the Model](#) on page 1377.
- Create site utilities. See [Creating Site Utilities for Export](#) on page 1378.
- Create at least one gross building area and (optionally) property lines. See [Creating Gross Building Areas and Property Lines](#) on page 1378.

Simplifying the Model

To create an efficient [ADSK file](#) on page 1376 for opening in a civil engineering application, such as Civil 3D, export only the relevant parts of the model (such as exterior walls and doors) and hide the rest. Do this by applying the Export to Civil Engineering view template to the 3D view, as follows:

- 1 Set the Function parameter to Interior for non-essential walls, doors, stairs, floor, ramps, and curtain walls.

NOTE The Function parameter must be set to interior for the Export to Civil Engineering view template to work correctly.

- 2 In the 3D view, click View tab ► Graphics panel ► View Templates drop-down ► Apply new template to current view.
- 3 In the Apply View Template dialog, select Export to Civil Engineering from the Names list.

NOTE If Export to Civil Engineering is not in the list, you need to update your project to the new template by transferring project standards. See [Transferring Project Standards](#) on page 446.

- 4 In the Apply View Template dialog, apply addition visibility and graphic overrides by clicking Edit under View Properties. See [Creating a View Template](#) on page 507.
- 5 Click OK.

The categories listed below are visible when the Export to Civil 3D view template is applied to the 3D model. All other categories are not visible, including categories from other disciplines.

- Areas
- Columns
- Curtain systems
- Doors
- Floors
- Generic models
- Mass
- Parking
- Plantings
- Ramps
- Roads
- Roofs
- Site
- Stairs
- Structural columns
- Structural foundations
- Structural framing
- Walls

Creating Gross Building Areas and Property Lines

To [export a building site to an ADSK file](#) on page 1376, at least one area plan must be designated as the gross building area. You can create the gross building area before starting the export process, or you can let Revit Architecture guide you through the process of creating one when exporting. The gross building area should be at ground level, because it becomes the building footprint when exported. You can have more than one area plan in the 3D view, but only one can be designated as the gross building area. See [Creating an Area Plan](#) on page 1010.

Optionally, you can sketch, or specify using survey data, one or more property lines for the building site. Only one property line is exported with the site. See [Sketching Property Lines](#) on page 962 and [Creating Property Lines with Survey Data](#) on page 963.

Creating Site Utilities for Export

You can place site utilities of interest to civil engineers on the [building site to be exported](#) on page 1376. Examples of site utilities include gas, water, telephone, cable, and steam connections.

The site utilities are loadable families that have connectors or have the capability of hosting connectors. These connectors become functional when linked in the civil engineering application. For a connector to be exported, the Utility parameter must be selected in its instance properties. See [Connectors](#) on page 435 for more information about the types of connectors that are available.

You can load a site utility family into your project or open one in the Family Editor to add or remove connectors or make other modifications. You can also create your own site utility with connectors by using the Site.rtf template in the ImperialMetric Template folder.

To place a site utility component

- 1 Load the site utility into the project. See [Loading Families](#) on page 427.
- 2 Click Home tab ► Build panel ► Component drop-down ► Place a Component.
- 3 Click to place the component in the drawing area.

To modify a site utility in the Family Editor

- 1 Open the site utility family in the Family Editor like any other family. See [Opening the Family Editor](#) on page 417.
- 2 Modify the site utility family like any other family. See [Modifying a Family Type](#) on page 420.

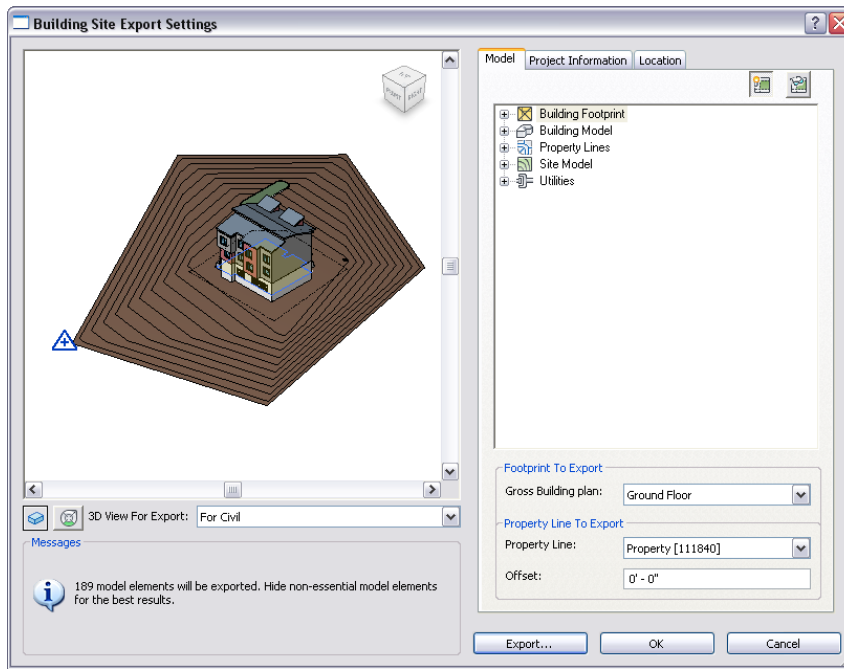
To create a utility connection

- 1 In the Family Editor, select the connector.
- 2 Click Modify Connector Element tab ► Element Properties drop-down ► Instance Properties.
- 3 In the Instance Properties dialog, under Identity Data, select Utility.
- 4 Enter a description for the connector, if desired. This description is exported to the civil engineering application as the name of the connector.

To create a site utility that hosts connectors, see [Creating Loadable Families](#) on page 430.




Export Settings for a Building Site

Before [exporting the building site](#) on page 1376, review the settings in the Building Site Export Settings dialog.



Use the left pane to preview the 3D model that will be exported. Revit Architecture exports everything you see in the preview pane to the ADSK file.

Under Messages, the number of model elements to export is displayed. If the number of model elements is large, try simplifying the view again before exporting it. See [Simplifying the Model](#) on page 1377.

Use  (Model Graphics Style),  (SteeringWheels), and  (ViewCube) to view and navigate the building site in the preview pane. See [Specifying a Model Graphics Style](#) on page 251 and [SteeringWheels](#) on page 225. For 3D View for Export, select a 3D view to be exported to the ADSK file.



The first time you open the Building Site Export Settings dialog, the active 3D view displays in the preview pane, by default. If the active view is not a 3D view, the first 3D view in the 3D View for Export list displays. Clicking Export or OK saves the dialog settings, so the next time you open the dialog, the settings will be the same.

The right pane has the following tabs for reviewing the model elements in the preview panel.

- **Model.** Displays the elements to be exported to the ADSK file. See [Reviewing the Model Elements of a Building Site](#) on page 1380.
- **Project Information.** Displays information for the project. See [Reviewing Project Information for the Building Site](#) on page 1380.
- **Location.** Displays the survey point in shared coordinates. See [Reviewing Location Settings for the Building Site](#) on page 1381.

When you are satisfied with the settings, click Export to export the building site to an ADSK file.


Reviewing the Model Elements of a Building Site

On the Model tab of the [Building Site Export dialog](#) on page 1376, review the elements to be exported by expanding the nodes in the tree structure. Use  (Highlight) and  (Isolate) to highlight or isolate a category of elements or a specific instance of an element in the preview pane.

- **Building footprint.** Displays the gross building plan to be exported. If there is more than one area plan, the plan for the lowest level is used, by default.
To change the area plan to be exported, under Footprint to Export, select the desired area plan from the Gross Building Plan list.
- **Building Model.** Displays count and instance information for doors, windows, and roofs. All other categories and their instances are grouped under Others.
To reduce the number of instances, reduce the number of elements in the model. See [Simplifying the Model](#) on page 1377.
- **Property Lines.** Indicates whether the site has a property line and if there is an offset. The element ID of the property line to be exported is displayed if applicable.
To change the property line to be exported, select a different one in the list under Property Line to Export. The offset specifies how far the property line is above or below the level on which the property line is drawn. To change the offset to be exported, enter a new value for Offset under Property Line to Export. See [Sketching Property Lines](#) on page 962 and [Creating Property Lines with Survey Data](#) on page 963.
- **Site Model.** Displays the number of elements that comprise the building site from categories, such as site, roads, pads, parking, and topography, as well as ramps, stairs, and floors that have the Function parameter set to Exterior.
- **Utilities.** Displays the utilities with connectors that have Utility parameters set for exporting. The Utility parameter for the connector is found in the Instance Properties dialog under Identity Data.

Reviewing Project Information for the Building Site

On the Project tab of the [Building Site Export dialog](#) on page 1376, review the project information to be exported. Changing existing project information here (such as project name, project address, and building type), changes the information for the entire project. Also, you can change this project information by clicking Manage tab ► Project Settings panel ► Project Information. See [Specifying Project Information](#) on page 447.

To change any of the following values, which are calculated by Revit Architecture, click  to unlock the field, and then enter the new value. Click the lock again to return to the calculated value.

- **Area per person.** This value is based on the building type specified in Project Information for the project.
- **Total gross building area.** The sum of all existing gross building areas in the project.
- **Total occupancy.** Total Occupancy = Total Gross Building Area/Area per person.

Reviewing Location Settings for the Building Site

Revit Architecture exports the building geometry relative to the shared coordinate system of the civil engineering application. On the Location tab of the [Building Site Export dialog](#) on page 1376, review the following building site coordinates to be exported.

- **Current Location.** Displays the name of the building site to be exported, if there is more than one building location on the site. To change the location of the building site that is exported:
 - 1 Click Manage Locations.
 - 2 Select the desired location from the list.
 - 3 Click Make Current.
 - 4 Click OK.See [Defining Named Locations](#) on page 1296 for more information about managed locations.
- **Survey Point.** Displays the survey point coordinates to be exported and indicates whether the survey point is clipped. These coordinates should be the coordinates that you received from the civil engineer. They correctly orient the building geometry in the coordinate system of the civil engineering application. To change the survey point coordinates, enter the values in the appropriate fields. Alternatively, drag the unclipped survey point in the project drawing and use the Specify Coordinates at a Point tool. See [Relocating and Mirroring a Project](#) on page 1300 and [Project Base Points and Survey Points](#) on page 1302.

NOTE If the survey point is clipped or pinned, you cannot change the survey point coordinates on the Location tab. See [Project Base Points and Survey Points](#) on page 1302.

- **Angle from Project North to True North.** Displays the angle between Project North and True North. Changing the angle rotates the shared coordinate system around the survey point. See [Rotating a View to True North](#) on page 449.

Reviewing the Export Report and Delivering the Results

After [exporting a building site](#) on page 1376, review the results of the Export Building Site report in your Web browser. The report lists the contents of the ADSK file. Verify that the model elements were exported as you expected.

NOTE The export report does not automatically display if you did not select View Export Report in Default Browser when saving the ADSK file.

Be sure to allow blocked content in Internet Explorer, so you can expand the elements and view their properties.

Deliver the ADSK file to the civil engineer. Double-clicking the ADSK file displays the Export Building Site report. The civil engineer can use the report to verify that the model elements opened correctly in the civil engineering application.

Publish

You publish projects to Buzzsaw (using DWG or DWF files) and families to Autodesk® Seek.

Publishing to Autodesk® Seek

From Revit Architecture, you can publish families, products, or design information directly to the [Autodesk Seek](#) on page 108 website. The published item can be shared with others who are searching for manufacturer-specific or generic building products online. This process is known as Sharing with Autodesk Seek.

NOTE Autodesk Seek is currently available only in the English edition of the software.

Publishing for Manufacturers

If you are a manufacturer who wants to share content on [Autodesk Seek](#) on page 108, see the Manufacturer Home <http://seek.autodesk.com/manufacturer.htm> to learn how best to create and share your product content with the online design community.

NOTE Autodesk Seek is currently available only in the English edition of the software.

Preparing Content for Sharing

Before sharing content with [Autodesk Seek](#) on page 108, you need to decide:

- Whether to assign an OmniClass code to the family.
- Whether the family requires associated files to be included for proper display and functioning.

NOTE Autodesk Seek is currently available only in the English edition of the software.

Assigning OmniClass codes

OmniClass is a new classification system for the construction industry. The [Autodesk Seek](#) on page 108 website uses codes from OmniClass Table 23 to filter and identify shared content. A code consists of an OmniClass number and title.

If an OmniClass code is not already assigned to a family, you are prompted to assign one during the sharing process. However, you can continue to share with Autodesk Seek without defining one. All Revit families have parameters for assigning an OmniClass code, except for the System and Annotation families.

You can access the OmniClass Number and OmniClass Title parameters in the Family Category and Parameters dialog under Family Parameters. See [Family Category and Parameters](#) on page 433.

Determining how to share the family

If the family you are sharing to [Autodesk Seek](#) on page 108 works correctly and has been tested, no additional setup is required. However, if the family was saved to a different location for sharing, you must ensure that Revit Architecture can find any associated files needed for the proper display and functioning of the family.


Revit Architecture uses the default installation paths on Windows XP and Windows Vista® to look for content as shown in the following table. Because these paths can be changed during installation, your paths might be different.

File Type	Location
Type catalogs (TXT) that manage parameters for families with many type variations	Same folder as the RFA file

File Type	Location
NOTE The type catalog must have exactly the same name as its family RFA file. The names are case-sensitive.	
Lookup tables (CSV) that Revit MEP components use to define instance parameters	<ul style="list-style-type: none"> ■ Windows XP: <i>C:\Documents and Settings\All Users\Application Data\Autodesk\<Revit MEP release name>\LookupTables</i> ■ Windows Vista: <i>C:\Program-Data\Autodesk\<Revit MEP release name>\LookupTables</i>
Image Files (BMP, JPG, JPEG, or PNG) that create a custom color, design, texture, or bump map for a render appearance	<p>Folders in the Revit Render Appearance Library installed by default at:</p> <ul style="list-style-type: none"> ■ Windows XP: <i>C:\Program Files\Autodesk <Revit release name>\Data\Rendering\assetlibrary_base.fbm</i> ■ Windows Vista: <i>C:\Program Files\Autodesk <Revit release name>\Data\Rendering\assetlibrary_base.fbm</i>
Photometric data files (IES) for use with lighting families	<ul style="list-style-type: none"> ■ Windows XP: <i>C:\Documents and Settings\All Users\Application Data\Autodesk\<Revit release name>\IES</i> ■ Windows Vista: <i>C:\Program-Data\Autodesk\<Revit release name>\IES</i>

Sharing with Autodesk Seek

NOTE [Autodesk Seek](#) on page 108 is currently available only in the English edition of the software.

- 1 In the Family Editor, click  ► Publish ► Share with Autodesk Seek.
 - 2 In the Share family with Autodesk Seek dialog, specify whether to share the current family or browse for one, and click OK.
- BEST PRACTICE** Use the 3D view of the family. There should not be any dimensions, reference planes, or lines visible in the preview.
- 3 In the Set OmniClass Code dialog, specify whether to apply an OmniClass code to your family or continue with publishing.
- If you select Apply an OmniClass code, the OmniClass Table 23 Product Classification dialog displays, from which you assign a code that is appropriate for your content. Select a code, click OK, and click Save to save the OmniClass code to your family.

Revit Architecture displays a progress bar showing that it is packaging and then uploading the family.



- 4 After the Seek Upload Successful dialog displays, click Show details to view the list of contents published to the Autodesk Seek site.
- 5 Click Close to dismiss the dialog and open the Autodesk Seek website in your default Web browser.
- 6 Follow the prompts on the web page to complete the Share with Autodesk Seek process.

Publishing to Buzzsaw

Autodesk® Buzzsaw® is an online collaboration service that allows you to store, manage, and share project documents from any Internet connection, thus enhancing team productivity and reducing costs. You can use the Publish to Buzzsaw tools to export sheets and views to a DWG or DWF file, and then upload these to a Buzzsaw project site in one step. For information about DWG files, see [Exporting to CAD Formats](#) on page 1341. For information about DWF files, see [Exporting to Design Web Format](#) on page 1355.

To be able to publish to Buzzsaw, the projects and folders to which you want to publish files must already exist. In addition, you must have Buzzsaw Administrator permission or Edit permission to add files to a folder. Consult your Buzzsaw administrator for details.

Publish DWG to Buzzsaw


- 1 Click  ► Publish ► DWG to Buzzsaw.
- 2 In the Publish to Buzzsaw (DWG) dialog, under Buzzsaw Sites, select the site to which you want to publish project files.
If you need to add a new Buzzsaw location, click Add. For instructions, see [Adding a New Buzzsaw Location](#) on page 1385.
- 3 Enter a name, or accept the default name, for the exported file.
- 4 Select an AutoCAD version of the published DWG file from the Files of type list.
- 5 Select Automatic - Long (Specify prefix) or Automatic - Short from the Naming list to define the automatically generated file name. See [File Names for Exported Files](#) on page 1353.
- 6 Optionally, to prohibit Revit Architecture from creating external references, select Xref views on sheets. Any Revit or DWG links in the project are published to a single file rather than several files that reference each other.
- 7 Determine which views and sheets are to be published in the DWG file.
If you are publishing a single view, select Current View from the Range drop-down.
If you are publishing multiple views and sheets, do the following:
 - a For Range, select Selected Views/Sheets.
 - b Click  (Browse).
 - c In the View/Sheet Set dialog, select the views and sheets to publish. See [Selecting Views to Print](#) on page 1084.
- 8 To specify publishing options, click the Options. The following options are available.
 - [Layers and Properties](#) on page 1349
 - [Linetype Scaling](#) on page 1350

- [Coordinate System Basis](#) on page 1351
- [One DWG Unit Is](#) on page 1352
- [Solids \(3D Views Only\)](#) on page 1352
- [Export Rooms and Areas as Polylines](#) on page 1353

9 Click Publish.

Revit Architecture generates a DWG file and posts it on the specified Buzzsaw site.

Publish DWF to Buzzsaw

- 1 Click  ➤ Publish ➤ DWF to Buzzsaw
- 2 Determine which views and sheets are to be published in the DWF file.
If you are publishing a single view, select Current View/Sheet Only from the Export list on the View/Sheet Set tab of the dialog.
If you are publishing multiple views and sheets, do the following:
 - a Select In session view/sheet set from the Export list on the View/Sheet Set tab of the dialog.
 - b In the View/Sheet Set dialog, select the views and sheets to publish. See [Creating View and Sheet Sets](#) on page 1346 and [Selecting Views to Print](#) on page 1084.
- 3 To specify publishing options, click the DWF Properties tab of the DWF Publish Settings dialog. See [Exporting to DWF Options](#) on page 1358.
- 4 To edit or add project-related metadata, click the Project Information tab of the DWF Publish Settings dialog. If this information is changed, the data is saved to the published DWF files and the project. See [Specifying Project Information](#) on page 447.
- 5 Click Publish.

TIP To save the current publish settings and close the dialog without publishing, click OK.


- 6 In the Publish DWF to Buzzsaw dialog, under Buzzsaw Sites, select the site to which you want to publish project files.
If you need to add a new Buzzsaw location, click Add. For instructions, see [Adding a New Buzzsaw Location](#) on page 1385.
- 7 For Files of type, select DWF or DWFx.
- 8 For Naming, select Automatic - Long (Specify prefix) or Automatic - Short. See [File Names for Exported Files](#) on page 1353.
- 9 Click Publish.

Revit Architecture generates a DWF file and posts it on the specified Buzzsaw site.

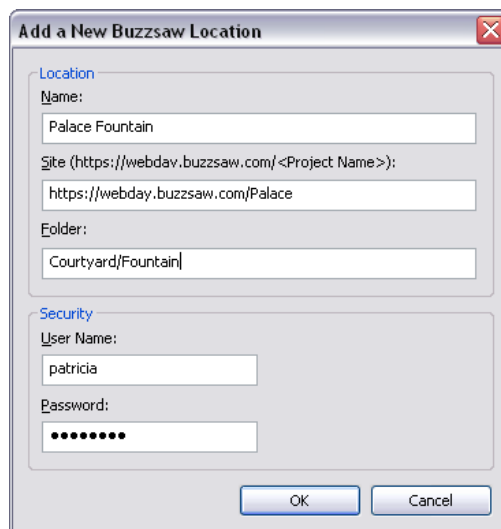
Adding a New Buzzsaw Location

When [publishing project files to Buzzsaw](#), you can add a Buzzsaw location. This process defines the location to Revit Architecture and provides access to the site for uploading the project files. However, the location that you specify (including the Buzzsaw site, project, and folders) must exist before you add it to Revit Architecture. Consult your Buzzsaw administrator for details.

To add a new Buzzsaw location

- 1 Click  ➤ Publish ➤ DWG to Buzzsaw or DWF to Buzzsaw.
- 2 If you selected DWF to Buzzsaw, click Publish in the dialog.
- 3 In the Publish DWG/DWF to Buzzsaw dialog, click Add.
- 4 In the Add a New Buzzsaw Location dialog, for Name, enter a descriptive name for this Buzzsaw location.
- 5 For Site, enter the Buzzsaw site URL for the project.
The Buzzsaw site URL is `https://webdav.buzzsaw.com/<site_name>`, where `<site_name>` is the name of your project site. For example, if the project site is named Palace, enter the following:
`https://webdav.buzzsaw.com/Palace`

- 6 For Folder, specify the folder to which you want to upload Revit project files.
A Buzzsaw project can contain a hierarchy of project folders (which contain administrative information only) and standard folders (which contain data). If the target folder is a subfolder, specify the path from the project site. For example, if you want to upload project files to the Fountain subfolder in the Courtyard project folder of the Palace project site, enter the following:
Courtyard/Fountain



The dialog box is titled "Add a New Buzzsaw Location" and has a close button (X) in the top right corner. It is divided into two sections: "Location" and "Security".

Location Section:

- Name:** A text box containing "Palace Fountain".
- Site (https://webdav.buzzsaw.com/<Project Name>):** A text box containing "https://webdav.buzzsaw.com/Palace".
- Folder:** A text box containing "Courtyard/Fountain".

Security Section:

- User Name:** A text box containing "patricia".
- Password:** A text box with masked characters (dots).

At the bottom of the dialog are "OK" and "Cancel" buttons.

- 7 Under Security, specify the user name and password to use to log into the Buzzsaw project site.
- 8 Click OK.

The new Buzzsaw location is included in the list of Buzzsaw sites on the Publish dialog.

Import/Link

The Import and Link tools allows you to import or link to various file formats.

Different file formats may be imported with different qualities of geometry. For information about variations in imported geometry, see [Suitability of Imported Geometry](#) on page 1387.

When you import files, you may need to zoom in the drawing area to see the imported data. See [Zooming Project Views](#) on page 243.

For information about linking Revit models, see [Working with Linked Models](#) on page 1277.

Suitability of Imported Geometry

When you import a file into Revit Architecture, the format of the imported file may support varying qualities of geometry. These variations are caused by the file type, the export settings, and the import settings.

Some tools and capabilities in Revit Architecture require specific types of geometry. For example:

- The Join Geometry tool requires volumetric geometry.
- Rendering an image requires that faces are associated with material properties.
- The Roof by Face tool requires geometry with suitably sized faces for flat roof panels or a NURB representation of a complex, shaped roof panel.
- Masses require volumetric geometry to calculate volume, surface area, and floor area faces. See [Considerations for Imported Geometry in Mass or Generic Model Families](#) on page 626 and [Importing Massing Studies from Other Applications](#) on page 626.

You can import many different types of file formats into Revit Architecture. When you export a file from the originating application for use with Revit Architecture, you can set a variety of export options. With these many variations of file formats and export options, it is important to ensure that the exported file provides the geometric data needed for the Revit capability that you plan to use. To optimize results with various file formats, consult the documentation provided with the exporting applications.

Importing or Linking CAD Formats

Open a Revit project, and click Insert tab ► Link panel ► Link CAD, or Insert tab ► Import panel ► Import CAD to import or link vector data from other CAD programs such as AutoCAD (DWG and DXF), MicroStation® (DGN), SketchUp (SKP and DWG), and ACIS (SAT). Revit Architecture supports importing most DGN surfaces and solids with the exceptions of cones, B-Spline surfaces, and SmartSolids.

In addition to using the Import CAD and Link CAD tools, you can import CAD files using drag-and-drop from Windows® Explorer onto a model, drafting, or sheet view of Revit Architecture. See [Importing CAD Files Using i-drop](#) on page 1389.

You can mirror imported and linked CAD files. See [Mirroring Elements](#) on page 380.

NOTE Revit Architecture imports ACIS solids from SAT files. SAT file formats later than version 7.0 do not import into Revit Architecture. You should determine which version your solid modeling program is creating. Some solid modeling products (such as form-Z®) create SAT file formats later than version 7.0 by default.

Snapping to Imported Geometry

Suppose that you import an AutoCAD® drawing into Revit Architecture and then want to trace over walls in that drawing. As you place the cursor near the lines representing the walls, it can snap to the lines or the midpoint between the lines.

Proxy Graphics from AutoCAD Files

Revit Architecture supports reading in proxy graphics from AutoCAD files. Proxy graphics are AutoCAD's representations of AutoCAD Architecture objects. Unlike AutoCAD Architecture objects, proxy graphics have no intelligence.

Proxy graphics can exist for many types of data in AutoCAD, including Mechanical Desktop (MDT) parts and AutoCAD Runtime eXtension (ARX) objects. If you set the Proxygraphics command to 1 in AutoCAD, Revit Architecture can then import ARX objects and AutoCAD Architecture objects (such as walls and floors) in the DWG or DXF file.

Subdivision Surfaces and Solids Created in AutoCAD

Revit Architecture can import DWG files containing subdivision surfaces and solids created in AutoCAD. Some complex subdivision meshes may fail to convert to a traditional solid or surface altogether, or generate a problematic solid or surface. Other highly complex SubD meshes may not import completely or at all.

Implications of Importing vs. Linking for Xrefs

Suppose you use AutoCAD to generate a DWG file that contains external references (xrefs). When you import or link the DWG file, Revit Architecture displays the geometry from the nested xrefs. The decision to import or link a file to a Revit project affects what you can do with the xref information:

- If you **import** the file, you can explode the nested xrefs to Revit elements. However, if the xref file is updated after the import, Revit Architecture will not automatically reflect changes to the xref file.
- If you **link** the file, Revit Architecture automatically updates the geometry to reflect changes to the xref files. However, you cannot explode the nested xrefs to Revit elements.

For more information, see [Exploding Imported Geometry](#) on page 1404.

Importing or Linking CAD Files Using the Import CAD and Link CAD Tools

- 1 Click Insert tab ► Import panel ► Import CAD, or click Insert tab ► Link panel ► Link CAD.

If you link the file instead of importing it, see [Implications of Importing vs. Linking for Xrefs](#) on page 1388.

- 2 In the Import CAD Formats or Link CAD Formats dialog, navigate to the folder that contains the file to import or link.

TIP Make sure you import the geometric data needed for the Revit capability that you plan to use. For more information, see [Suitability of Imported Geometry](#) on page 1387.

- 3 Select the file.

- 4 Specify the import or link options. See [Import and Link Options for CAD Formats and Revit Models](#) on page 1392.

- 5 Click Open.

NOTE If you open a DGN file, the Select View dialog displays. Select a view to open. The view corresponds exactly to the MicroStation view and imports into Revit Architecture exactly as it appeared in MicroStation.

- 6 If you chose to manually place the imported data, it displays in the drawing area and moves with the cursor. Click to place the imported data.

You may need to zoom in to see the imported data. See [Zooming Project Views](#) on page 243.

Related topics

- [Importing or Linking CAD Formats](#) on page 1387
- [Moving a View-Specific Import to the Foreground or Background](#) on page 1395

Importing CAD Files Using i-drop

Revit Architecture supports the Autodesk i-drop® drag-and-drop feature. When i-drop objects are pulled from an i-drop-enabled web page, Revit Architecture downloads the file and imports it as if it were pulled from a local file.

When you drag-and-drop a file, the file is imported with the default settings. If you want to use different settings (for example, Manual - Origin rather than Auto - Center to Center), import the file using the Import CAD tool. (See [Importing or Linking CAD Files Using the Import CAD and Link CAD Tools](#) on page 1388.)

TIP Make sure you import the geometric data needed for the Revit capability that you plan to use. For more information, see [Suitability of Imported Geometry](#) on page 1387.

To import CAD files using i-drop

- 1 From an i-drop-enabled web page, click the thumbnail image of the object.
- 2 Drag the file from the web page into Revit Architecture.
- 3 Release the object directly into the active view.

Importing Files from SketchUp

Google™ SketchUp® is a general purpose modeling and visualization tool. Revit Architecture uses building information modeling (BIM), in which building elements understand their relationship to each other. When working on a design project, you can use both products to leverage the unique strengths of each. For example:

- If you want to model an initial design pass or quickly model a single element, start with SketchUp. Later, use Revit Architecture to refine the design.
- If you want to design entire building masses and then associate real building elements to them, use SketchUp for the design phase. Later use Revit Architecture for the detailed planning phase.

To use a SketchUp design in Revit Architecture, import a SKP file from SketchUp directly into Revit Architecture. As an alternative, you can use SketchUp to export a DWG file, and then import that DWG file into Revit Architecture.

To incorporate a SketchUp design into a Revit project, use the following general process:

- 1 Use Revit Architecture to create a family outside the project or an in-place family within the project.
- 2 Import the SketchUp file into the family.
- 3 If you created the family outside the project, load the family into the project.

NOTE Revit Architecture does not support linking of SketchUp files. As a result, if you import a SketchUp file into a Revit project and later make changes to the SketchUp file, you cannot easily update the Revit project to reflect the changes. Therefore, complete as much of the design in SketchUp as possible before importing it into Revit Architecture.

Related topic

- [Importing Massing Studies from Other Applications](#) on page 626

Importing SKP Files


Before importing a SKP file from SketchUp into Revit Architecture, do the following:

- Make sure you import the geometric data needed for the Revit capability that you plan to use. See [Suitability of Imported Geometry](#) on page 1387.
- Review [Limitations of SketchUp Data Imported to Revit Architecture](#).
- Review [Best Practices When Importing Masses](#) on page 627.

To import SketchUp files

- 1 Create an in-place family in a Revit project, or create a family in the Family Editor.
See [Revit Families](#) on page 415.
- 2 Click Insert tab ► Import panel ► Import CAD.
- 3 In the Import CAD Formats dialog, navigate to the folder that contains the SketchUp file.
- 4 For Files of Type, select the SKP file type
- 5 Select the file to import.
- 6 Specify the desired import settings.
The following settings are recommended:
 - Colors: Preserve
 - Import Units: Auto-Detect
 - Positioning: Auto - Origin to Origin
 - Place at: Level 1 or Ref. Level
 - Orient to View
- 7 Click Open.

You may need to do the following to see the SketchUp-based form:

- Switch to a 3D view.
- To improve visibility, on the View Control Bar, for Model Graphics Style, select  (Shading with Edges).
- Click Home tab ► Work Plane panel ► Set. In the Work Plane dialog, select a plane.
- Type ZF (Zoom to Fit) to adjust the drawing area to show the entire mass.
- If you are creating a mass family, click Massing & Site tab ► Conceptual Mass panel ► Show Mass.

Limitations of SketchUp Data Imported to Revit Architecture

Revit Architecture treats the data imported from SketchUp as a large block of geometry that resists being manipulated (in the ways that you can usually manipulate geometry that is native to Revit Architecture). However, you can change the layer settings from SketchUp. (For example, to assign colors or materials on a by-layer basis, click Manage tab ► Project Settings panel ► Settings drop-down ► Object Styles, and change settings on the Imported Objects tab.) When you import a SketchUp design into a Revit mass family and then load the mass family into a Revit project, you can convert mass faces (from the SketchUp design) into walls, floors, and roofs. (See [Importing Massing Studies from Other Applications](#) on page 626.)

When creating content in SketchUp for use in Revit Architecture, consider the following restrictions:

- **Exploding 3D data:** In Revit Architecture, you will not be able to explode 3D data. If you try this, 3D faces will disappear, and you will receive a warning message.
- **Parameters:** In Revit Architecture, you cannot add parameters to control geometric flexing. However, you can add some controls that manipulate imported data, such as the location of an imported element and its material assignments.
- **Visibility/graphics:** In Revit Architecture, you cannot manipulate the geometry or isolate parts of whole elements with visibility/graphics settings.
- **Two-sided surfaces:** If a material or color is assigned to only one side of a surface in SketchUp, Revit Architecture applies the material or color to both sides of the surface by default. If there is material on both sides of the surface, Revit Architecture applies the Face 1 material to both sides. If faces are flipped and painted differently in SketchUp, they may not display the correct material in Revit Architecture.
- **SketchUp properties:** The following SketchUp properties are currently not supported in Revit Architecture import: Texture Image Maps, Transparency, “Smooth” Curved Surfaces, Text and Dimensions, Raster Images, and saved “Pages”.
- **Cut planes:** Imports cannot be cut by a cut plane unless imported into a cuttable family category. See [Cuttable Families](#) on page 514.
- **SketchUp and massing:** Not all SketchUp imports are appropriate to massing. See [Suitability of Imported Geometry](#) on page 1387. Also see [Importing Massing Studies from Other Applications](#) on page 626.
- **Scaling:** Groups or components that have been scaled in their entirety with the SketchUp Scaling tool may be incorrectly scaled when imported to Revit Architecture. Exploded SketchUp models should import at the correct scale.

Importing ACIS Objects

Revit Architecture supports the import of ACIS objects contained in DWG, DXF, and SAT files. (ACIS objects describe solids or trimmed surfaces.) For example, you can create ACIS objects using the AutoCAD commands Draw Solids and Draw Region. You can also import SmartSolids™ from MicroStation® into Revit Architecture. To import ACIS objects, use the procedure [Importing or Linking CAD Files Using the Import CAD and Link CAD Tools](#) on page 1388.

Revit Architecture supports the following types of surfaces when importing ACIS objects:

- Plane
- Sphere
- Torus
- Cylinder
- Cone
- Elliptical cylinder
- Elliptical cone
- Extruded surface
- Revolved surface
- NURB surfaces

You can import NURB (non-uniform rational B-splines) surfaces on ACIS objects in DWG or SAT files into Revit mass or generic model families while you are creating the family. You can then use the Roof by Face and Curtain System by Face tools to create roofs and curtain systems on these imported surfaces. For more information, see [Creating Curtain Systems by Face](#) on page 619 and [Creating Roofs Using the Roof by Face Tool](#) on page 622.

To use ACIS imports for face-based host tools, import geometry into an in-place family of category Mass or Generic Model. Face-based tools work best on ACIS solids. For example, if you create walls by face on a cube, the walls join and miter correctly. If you create a curtain system by face on a solid, you can add corner mullions onto the joins between faces of the curtain system. For more information on face-based tools, see [Creating Building Elements from Mass Instances](#) on page 615.

TIP Make sure you import the geometric data needed for the Revit capability that you plan to use. For more information, see [Suitability of Imported Geometry](#) on page 1387.

Import and Link Options for CAD Formats and Revit Models

The following options apply to linked or imported CAD format files (on the Import CAD Formats and Link CAD Formats dialogs that display when you click Insert tab ► Import panel ► Import CAD, or Insert tab ► Link panel ► Link CAD). Positioning options also apply to linked Revit models (when you click Insert tab ► Link panel ► Link Revit).

Option	Definition
Current View Only	<p>Imports a CAD drawing into the active Revit view only. For example, you might want an AutoCAD object to appear only in a Revit floor plan view and not in a 3D view. If you set this option, any text in the imported file is visible and can be cropped by the crop region of the view. If you are using worksharing, the import will belong to a view workset.</p> <p>If the option is not selected, only lines and geometry are imported, and the import behaves like model geometry: it can be cropped by the crop region of the view. This option is not available in 3D views. If you are using worksharing, the import will belong to a model workset.</p> <p>NOTE If you are importing data from a CAD file for use in creating a toposurface, do not select this option.</p>
Colors	
Invert	Inverts the colors of all line and text objects from the imported file to Revit-specific colors. Dark colors become lighter, and light colors become darker. This can improve readability when the file is in Revit Architecture. This option is set by default.
Preserve	Preserves the colors defined in the imported document.
Black and White	Imports the document in black and white.
Layers	
All	Imports or links all layers. Layers that are not visible in the link are turned off in the current view in Revit Architecture.
Visible	Imports or links only visible layers.

Option	Definition
Specify	<p>Allows you to select the layers and levels to import or link (on the dialog that displays). Layers not selected are deleted.</p> <p>If you select Visible or Specify and you are linking the file, when you later reload the linked file, still only the selected or visible layers originally linked are loaded. Any layers not selected or visible are not linked. If you later want omitted layers to be linked, you must delete the link and relink the file.</p> <hr/> <p>TIP If you want to be able to see and hide layers as needed, you can link to all layers, and then click View tab ► Graphics panel ► Visibility/Graphics to control the visibility of different categories in a view. (See Visibility and Graphic Display in Project Views on page 198.) Or you can link to all layers, and then query the import and hide a selected layer in the active view. (See Querying Objects in Layers on page 1405.)</p>
Import Units	<p>Explicitly sets the unit of measure for imported geometry. The values are Auto-Detect, feet, inch, meter, decimeter, centimeter, millimeter, and Custom factor.</p> <p>If you specify Auto-Detect for an AutoCAD file created in Imperial (English), then the file imports with feet and inches as the units. If the AutoCAD file was created in metric, then the file imports into Revit Architecture with millimeters as the units.</p> <p>For MicroStation® files, Revit Architecture reads the units from the file and uses them. Feet, inches, meters, centimeters, decimeters, millimeters are all supported. If the DGN file has custom units, then the unit in Revit Architecture defaults to feet.</p>
<p>NOTE If you import a file into a project with opposing units (for example, a metric file into an Imperial project), the units in the host project prevail. If the imported file has a custom unit, select Custom factor for Import Units. This enables the text box adjacent to the selection list so that you can enter a scale value.</p> <hr/> <p>For example, the file has a unit called widget where one widget equals 10 meters. When importing the file, select Custom factor for Import Units and specify a value of 10 in the adjacent text box. Each unit from the source file is now equal to 10 meters in the Revit file.</p> <p>The value you enter here displays in the Scale Factor type property of the import symbol.</p> <p>If the units are known, you can select Custom factor and enter a scale factor. This can increase or decrease the size of the imported elements in Revit Architecture.</p>	
Positioning	
Auto - Center to Center	<p>Revit Architecture places the center of the import at the center of the Revit model. The center of a Revit model is calculated by finding the center of a bounding box around the model.</p> <p>If most of the Revit Architecture model is not visible, this center point may not be visible in the current view. To make the point visible in the current view, set the zoom to Zoom View to Fit. This centers the view on the Revit Architecture model.</p>
Auto - Origin to Origin	<p>Revit Architecture places the import's world origin at the Revit project's internal origin. If the import object has been drawn at a large distance from its origin, it may display at a large distance from the model. To test this, set the zoom to Zoom View to Fit.</p>
Auto - By Shared Coordinates	<p>Revit Architecture places the imported geometry according to its location with respect to the shared coordinates between the 2 files.</p> <p>If there is no current shared coordinate system between the files, Revit Architecture notifies you, and uses Auto - Center to Center positioning. See Shared Positioning on page 1296.</p> <hr/> <p>NOTE This option is for Revit files only.</p>
Manual - Origin	<p>The imported document's origin is centered on the cursor.</p>

Option	Definition
Manual - Base Point	The imported document's base point is centered on the cursor. Use this option only for AutoCAD files that have a defined base point.
Manual - Center	Sets the cursor at the center of the imported geometry. You can drag the imported geometry to its location.
Place at	Select the level to place the origin/base point.
Orient to View	Revit Architecture places the import at the same orientation as the current view. This option is available only for non-view-specific imports.

Setting Scaling for Imported DWG or DXF Files

1 Select an import symbol and click Modify <File Name> tab ► Element panel ► Element Properties drop-down ► Type Properties.

2 In the Type Properties dialog, modify Import Units or Scale Factor.

If you change the import units, the scale factor automatically updates. See [Import and Link Options for CAD Formats and Revit Models](#) on page 1392.

NOTE If no values display for these parameters, you must reload the link or reimport the file.

3 Click OK.

Setting Line Weights for Imported DWG or DXF Files

When you import a DWG or DXF file, each layer in the file is assigned a line weight based on the pen number-line weight settings. Revit Architecture can import pen numbers from a DWG or DXF file and map them to a Revit line weight. You can then save these mappings in a text file, and they become the set mappings for the project.

Revit Architecture includes the following files with pen and line weight mappings:

- importlineweights-dwg-AIA.txt
- importlineweights-dwg-BS1192.txt
- importlineweights-dwg-ISO13657.txt
- importlineweights-dwg-CP83.txt

These files reside in the Data folder of the Revit Architecture installation directory.

To set line weights

1 Click Insert tab ► Import panel ► .

The Import Line Weights dialog displays the mappings in the importlineweights-dwg-default.txt file.

2 If this is not the file that you want to edit, click Load, navigate to the correct mappings file, and open it.

- 3 In the dialog, match the appropriate pen to the appropriate line weight (for example: Pen Number 1 to Line Weight Number 1, Pen Number 2 to Line Weight Number 2, and so on). Set as many pen-line weight mappings as desired.
- 4 Click OK, or to save the mappings in a new file, click Save As.

Mapping AutoCAD SHX Fonts to TrueType Fonts

When you import AutoCAD drawings that contain text, you can map the AutoCAD SHX fonts to TrueType fonts so they appear correctly in Revit Architecture. You can map to any of your existing fonts.

NOTE For SHX fonts that are not mapped, Revit Architecture will use a similar font, but the results are unpredictable.

To map TrueType fonts

- 1 Open the shxfontmap.txt file in a text editor.
This file resides in the Data folder of the Revit Architecture installation directory.
- 2 On a new line, enter the SHX file name.
- 3 Press *Tab*.
- 4 Enter the name of the font to map it to.
- 5 Save and close the file.

You do not need to restart Revit Architecture for the font mapping to take effect. If you have already imported the file, you will need to import it again.

Setting Constraint Parameters for Imported Geometry

If you have imported geometry into all views, you can set the base level for it and specify a height offset from that level.

To set constraint parameters

- 1 Select the imported geometry, and click Modify <Element> tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 2 Set the Base Level and Base Offset instance parameters.

Alternatively, you can select the geometry in an elevation view and move it to adjust the base offset value.

Moving a View-Specific Import to the Foreground or Background

You can move a view-specific import symbol between the foreground and the background of a view, with respect to model elements in the view. If the import symbol is in the foreground of the view, it is in front of model elements, such as walls. It is still behind detail components and annotations.

NOTE View-specific import symbols are those files that are imported with the Current View Only option selected.

- 1 Select the import symbol, and click Modify <Element> tab ► Element panel ► Element Properties drop-down ► Instance Properties.
- 2 In the Instance Properties dialog, for Draw Layer, specify Background or Foreground.

Alternatively, select Background or Foreground from the Options Bar.

You can also use the sort order for detail components to move an import symbol in front of or behind detail components. For more information on sort order tools, see [Sorting the Draw Order of Detail Components](#) on page 1156.

Importing Images

You can import raster images to a Revit project to use as background images or as visual aids needed during the creation of a model. By default, images are imported behind the model and annotation symbols; however, you can change the display order. You can import images into 2D views only.

You can import images by clicking Insert tab ► Import panel ► Image, or by dragging and dropping them from Windows® Explorer.

To import an image

- 1 Click Insert tab ► Import panel ► Image.
- 2 In the Import Image dialog, navigate to the folder containing the image file to import.
- 3 Select the file, and click Open.
The imported image displays in the drawing area and moves with the cursor. The image displays symbolically, with 2 crossing lines indicating the extents of the image.
- 4 Click to place the image.

Related topic

- [Adding an Image to a Sheet](#) on page 1044

Modifying Imported Images

You can modify imported images using tools (such as Rotate and Copy) on the Modify Raster Images tab. This tab displays when you select an imported image in the drawing area.

NOTE These tools also affect captured, rendered 3D images.

To modify an imported image

- 1 Select the image so that handles display on the image, and modify the image as follows:
 - To scale the image, drag the corner handles.
 - To move the image, drag it to the desired location.
 - To keep width and height settings proportional while scaling, on the Options Bar, select Lock Proportions.
- 2 Click Modify Raster Images tab ► Element panel ► Element Properties drop-down ► Instance Properties. In the Instance Properties dialog, specify the values for the height and width of the image.
- 3 If you want to rotate the image, click Modify Raster Images tab ► Modify panel ► Rotate. See [Rotating Elements](#) on page 379.
- 4 If you want to change the draw order, select the image and use the tools on the Arrange panel of the Modify Raster Images tab.
The draw order of raster images can be controlled in the same manner as detail elements. See [Sorting the Draw Order of Detail Components](#) on page 1156.

Related topics

- [Importing Images](#) on page 1396
- [Deleting Raster Images](#) on page 1397

Deleting Raster Images

The Manage Images tool lists all raster images in the project, including any rendered images that you have captured. The tool offers the only way for you to delete an image from the project. You cannot remove an image from the project by deleting it from a view or a sheet.

To delete a raster image

- 1 Click Insert tab ► Import panel ► Manage Images.
The Manage Images dialog lists all raster images in the project.
- 2 Select the image name, and click Delete.
- 3 Click OK when prompted to confirm the deletion.
- 4 Click OK to close the Manage Images dialog.

Opening Industry Foundation Class (IFC) Files


Revit Architecture opens Industry Foundation Classes (IFC) based on the latest International Alliance for Interoperability (IAI) IFC 2x3 data exchange standard. (If you open a file that uses an earlier standard [IFC 2x or 2x2], Revit Architecture supports the format and opens it properly.) For information about the IFC file format, see [Exporting to Industry Foundation Classes \(IFC\)](#) on page 1367.

When you open an IFC file, Revit Architecture creates a new file based on the default template. For information about selecting the default template, see [Selecting a Template for IFC Files](#) on page 1397.

You can load your own IFC class mapping files and override the categories and subcategories for IFC objects.


TIP Make sure you import the geometric data needed for the Revit capability that you plan to use. For more information, see [Suitability of Imported Geometry](#) on page 1387.

To open an IFC file


- 1 Click  ► Open ► IFC.
- 2 In the Open IFC File dialog, navigate to the IFC file to import.
- 3 Select the IFC file, and click Open.

Revit Architecture creates a new file based on the default template.


Selecting a Template for IFC Files

- 1 Click  ► Open ► IFC Options.
- 2 In the Import IFC Options dialog, click Browse.
- 3 In the Browse for Template File dialog, navigate to the desired IFC template file, select it, and click Open.
- 4 In the Import IFC Options dialog, click OK.

Loading an IFC Class Mapping File

- 1 Click  ► Open ► IFC Options.
- 2 In the Import IFC Options dialog, click Load.
- 3 In the Load IFC Class Mapping File dialog, navigate to an IFC class mapping file, select it, and click Open.
- 4 In the Import IFC Options dialog, click OK.


Overriding Categories and Subcategories for IFC Objects

- 1 Click  ► Open ► IFC Options.
- 2 In the Import IFC Options dialog, double-click in a category or subcategory, and enter a new value to override the current value.
As an alternative, you can click Standard to reset all values to the standard (default) settings.
- 3 Click OK, or to save the mappings in a new file, click Save As.

Importing Building Components

Manufactured building components that are formatted as Autodesk Exchange (ADSK) files provide design and connection data that you can use to accurately place the component in a Revit project. These building components can be designed in mechanical applications, such as Autodesk® Inventor® and used in Revit Architecture, Revit MEP, and Revit Structure.

To open a building component ADSK file, do one of the following:

- Click  ► Open ► Building Component.
- Click Home tab ► Build panel ► Component drop-down ► Place a Component. Then click Place Component tab ► Model panel ► Load Family, select the ADSK file, and place it in the project.

Building Component ADSK Files


A building component ADSK file provides the following information to aid in the design process:

- Physical appearance of the component in views, such as 3D, which lets you determine clearance for accurate placement
- Connectors and their placement

NOTE Although conduit and cable tray connectors are displayed in the Autodesk Inventor Translation report, they are not imported into Revit Architecture.

- Data about the component, such as its identity data

Opening or loading an ADSK file automatically creates a family from the category that is based on the OmniClass assignment made on export.

You can also save the ADSK file as an RFA file ( ► Save As ► Family), which lets you create a family that can be used in multiple projects. See [Revit Families](#) on page 415 for more information about using families in Revit Architecture.

Working with Building Components

Using a building component ADSK file, you can:

- View the component's bounding box at a coarse detail level. Connectors will still display in their correct locations in the coarse scale view.
- View the component's detailed appearance at fine and medium detail levels.
- Change the component's graphic display by changing the detail level in the project. You can also modify the component's visibility settings in the Family Editor to coarse, medium, or fine.
- View the component in a 3D, plan, elevation, or section view.
- Place connectors on the component using the Family Editor. See [Connectors](#) on page 435.
- Create new family types from the original component by adding new parameters or changing existing ones using the Family Editor.
- View or change the component's identity data.
- Use the component's reference planes or some of its geometry for dimensioning.
- Tag and schedule the component's parameters.
- Render the component.

Restrictions to using a building component ADSK file include the following:

- The geometry of the component cannot be changed in Revit Architecture. Changes to geometry can only be made in the application in which the building component was originally designed.
- Although the materials assigned in the mechanical application are not imported into Revit Architecture, you can assign a material in Revit Architecture that applies to the whole component.
- Currently, the workflow is only one-way from Inventor to Revit Architecture. Inventor cannot open ADSK files.

Tips for Working with Building Components

Consider the following when working with building components:


- To optimize model performance in Revit Architecture, whenever possible, work with the building component as a bounding box at coarse scale.
- Because building components can have large quantities of detailed geometry, they might take a few minutes to open. If opening the component takes too long, or if zooming and panning performance is slow, ask its creator to further simplify the model prior to exporting.
- If the component opens in Revit Architecture with a different orientation than expected, either rotate the component in the Family Editor or ask its creator to create a custom Universal Coordinate System (UCS) and re-export the ADSK file using the new UCS.

- Use the Autodesk Inventor Translation report to review the export results. The report lists the contents of the ADSK file. Verify that the model elements were exported as you expected. Double-click the ADSK file to open the report in your Web browser.

Building Component Workflow

The following steps describe a typical workflow for using a building component in a Revit project. For example, suppose a manufacturer published the contents of a rooftop HVAC unit to its website as an ADSK file to be used by engineers and architects. You want to incorporate this building component in your model. Using the component's geometry and data, you can properly place the component in the project and also create connectors on it, so the component can be used in Revit MEP.

Your workflow looks like the following:

- 1 Download the building component ADSK file from the manufacturer's website.
- 2 To open the ADSK file in Revit Architecture, click  ➤ Open ➤ Building Component.
- 3 Load the ADSK file into the project from the Family Editor.

NOTE You can load the ADSK file directly into the project. Click Home tab ➤ Build panel ➤ Component drop-down ➤ Place a Component. Then click Place Component tab ➤ Model panel ➤ Load Family, select the ADSK file, and place it in the project.

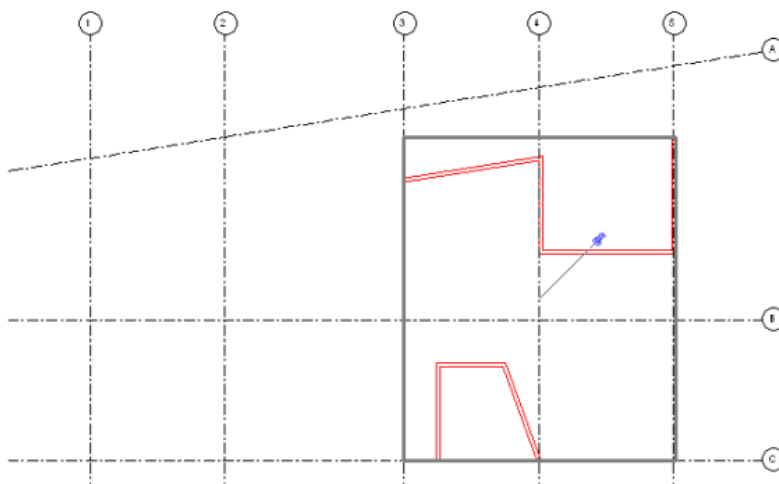
- 4 Place the component in the project.
- 5 Display the component as a bounding box at a coarse level of detail.
- 6 Display the full geometry at medium and fine levels of detail.
- 7 View the component in any view.
- 8 Run an interference check to ensure proper clearance.
- 9 Tag and schedule the component using its parameters.
- 10 Dimension the component to its reference planes and to some of its geometry.
- 11 Create any extra connectors on the component in the Family Editor. When they are connected to building services in Revit MEP, the connectors can be used in flow analysis.

Linking AutoCAD Files to a Revit Project

You can link AutoCAD files to a Revit project. For example, you may want to use linked files as follows:

- Some team members use AutoCAD to create details or elevations, but the rest of the project is created using Revit Architecture. You want to link the AutoCAD drawings to the Revit project and place them on sheets. These drawings can then be included in the set of construction documents that Revit Architecture generates.
- Team members from other disciplines (such as structural engineers or electrical engineers) are using AutoCAD to plan their part of the project. You want to link their AutoCAD drawings to a Revit project to use them as underlays for your project views.

For example, the following floor plan shows a linked file that will be used as an underlay to trace and create structural walls in Revit Architecture.



Related topics

- [Managing Links](#) on page 1286
- [Managing Layers in Linked and Imported Files](#) on page 1404

How Linking to AutoCAD Files Works

When you link an AutoCAD file to a project, Revit Architecture maintains a link to that file. Whenever you open the Revit project, Revit Architecture retrieves the current, saved version of the linked file and displays it in the project. Any changes to the linked file are displayed in the Revit project. If the linked file changes while the Revit project is open, reload the file to retrieve the latest changes. (See [Managing Links](#) on page 1286.)

This ability to retrieve the latest changes to an AutoCAD file is the difference between linking and importing. When you import an AutoCAD file, Revit Architecture uses the version of the file that you imported. It does not retrieve or display changes to the imported file.

When you link (or import) an AutoCAD file to a Revit project, you can do the following:

- [Query objects in the file](#) on page 1405
- [Hide or delete selected layers in the file](#) on page 1405.
- [Change the graphic display of layers in the file](#) on page 1407.

When you link a file to a Revit project, you can control whether the linked file is visible only in the current view, or in all views. As a 2D drawing, the linked file is displayed only in relevant 2D Revit drawings, such as floor plans. In a 3D view, the linked file is displayed as flat, 2D shapes.

Linking to an AutoCAD File

- 1 Open the Revit project.
- 2 If you want the linked file to display only in a particular view, open that view.
- 3 Click Insert tab ► Link panel ► Link CAD.

4 Specify the file to link, as follows:

- For Look in, navigate to the location of the file.
- For File name, specify the name of the file.
- For Files of type, specify DWG.

5 Specify the following options for the linked file:

- a If you want the linked file to display in the current view only, select Current view only.
If you do not select this option, the linked file is displayed in all relevant 2D views, such as floor plans.
- b For Layers, select one of the following values:
 - **All:** Displays all linked file layers in the Revit project, including hidden layers.
 - **Visible:** Displays visible layers of the linked file in the Revit project. Layers that are currently hidden in AutoCAD do not display in Revit Architecture.
 - **Specify:** Allows you to select the layers to display in the Revit project from a list. After you click Open, Revit Architecture displays the list of layers from which to choose.

6 Specify the desired import options.

For details about these options, see [Import and Link Options for CAD Formats and Revit Models](#) on page 1392.

7 Click Open.

8 If, for Layers, you chose Specify, the Select Layers/Levels to Import/Link dialog lists the layers in the file. Select the desired layers, and click OK.

Unselected layers are not available in the Revit project. (However, the layers still exist in the AutoCAD file.)

Revit Architecture retrieves the current version of the linked file and displays it in the current Revit view.

Related topics

- [Querying Objects in Layers](#) on page 1405
- [Hiding and Deleting Layers](#) on page 1405
- [Changing the Graphic Display of Layers](#) on page 1407
- [Managing Links](#) on page 1286

Location of the Linked File

Whenever you open a Revit project that is [linked](#) to a file, Revit Architecture retrieves the current saved version of the linked file. The path to the linked file displays in the Saved Path column of the Manage Links dialog. See [Identifying and Re-establishing Unresolved References](#) on page 1286.

If Revit Architecture cannot locate the linked file, it displays the path to the version of the linked file that it retrieved most recently. Revit Architecture is not able to update the link. To reload the linked file from a different location, use the Reload From function of the Manage Links dialog. See [Managing Links](#) on page 1286.

Use the Path Type column to indicate whether the path is absolute or relative. In general, use a relative path instead of an absolute path.

- If you use a relative path and later move the project and the linked file together to a new directory, the link is maintained. The new working directory becomes the relative path for the linked file.
- If you use an absolute path and later move the project and the linked file to a new directory, the link is broken.

Use an absolute path when you link to a workshared file, such as a central file that other users need to access. This file is likely not to move from its location on the disk.

Linking DWF Markup Files

1 Click Insert tab ► Link panel ► DWF Markup.

2 In the Import/Link DWF File dialog, navigate to the DWF markup file, select it, and click Open.

The Link Markup Page to Revit Sheets dialog opens. Under the DWF View column, the dialog displays the sheet view names that are marked up in the DWF file. The Revit View column displays the corresponding Revit sheet view. If the sheet name from the DWF file is the same as the sheet name from the Revit file, then the Revit sheet name is automatically filled in the Revit View column.

If the Revit sheet view name changed after it was exported to DWF, the Revit View column displays <Not linked> next to the DWF sheet view.

3 If the Revit View value is <Not linked>, select a Revit sheet view by clicking the box below the Revit View column, and selecting a name from the list.

You might also do this if you have several other sheet views in the Revit file, and you want to apply the markups to one of the other sheet views. This would make sense only if the other sheet title blocks were the same size as the original.

4 Click OK.

The DWF markups are placed on the sheet view as an import symbol. The markups are pinned, which means that you cannot modify their position or copy, rotate, mirror, delete, or group them unless they were created in Autodesk Design Review. See [Modifying DWF Markups Created in Design Review](#) on page 1403.

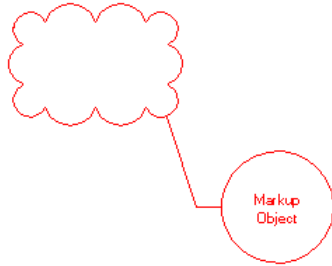
Modifying DWF Markups Created in Design Review

If markups were created in Autodesk Design Review using its markup tools, you can modify the Status and Notes properties in Revit Architecture. This feature allows you to add information to the markup or maintain information about its status.

To modify markups created in Design Review

1 Select a markup object that was created in Design Review.

A markup object might look as follows.



2 Click Modify <File Name> tab ► Element panel ► Element Properties drop-down ► Instance Properties.

3 In the Instance Properties dialog, modify the Status and Notes properties as desired.

4 Click OK.

The changes are saved to the linked DWF file. The changes can be viewed in the DWF file by selecting the corresponding markup object.

Exploding Imported Geometry

When you import a drawing into Revit Architecture, you are importing all the elements, such as blocks and external references (xrefs) from the drawing. (See [Implications of Importing vs. Linking for Xrefs](#) on page 1388.) They are all contained inside a Revit element called an import symbol.

You can explode (disassemble) the import symbol into its next highest level elements: nested import symbols. This is a partial explode. A partial explode of an import symbol yields more import symbols, which, in turn, can be exploded into either elements or other import symbols. This is analogous to exploding in AutoCAD with nested xrefs and blocks. For example, you explode an xref into other xrefs and blocks. Those xrefs and blocks can, in turn, be exploded into more blocks and xrefs.

You can also explode the import symbol immediately into Revit text, curves, lines, and filled regions. This is a full explode.

NOTE You cannot explode linked files or an import symbol that would yield more than 10,000 elements.

To explode imported geometry

1 Select the import symbol.

2 Click Modify <File Name> tab ► Import Instance panel ► Explode drop-down ► Partial Explode or Full Explode.

These tools are also available on the shortcut menu that displays when you right-click the import symbol.

Resulting partial explode import symbols can be exploded again by selecting them and clicking Partial Explode. You can continue to do this until all import symbols are converted to Revit elements.

Managing Layers in Linked and Imported Files

When you import or link a CAD file to a Revit project, you can query, hide, delete, or change the graphic display of layers in the file.

Querying Objects in Layers

When you import or link a file to a Revit project, you can query the file for information about its objects. This allows you to determine the identity of an object and the layer on which it resides. You can also hide the object's layer or delete it.

To query objects in layers

1 Open a project view in Revit Architecture.

2 Highlight the import symbol for the file, and click to select it.

When you highlight the import symbol, the status bar displays the following:

<imported file name> : Import Symbol : location <Shared> or <Not Shared>.

3 Click Modify <File Name> tab ► Import Instance panel ► Query.

4 Select the object to query, as follows:


- Move the cursor over the import symbol in the view.
Revit Architecture highlights lower-level objects (such as lines) first. Press *Tab* to switch to highlighting of higher-level objects, such as blocks.
- Watch the status bar. When it describes the target object, click to select it.

The Import Instance Query dialog opens and displays the following information:

- Type: object type
- Block Name: the block that contains the object, if applicable
- Layer: the name of the layer containing the object
- Style By: indicates whether the object style comes from the layer or by color

5 To hide the object's layer in the current view, click Hide in view.

The selected layer may still be visible in other views.

TIP To see the hidden layer temporarily, click Reveal Hidden Elements  on the View Control Bar. To redisplay the layer, click View tab ► Graphics panel ► Visibility/Graphics. On the Imported Categories tab, select the layer, and click OK.

6 To delete the object's layer from the Revit project, click Delete.

The selected layer is no longer visible in any project views.

7 To close the Import Instance Query dialog, click Close.

The query editor remains active so that you can select other entities.

8 Press *Esc* to exit the query editor.

Hiding and Deleting Layers

When you import or link a file to a Revit project, you may not want all of the file's layers to be visible in Revit Architecture. To control the visibility of layers, you can do either of the following:

- **Hide layers:** When you hide layers, they are still available to the Revit project, but they do not display in views. You can make them visible again as needed.
- **Delete layers:** When you delete layers, they are not available to the Revit project. (However, they still exist in the original CAD file.) If you want to restore the layers, you must delete the file and either import or link it to the project again.

Related topic

- [Changing the Graphic Display of Layers](#) on page 1407

Hiding Layers

When you import or link a file, you can specify how to hide its layers in each Revit view. For example, you can display all layers in one view, but hide some layers in another view. You can redisplay the layers later, if needed.

If you are not sure on which layer an object resides, see [Querying Objects in Layers](#) on page 1405.

To hide layers

- 1 Open a project view in Revit Architecture.
- 2 Click View tab ► Graphics panel ► Visibility/Graphics.
- 3 Click the Imported Categories tab.
- 4 In the Visibility column, click to expand the DWG file name of the linked or imported file.
Revit Architecture lists the layers in the file.
- 5 Clear the check boxes for any layers that you want to hide in the current view.
- 6 Click OK.

The layers are hidden in the current view only. To redisplay hidden layers, repeat this process and select the desired layers.

Deleting Layers

When you delete layers in either an imported file or a linked file, the layers are no longer available to the Revit project. (However, they still exist in the original CAD file.) If you want to restore the layers, you must delete the file from the Revit project and link to or import it again.

To delete layers in a linked or imported file, use one of the following methods:

- When you link or import the file to the Revit project, in the Import or Link dialog, for Layers, select Visible to display only the layers that are currently visible in AutoCAD, or select to specify the layers to display in Revit Architecture. Any omitted layers are effectively deleted. They are not available to the Revit project.
- If you want to delete an object in a CAD file, and you are not sure on which layer it resides, see [Querying Objects in Layers](#) on page 1405.
- Delete specified layers, as described in the following procedure.

To delete known layers

- 1 Open a project view in Revit Architecture.
- 2 Highlight the import symbol for the file, and click to select it.
The status bar displays the following:
<imported file name> : Import Symbol : location <Shared> or <Not Shared>.
- 3 Click Modify <File Name> tab ► Import Instance panel ► Delete Layers.
- 4 In the Select Layers/Levels to Delete dialog, select the layers to delete, and click OK.

The deleted layers do not display in any views in the Revit project.

Changing the Graphic Display of Layers

When you import or link a file to a Revit project, you can control the graphic display of each layer in the file. For example, you can change the line color, weight, and style of the objects. For example, when using a file as an underlay, you can display the entire file in halftone to distinguish it from the Revit model.

Related topic

- [Hiding and Deleting Layers](#) on page 1405

Preserving or Discarding Graphic Overrides for Linked Files

When you change the graphic display of layers in a [linked file](#), you can specify whether Revit Architecture preserves or discards the graphic overrides.

NOTE This feature is available for linked CAD files only. It is not available for imported CAD files.

When you preserve graphic overrides, Revit Architecture retains any changes made to the graphic display of its layers when it reloads the linked file. Otherwise, Revit Architecture discards graphic overrides when reloading the linked file. This option applies to all CAD files that are linked to the project.

To preserve or discard graphic overrides for linked files

- 1 Open the Revit project.
- 2 Click Manage tab ► Manage Project panel ► Manage Links.
- 3 In the Manage Links dialog, do either of the following:
 - To retain the overrides, select Preserve graphic overrides.
 - To discard the overrides, clear Preserve graphic overrides.
- 4 Click OK.

Making Global Changes to the Graphic Display of Layers

When you import or link a file to a Revit project, you can control the graphic display of file layers in all views.

To make global changes to the graphic display of layers

- 1 Open the Revit project.
- 2 Click Manage tab ► Project Settings panel ► Settings drop-down ► Object Styles.
- 3 In the Object Styles dialog, click the Imported Objects tab.
- 4 Click to expand the DWG file name of the file.
Revit Architecture lists the layers in the file.
- 5 For each layer, change the values for Line Weight, Line Color, or Line Pattern, as desired.
See [Object Styles](#) on page 493.
- 6 Click OK.

Related topics

- [Preserving or Discarding Graphic Overrides for Linked Files](#) on page 1407
- [Hiding and Deleting Layers](#) on page 1405

Making View-Specific Changes to the Graphic Display of Layers

When you import or link a file to a Revit project, you can control the graphic display of its layers in individual views.

To make view-specific changes to the graphic display of layers

- 1 Open a project view that shows the file.
- 2 Click View tab ► Graphics panel ► Visibility/Graphics.
- 3 Click the Imported Categories tab.
- 4 If you want the entire file to appear in halftone, select Halftone.
See [Halftone/Underlay](#) on page 497.
- 5 In the Visibility column, click to expand the DWG file name.
Revit Architecture lists the layers in the file.
- 6 To change the graphic display of a visible layer in the file:
 - a Click the Lines column for the layer, and click Override.
 - b In the Line Graphics dialog, specify the line weight, color, and pattern, and click OK.
- 7 In the Visibility/Graphic Overrides dialog, click OK.

Related topics

- [Preserving or Discarding Graphic Overrides for Linked Files](#) on page 1407
- [Hiding and Deleting Layers](#) on page 1405

Troubleshooting Problems with Linked Files

The following topics describe issues that you may encounter when linking files to Revit projects.

Changes in the DWG File Are Not Reflected in the Revit Project

Symptom: After linking a DWG file to a Revit project, you made changes to the DWG file in AutoCAD. However, the Revit project does not display these changes.

Issues and Solutions: This issue can have several causes:

- The linked file was changed after it was loaded into the Revit project, and the Revit project is still open. To correct this situation, reload the linked file. In Revit Architecture, click Manage tab ► Manage Projects panel ► Manage Links. In the Manage Links dialog, on the CAD Formats tab, select the linked file in the list, and click Reload. Click OK. Revit Architecture retrieves the most recently saved version of the linked file and displays it in the Revit project.
See [How Linking to AutoCAD Files Works](#) on page 1401.
- The file was imported, not linked.
When a file is imported, Revit Architecture does not retrieve or display changes to the imported file. To confirm that the file was linked and not imported, click Manage tab ► Manage Projects panel ► Manage Links. In the Manage Links dialog, the CAD Formats tab lists all linked files. It does not list files that are imported. Therefore, if the file is not listed here, then it was imported.
To correct this situation, go to the view in which the imported file displays, select it, and press *Delete*. Then link to the file. See [Linking to an AutoCAD File](#) on page 1401.

- Revit Architecture cannot locate the linked file in its saved path.
If the linked file was moved, Revit Architecture cannot locate it, and so it cannot retrieve the latest saved version of the file. To reload the file from a different location, use the Reload From function of the Manage Links dialog. (See [Managing Links](#) on page 1286.)

Changes to the Layer Color and Line Style Do Not Display in the Revit Project

Symptom: You made changes to the graphic display of layers in the linked file. After the linked file was reloaded into the Revit project, these changes disappeared.

Issue: To save changes to the graphic display of layers in linked files, select the Preserve Graphic Overrides option on the Manage Links dialog. If this option is not selected, Revit Architecture discards graphic overrides when the linked file is reloaded.

Solution: See [Preserving or Discarding Graphic Overrides for Linked Files](#) on page 1407.

Layers in the DWG File Do Not Display in the Revit Project

Symptom: Some layers in the linked file do not display in the Revit project.

Issue: The layers may be hidden or deleted.

Solution: To determine whether the layers are hidden or deleted, click View tab ► Graphics panel ► Visibility/Graphics. On the Imported Categories tab, click to expand the DWG file. Revit Architecture lists the layers in the file.

Layers that are not listed here have been deleted; they are not available to the Revit project. If you want to restore the layers, you must first delete the linked file and then link it to the project again. When linking, be sure that for Layers, you select All or Select. See [Linking to an AutoCAD File](#) on page 1401.

If the Visibility option for a layer is cleared, the layer is hidden in the current view. To display the layer, select the Visibility option, and click OK. Revit Architecture displays the layer in the current view.

File Operations (Open, Save, Synchronize) Are Blocked or Slow

Symptom: In some cases, Revit cannot open, save, or synchronize with files.

Issue: Some antivirus software solutions lock files, preventing other applications from accessing them.

Solution: You or your network administrator can define the following file extensions as exceptions in your antivirus filter.

- Revit Projects (RVT)
- Revit Families (RFA)
- Revit Templates (RTE)
- Autodesk Design Package (ADSK)
- Industry Foundation Classes (IFC)
- AutoCAD drawings (DWG)
- CAD Data Transfer (DXF)
- MicroStation drawings (DGN)
- ACIS models (SAT)

- SketchUp drawings (SKP)
- Images (BMP, JPG, and PNG)
- Data (RWS and DAT)

NOTE It may be necessary to contact your network administrator to add these exceptions.

Print Troubleshooting, Diagnostic Tools, and Error Handling

25

This topic includes information on troubleshooting printing issues, diagnostic tools used for support requests, and error handling.

Print Troubleshooting Guide

This topic provides information that may answer some questions you have about printing problems in Revit Architecture.

General Printing Tips

The following is a list of problems and their suggested solutions. The problems are presented in bold type, followed by the suggested solutions.

How are drawings printed to scale with a titleblock in Revit Architecture?

Create a new sheet view, and add a titleblock to it.


Add any views (plans, elevations, sections) to the sheet. After you add a view, change its view scale through the view properties.

You can plot multiple views at different scales on the same sheet.


Only a portion of a print job comes out on a sheet.

Several printers have limited on-board memory to process print data.


When plotting large format sheet sizes to plotters such as the HP DesignJet, change the plotter's settings so that the data is processed in the computer.

To change the settings, click  ► Print. Select the correct printer, and click Properties. In the dialog, click the Advanced tab. Select the option to process the document in the computer, and click OK.


My reference planes, crop boundaries, and scope boxes do not print.

Reference planes, crop boundaries, and scope boxes are hidden for printing by default. To show them when you print, click  ► Print ► Print Setup. In the Print Setup dialog, clear the options for reference planes, crop boundaries, and scope boxes.

My reference planes are printing. I don't want them to print.

Click  ► Print ► Print Setup. In the Print Setup dialog, select the Hide ref/work planes check box.

Can the colors in a drawing be overridden so they print in solid black and white?

Click  ► Print ► Print Setup. In the Print Setup dialog, select the Black Lines option from the Colors menu.

This ensures that a black and white printer properly processes colors in a project. This option does not produce grayscale. All colors are converted to black.

How do I increase print speed in elevation, section, and perspective views?

Be sure that the Far Clipping property is active for the view. Go to the view properties of the view, and select an option for Far Clipping.

I choose black lines or gray scale in Revit Architecture, but my printer still prints in colors.

Some printer drivers override the Colors setting that you specified in Revit Architecture. To get the desired color output, manually set the color through your printer's properties.

Graphics Issues

When I print, surface patterns are partially submerged into the concave side of a wall's surface.

Click  ► Print ► Print Setup. In the Print Setup dialog, select the Vector Processing option.

Images

The printed output of imported images is different than the on-screen display.

Click  ► Print ► Print Setup. In the Print Setup dialog, select the Raster Processing option.

Plotting

Problems printing raster images with a XES Synergix 8830 plotter.

In the properties dialog for the XES Synergix 8830, under the Graphics tab, there is a check box for Enable RTL native mode resolution. Clear the check box, and the raster images should print correctly.

How do I plot to Reprodesk?

If the PRN file has been changed to a PLT file and the processing of the file still produces a black screen, once the file has been sent to Reprodesk change the pen setting from standard (the default) to asinfile pen.

Other Plotting Considerations

Always use a color cartridge in the plotter when the Windows driver is set to use color mapping.

Use a monochrome cartridge in the plotter when the Windows driver is set to use either grayscale or black mapping. (A color cartridge may be used, but only the black ink will be used).

Diagnostic Tool

Revit Architecture features a diagnostic tool that can assist you when you are communicating with support. You can select elements by their ID or show their ID, which allows support to address your issues promptly.

Selecting Elements by ID Number

If you receive an error message during the course of your work, the message may report a problem with an element and refer to that element by an ID number. To help you locate that element in your project, you can select it using that ID number. Your support representative may also ask you to find the element using its ID.

To select an element by ID number

- 1 Click Modify tab ► Inquiry panel ► Element ID drop-down ► Select by ID.
- 2 In the Select Elements by ID dialog, type the ID number, and click Show.

Revit Architecture locates the element and selects it in the view. This tool is especially useful if you are trying to locate a view-specific element by its ID.

Finding an Element's ID Number

- 1 Select an element in a view.
- 2 Click Modify tab ► Inquiry panel ► Element ID drop-down ► IDs of Selection.
The ID number is reported in the Element IDs of Selection dialog.

Error Handling

If errors occur during your work, Revit Architecture displays dialogs that indicate the problems. Sometimes you can ignore the message, other times Revit Architecture requires that you cancel your last action. The dialog includes what the appropriate action should be.

Sample error dialog



Getting More Information on Error Messages

In the error message dialog, click More Info to access the online help topic providing further explanation about the problem.

Viewing Elements Involved in Errors

In the error message dialog, click Show to zoom in on the highlighted elements involved in the error.

When you click Show, Revit Architecture tries to display the elements in one of the following ways:

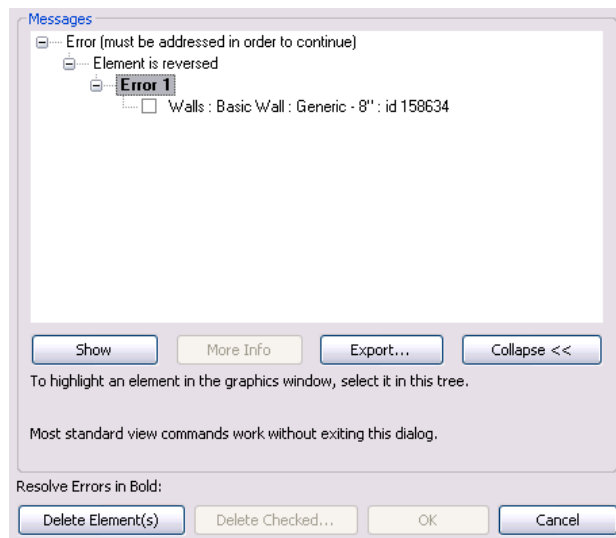
- The only view an element is visible in, if it is only visible in one view. Dimensions are such an example.
- A plan view that shows all the elements.
- An elevation view that shows all the elements.
- A drawing sheet that shows all the elements.
- A 3D view.
- Any view where many of the elements are visible.

If the element cannot be shown in any view, Revit Architecture informs you.

Viewing all Errors and Warnings Associated with an Error Message

In the error message dialog, click Expand to extend the error message dialog and view a tree structure listing the errors and warnings associated with your last action.

To see more information about each error, click the plus sign (+) in the tree structure.



You can select (highlight) an error heading, such as Error 1, and all elements associated with that error are selected in the drawing area. Additionally, you can highlight an element name and only that element is selected in the drawing area. After you highlight the element name, you can click Show, and Revit Architecture searches views for that element only.

You can select the check box next to an element and delete it by clicking Delete Checked.

To return the error dialog to the normal view, click Collapse.

Messages and Warnings You Can Ignore

Warnings that require no action can be ignored. These warnings display in a dialog in the lower-right corner of the interface. When the warning displays, the element or elements that cause it are highlighted in a user-definable color. See [Graphics Options](#) on page 517, for information about changing this color.

Unlike error messages, warning messages do not prohibit the current action. They just inform you of a situation that may not be your design intent. You can choose to correct the situation or ignore it. Revit Architecture maintains a list of warning messages that are displayed and ignored while you are working. The Warnings tool lets you view the list at your convenience to determine if the conditions described in the warnings still exist.

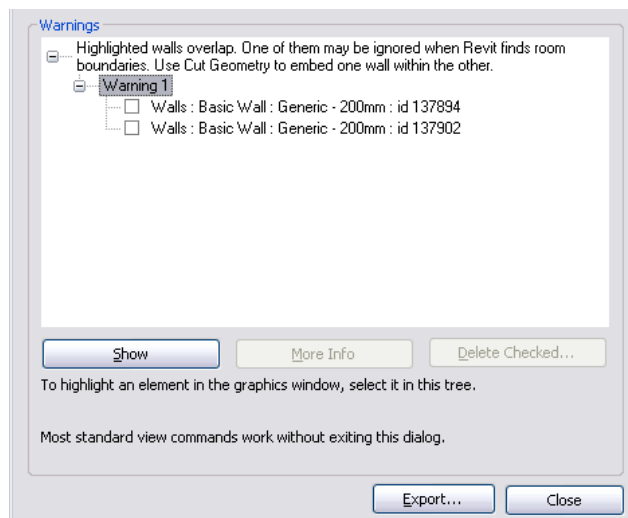
Reviewing Warning Messages

- 1 Click Modify tab ► Inquiry panel ► Warnings.
- 2 Click the arrow buttons as needed to scroll through the list of warning messages.
- 3 Click OK to close the list.

NOTE This tool is not enabled if there are no warning messages.

Warnings for Selected Elements


If there are any warnings associated with an element you select in a drawing, the respective Modify tab for the element displays a Warning panel with a Show Related Warnings tool. You can click this tool to view a list of the related warnings. These warnings are listed in the Messages panel on the Autodesk Revit Architecture 2010 dialog. The following graphic displays a list of warnings.




The Messages dialog lists warnings in a tree view that you can expand to see the individual elements associated with each warning. When you select the text next to a warning, the element highlights in all open views where it is visible.

To delete an element from the model, select the check box next to an element name, and click Delete Checked.

Exporting Warnings to a File

Warnings that are related to selected elements in the drawing area can be exported to a separate file using  on the Autodesk Revit Architecture 2010 dialog. See [Warnings for Selected Elements](#) on page 1415. This can be useful, if you want to have the warnings listed next to a project as you work on it.

To export warnings to a separate file

- 1 In the Autodesk Revit Architecture 2010 dialog, click  .
- 2 In the Export Revit Error Report dialog, browse to the location where you want to store this file.
- 3 Click Save to save the file, and close the window.
- 4 Click Close to close the Autodesk Revit Architecture 2010 dialog.

NOTE Warnings are exported in HTML format, but they can be opened in an Excel format for more advanced data manipulation.

More Information on Errors and Warnings

This topic provides expanded information about errors and warnings in Revit Architecture.

Curtain Walls

Message	Details
Switching wall type to family curtain wall. All dimension references to the side faces of the wall will be deleted.	Problem: You have placed permanent linear dimensions between wall faces and then change one of the walls to a curtain wall. You lose those dimensions. Solution: You will not lose dimensions between wall centerlines, if you change one wall to a curtain wall. See Placing Permanent Dimensions on page 265.
There is an invalid curtain panel in the model. This is probably caused by two grid lines almost meeting at a border of the curtain wall or sloped glazing, but not exactly at a point. The curtain panel cannot be displayed.	Problem: Typically, this problem occurs in a panel on a sloped glazing. A horizontal and vertical curtain grid on a panel are not meeting exactly at a point, creating a small triangular panel within the main panel; the triangular panel cannot be accurately regenerated because it is too small. This message displays when the program regenerates the curtain panel. Solution: Cancel the placement and/or the movement of the panel. When dividing the panels in a sloped glazing/wall, it is best to start with the placement of horizontal curtain grids and then snap vertical grids to the horizontal grid. This ensures the grids meet at a point and eliminate the creation of a small panel.
No curtain panel families loaded. Cannot make arced curtain wall.	Problem: You are sketching a curtain wall and then try to unload it as you are creating it, or you sketch a curtain wall and with the wall tool active, you unload curtain walls. Solution: If you unload curtain walls, you may be unable to draw another wall, until you reload at least one curtain wall panel.
Non-system panel families cannot be used for non-rectangular panels. If your panel is simple, create an appropriate panel type derived from the system panel family. If not, try making the panel in the wall or roof rectangular, and then	Problem: A non-system panel, such as a glazed or empty panel, cannot have a non-rectangular shape. Solution: This problem might occur if a curtain wall with non-system panels joins to a roof, and the curtain wall does not have a rectangular shape. It would also occur if you create a non-rectangular wall profile and then change that wall to a curtain wall with non-system panels.

using a panel family of the desired (non-rectangular) shape. The wall will then conform to the non-rectangular shape of the panel.

Cannot divide curtain grid by grid line.

Problem: You placed a curtain grid on a sloped glazing, such that the curtain grid division results in a complex piece of geometry that Revit Architecture cannot produce.

Solution: There is no workaround. You must cancel the action.

Currently, only straight walls with straight or arc edges are supported for non-rectangular curtain walls.

Problem: A curtain wall contains an ellipse in one of its sides. This problem could happen if the wall joins to a roof with an ellipse.

Solution: Cancel the action. This type of curtain wall is not supported.

Copy and Paste

Message

Details

Cannot paste selection in [name] view.

Problem: Revit Architecture is unable to paste the selected component in the view.

Solution: If you tried to paste a wall in an elevation view or a section view, you see this message. Try pasting in a plan, reflected ceiling plan, or 3D view. This message also displays if you try to paste a group of components that cannot be pasted into a certain view, for example, a column group into an elevation view.

Elements were deleted. Use Edit Pasted Elements to keep them.

Problem: Revit Architecture requires a proper host for the copied element. For example, a window needs a wall, and a tag or dimension needs reference elements.
Solution: If you tried to paste an element into a location that does not contain a proper host, you see this message. Click Cancel to remove the warning. On the ribbon, click Edit Pasted Elements. In Edit Pasted mode, place the copied element on its proper host. Click Finish to complete the paste process.

TIP The Paste Aligned tool does not provide the Edit Pasted Elements button. If you see this message, you can cancel, and use the Paste tool instead.

Also see [Editing Pasted Elements](#) on page 395.

Roofs

Message

Details

Can't create Curtain Panel. A Panel or a Mullion is probably too small.

Problem: Typically, this problem occurs in a panel on a sloped glazing. A horizontal and vertical curtain grid on a panel are not meeting exactly at a point, creating a small triangular panel within the main panel. The triangular panel cannot be accurately regenerated, because it is too small. This error can result from placing curtain grids, or moving one in such a way that the small triangular panel displays. Also, the triangle can display, if you created vertical grids and then placed a horizontal grid that did not snap to the vertical grids.

Solution: Cancel the placement and/or the movement of the grid. When dividing the panels in a sloped glazing, it is best to start with the placement of horizontal curtain grids and then snap vertical grids to the horizontal grid.

Cannot create curtain panel in opening. The opening is probably too small.

Problem: Typically, this problem occurs in a sloped glazing. A horizontal and vertical curtain grid are not meeting exactly at a point, creating a small triangular panel, which cannot support mullions.

Solution: Cancel the placement of the mullion. When dividing the panels in a sloped glazing, it is best to start with the placement of horizontal curtain grids and then snap vertical grids to the horizontal grid.

All parts of an extruded roof must face upward. Make sure that no part of the sketch lies below any other part of the sketch.

Problem: You have sketched an extruded roof in such a way that a part of the roof will lay under another part. Or you may have drawn vertical lines as part of your roof.

Solution: Sketch the roof edge such that lines join, but do not pass underneath one another. Also, remove any vertical lines in the sketch.

Sketching

Message

Details

Element is slightly off axis and may cause inaccuracies.

Problem: This warning is triggered by elements based on lines that are misaligned—by 1×10^{-9} to .2 degrees—in either the horizontal or vertical directions, or with a line at 45 degrees to the horizontal/vertical direction.

The problem can be caused by sketching or rotating elements when angle snaps are turned off, or it can result from pre-existing elements when you do any of the following:

- Create an element by picking a slightly off-axis face or line.
- Align an element to a slightly off-axis reference.
- Explode an AutoCAD import that contains slightly off-axis lines.
- Create floor area faces on a mass that has slightly off-axis geometry.
- Snap defining line ends to references that are slightly off-axis (such as imported drawings or 2 columns that are not properly aligned).
- Snap defining line ends to references that are positioned correctly in their respective contexts but the line between them is slightly off-axis (such as snapping to 2 different ceiling grids).

Off-axis problems need to be resolved, because Revit Architecture cannot create dimensions between lines that are not exactly parallel, and cannot join or cut geometry if faces are slightly off-parallel or have very small gaps due to off-axis elements.

Solution: Depending on the cause of the problem, do one of the following:

- Drag the end of the off-axis element a short distance and let it snap to the axis.
- Repeat the rotation operation with angle snaps turned on.
- If the inaccuracy is derived from pre-existing elements, correct them and repeat the operation.
- If the problem is caused by imported data, consider correcting it in the original software and re-importing it into Revit Architecture.

Ceiling sketch is invalid.

Problem: Revit Architecture failed to regenerate the ceiling geometry upon executing your last action.

Solution: You cannot ignore this warning. You must cancel the action. This error might occur if you have sketched an opening in a ceiling, and then locked that opening to another element, such as a wall. If you move the wall, the opening moves with it. If the opening should suddenly lose its host (the ceiling), this error would display. You can edit the ceiling sketch and then attempt the action again.

Floor sketch is invalid.	<p>Problem: Revit Architecture failed to regenerate the floor geometry upon executing your last action.</p> <p>Solution: You cannot ignore this warning. You must cancel the action. This error might occur if you have sketched an opening in a floor, and then locked that opening to another element, such as a wall. If you move the wall, the opening moves with it. If the opening should suddenly lose its host (the floor), this error would display. You can edit the floor sketch and then attempt the action again.</p>
Can't cut instance(s) of [component] out of wall.	<p>Problem: Revit Architecture cannot regenerate the geometry to display the moved model component.</p> <p>Solution: If you move a door or a window, or other wall-hosted components, in such a way that Revit Architecture cannot regenerate the geometry properly, this message displays. This might happen if you move a window onto a door in a plan view. Revit Architecture cannot cut both a door instance and a window instance simultaneously. Also, the error might occur if you move a component outside a wall, by either dragging the component, or shortening the wall, such that it cannot host the component. You can either cancel the move or delete the particular instance. Note that [component] is a variable for the particular instance, for example, a 36"X80" door.</p>
The dimension cannot be made constraining.	<p>Problem: While creating a family, you have tried to make a reference dimension constraining.</p> <p>Solution: You cannot turn a reference dimension into a constraint.</p>
Element is too small on screen.	<p>Problem: Revit Architecture prevents you from accidentally drawing the element, typically a wall, reference plane, or line, if it is less than 1mm on the screen.</p> <p>Solution: If you intend to make the element that small, zoom in the view.</p>

Worksets

Message	Details
The central file has been restored from a previous backup. As a result, the following workset(s) edited by you have been rolled back.	<p>Problem: You had a workset editable by you in this local file. Another user has replaced the central file with a previous backup copy, where the workset you are editing either does not exist or has a previous version.</p> <p>Solution: Find out why the central file was restored. If it must stay restored, you have to redo your changes again, by making another local copy. You can copy elements from your current local copy, if that is helpful.</p>

Creating Macros with Revit VSTA

26

This topic explains how to create macros in Revit. We will describe macro capabilities, the overall workflow, specific installation steps, a development environment called Revit VSTA, code examples, frequently asked questions, and related information about the Revit SDK.

Getting Started with Macros

First, let's answer the question: "What are macros, and why would you use them?" Macros are programs that are designed to help you save time, by automating repetitive tasks. Each macro performs a series of pre-defined steps to accomplish a particular task. The steps should be repeatable and the actions predictable.

For example, you might define a macro to add a grid to your project, to rotate a selected object, or to collect information about the square footage of all the rooms in your structure. Other general examples include:

- Locating and extracting Revit content to external files
- Refining geometry or parameters
- Creating many types of elements
- Importing and exporting external file formats

Revit provides an Application Programming Interface (API) that allows you to extend the functionality of the product. You can add customized commands to the Add-Ins tab ► External Tools panel, or add new panels and tools.

In addition to those API extensions, you can use the API to define macros that run in Revit. Unlike external commands and external applications, the macro functionality is available to Revit from the Revit VSTA add-in. We will explain the API differences later in this topic, but for experienced developers, note that you do not need to register the macros in Revit.ini, or add RevitAPI.dll as a reference.

VSTA is an acronym for Visual Studio Tools for Applications. It is a Microsoft technology that provides the .NET framework for creating macros in C# and VB.NET based on specific applications. VSTA is the next evolution of Visual Basic for Applications (VBA) that appears in several existing Autodesk applications.

About Revit VSTA Installation

The Revit VSTA application is now installed with Revit Architecture by default. Also note that Revit uses Microsoft .NET Framework version 3.5. Older applications compiled using .NET 2.0 will continue to function unless otherwise affected by changes in the Revit 2010 API.

Experienced Revit VSTA users should refer to [Upgrading from Revit VSTA 2009](#) on page 1422 for important upgrade information.


Expect API Changes

It is very likely that the Revit API will change in subsequent product releases. This means that after installing the next Revit release, you will need to edit and rebuild your macros to reflect the API changes.

Upgrading from Revit VSTA 2009

If you are upgrading from Revit VSTA 2009, some file management may be required to update and operate macros correctly in Revit. Be sure to familiarize yourself with changes in the The Revit Software Development Kit (SDK) and the following macros upgrade information.

Upgrading Document-Level Macros

- 1 Open the project containing embedded document-level macros. Once opened, the project has been updated.
- 2 Click Manage tab ► Macros panel ► Macro Manager.
- 3 Click each Document-level tab to update.
- 4 When complete, click Close.
- 5 On the Quick Access toolbar, click  (Save).
- 6 Close the project.

No further steps are required unless the macro code needs to be manually edited.

Upgrading Application-Level Macros

- 1 Copy the directories in *C:\Program Files\Revit Architecture 2009\Program\VSTAMacros\AppAddIns\defaultAddIns*.
- 2 Paste the directories into *C:\Program Files\Autodesk Revit Architecture 2010\Program\VSTAMacros\AppHookup*.
- 3 Launch Revit
- 4 Click Manage tab ► Macros panel ► Macro Manager.
- 5 Click the Application tab.
- 6 When complete, click Close.

NOTE In the event there are compatibility issues in the upgrade process, copies of the original project (for document-level macros) and application macros are placed in My Documents\Revit Architecture 2010 VSTA and appended with ~R. These files may be hidden depending on your Windows Explorer folder settings.

The code in projects may need to be manually modified in order to successfully build and run the macros in Autodesk Revit Architecture 2010. Consult the SDK for the list of changes to the API in order to address any version compatibility issues.

Revit VSTA Tools

You can use the Revit VSTA macro features in all Revit products: Revit Architecture, Revit Structure, and Revit MEP. In this topic, we refer to any of these products generically as Revit.

Revit VSTA provides:

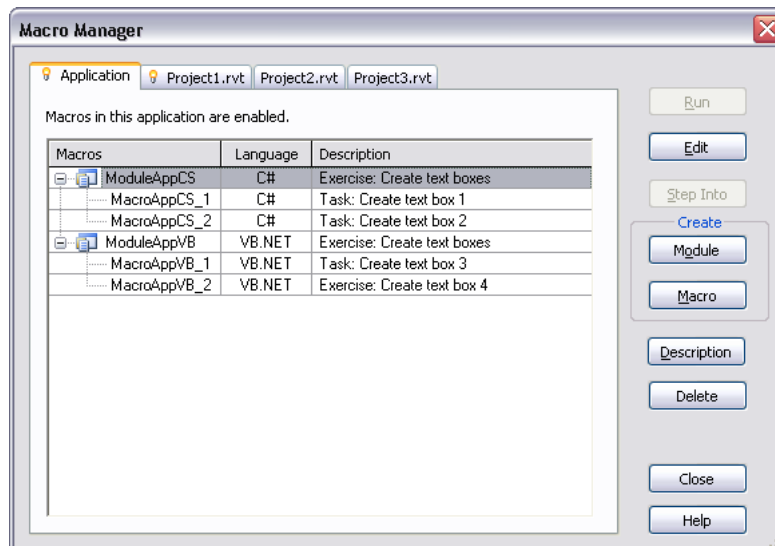
- Tools on the Manage tab ► Macros panel:
 - Macro Manager
 - Macro Security
- Macro Manager, a user interface launched by clicking Manage tab ► Macros panel ► Macro Manager. The Macro Manager presents a list of macros you built previously that you can run, edit, or debug (StepInto). Macro Manager also provides options to create new macros using different types of templates.
- An Integrated Development Environment (IDE) built into the product, the Revit VSTA IDE. You can launch it several ways, such as by selecting the Macro, Edit, or StepInto buttons from the Macro Manager.
- Access to the Revit API.
- Revit security settings for both application-level and document-level macros.

Using Macro Manager and the Revit VSTA IDE


Macro Manager is the user interface for:

- Selecting an option that launches the Revit VSTA IDE, where you can add, edit, build and debug your macros.
- Running a previously built macro from a categorized list.


Shown below is the Macro Manager screen:



The tabs indicate the scope or level of a macro.

- **Application tab.** The Application tab lists macro modules available to all opened Revit projects in the current instance of the Revit application. It is always the first tab to the left and active (indicated by the  icon). It is always available, whether projects are open.

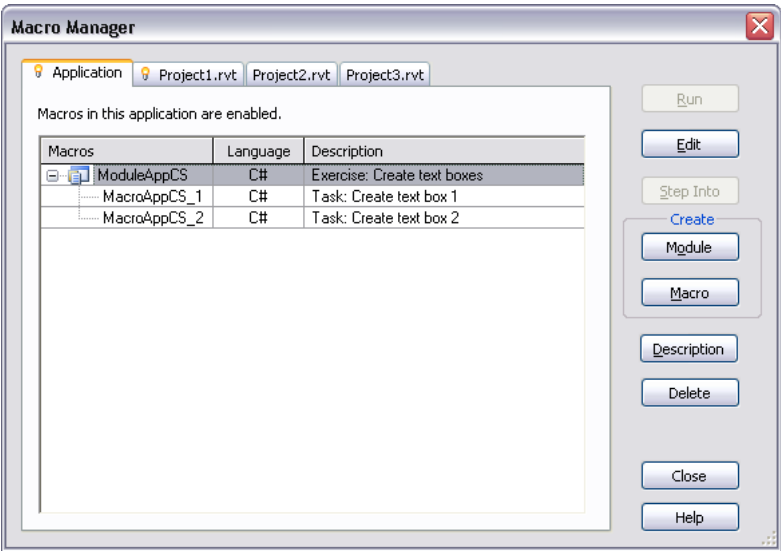
NOTE If you send the RVT file to a person on another computer, application level macros would not be available.

- **Active document tab.** The active document tab represents the currently active project in Revit. The project does not necessarily contain embedded macros as in this case, although it can. The tab bears the name of the active project (Project1 in this case) and is indicated by the  icon. This tab is not visible when a project is not open.
- **Inactive document tabs.** Inactive document tabs represent open projects that contain embedded macros (see below). The tab bears the name of the project (Project2 and Project3 in this case).




You add, modify, build, and delete modules and macros from these tabs.




Macros and Modules

A module is an organizational grouping of macros. Macros can be either independent within a module when they run, or share code or utilities with each other. They are arranged in the Macro Manager as follows with the macros organized under their parent module.



Macros within a module are seen and built together. The icons representing the module also show their current state.

Icon	Macro State
	The module is successfully built, enabled, and loaded. This module is ready to be run. See Running Macros in the Macro Manager on page 1433.
	The module has been edited, but not built. See Building Macros in the Revit VSTA IDE on page 1432.
	The module is disabled. See Macro Security on page 1434.

Icon	Macro State
	The module failed to build. See Building Macros in the Revit VSTA IDE on page 1432.
	The module failed to load.
	The module is corrupt.

Application-level and Document-level Modules

Fundamentally, application-level macro tools are written to be useful in any document in nearly any Revit session. Additionally, they do not require a project to be open in Revit to run. This allows you the flexibility to:

- Customize the Revit UI
- Add tools to Revit Architecture
- Modify documents on opening
- Batch open documents
- Apply new standards or settings to new documents

Should these uses be implemented, it is good practice to create application-level macros that initiate transactions needed by the macro.

Document-level macros tools are written for specific projects and are saved in the Revit project.

About Revit VSTA Implementation Languages

You create macros in Revit VSTA using the implementation language, C# or VB.NET. Your selection determines the type of source code template generated and edited in Revit VSTA IDE.

Macro Project File Locations

When you work in the Revit VSTA IDE, you must save and build the macros successfully before they will display in the Macro Manager's categorized list. Before we look at an example of the initial code loaded into the Revit VSTA IDE, let's discuss where macro project files reside on your computer.

Application-level macro projects are stored in a subfolder of the Revit installation directory. For example:

C:\Program Files\Autodesk Revit Architecture 2010\Program\VSTAMacros\AppHookup...

Document-level macro projects are stored within an RVT file. On disk, when the associated RVT project opens, any built and saved macro(s) are stored temporarily in:

C:\Program Files\Autodesk Revit Architecture 2010\Program\VstaMacros\DocHookups\...

However, these Document-level macro files are deleted from your local computer when their corresponding Revit project document (.rvt) closes. The saved document-level macros are stored in the RVT file.

Now that we have introduced the overall tools and processes, let's look at the specific tasks.

Basic Workflow for Revit VSTA Macro Development

The overall workflow for creating and using macros is as follows.

- 1 Click Manage tab ► Macros panel ► Macro Manager to open the Macros Manager.
- 2 Create modules based on application-level or document-level design. See [Creating Modules](#) on page 1426.
- 3 Define macros for the module with your implementation code using the Revit VSTA IDE. See [Creating Macros](#) on page 1427.
- 4 Build the module and its macros. See [Building Macros in the Revit VSTA IDE](#) on page 1432.
- 5 Run the macros in the Macro Manager to observe the results. See [Running Macros in the Macro Manager](#) on page 1433.

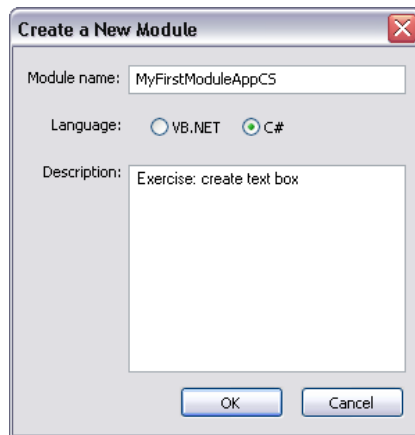
Creating Modules

To create macros, perform the following steps.

NOTE If the application or current document already contains modules, macros must be enabled in the Macro Security settings. See [Macro Security](#) on page 1434.

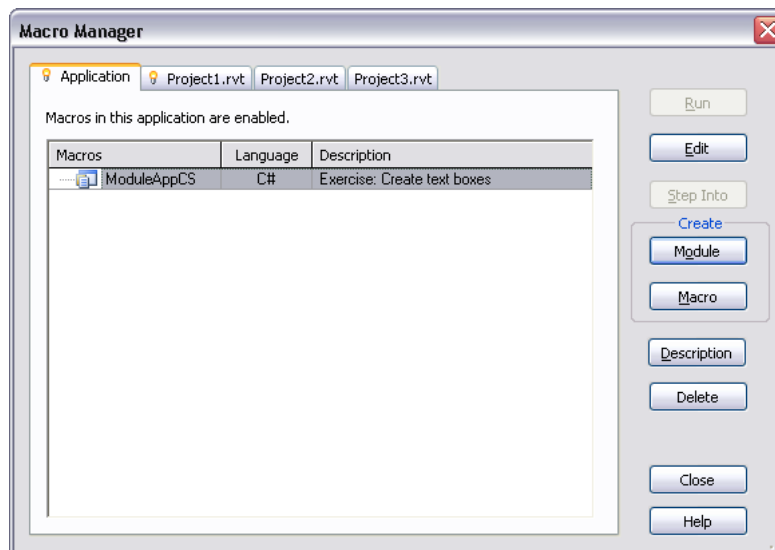
- 1 Click Manage tab ► Macros panel ► Macro Manager to open the Macros Manager.
- 2 Select the Application tab (for application-level macros) or a Project tab (for document-level macros).
- 3 In the Create section of the Macro Manager dialog, click Module.
The Create a New Module dialog opens.
- 4 Enter the following information:
 - Enter a name in the Module name field.
 - Select either C# or VB.NET in the Language field.
 - Optionally, add a brief description of the module in the Description field.

Creating an Application-level module in C#



- 5 Click OK.

The new module is created and listed in the Macros Manager. One or more macros may now be added.



Creating Macros

Developers know that in C#, you use the keyword `this` to return the current instance of an object. In VB.NET, you use the keyword `Me` to return the current instance of an object.

In Revit, all of the Application-level macros are associated with the `Application` object. Thus using the `this` keyword (C#) or the `Me` keyword (VB.NET) always returns the API `Application` object. This includes all the application-wide data and settings.

In Document-level macros (specific to RVT), the `this` keyword (in C#) or the `Me` keyword (VB.NET) returns the API `Document` object. If you need to access the `Application` object from a Document-level macro, use:

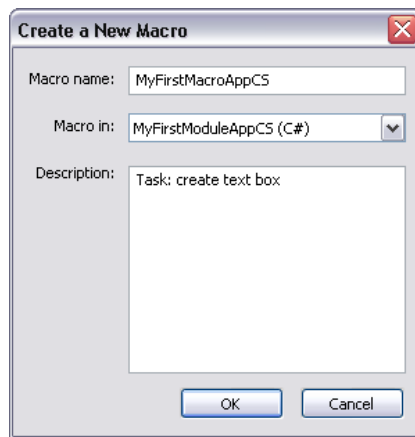
```
this.Application
```

or:

```
Me.Application
```

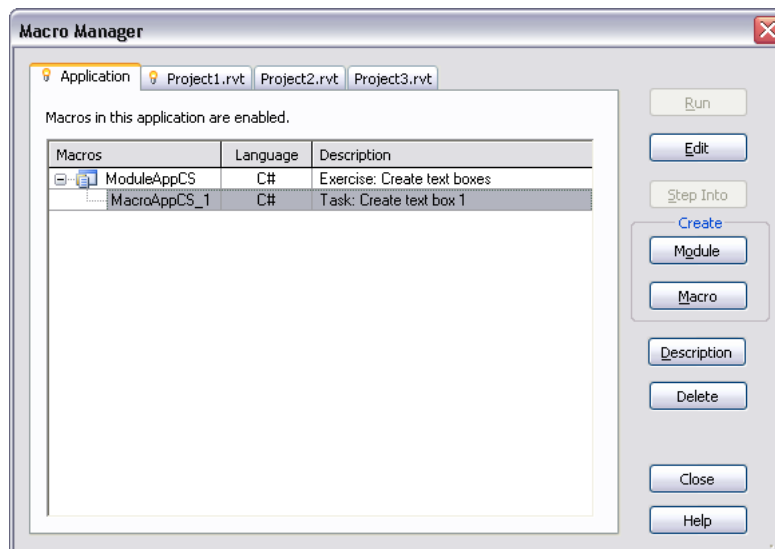
NOTE If the application or current document already contains macros, macros must be enabled in the Macro Security settings. See [Macro Security](#) on page 1434.

- 1 In the Macro Manager, select the `Application` tab (for application-level macros) or a `Project` tab (for document-level macros) where the macro will be placed.
- 2 In the `Create` section of the Macro Manager dialog, click `Macro`.
The `Create a New Macro` dialog opens.
- 3 Enter the following information:
 - Enter a name in the Macro name field.
 - Select a parent module from the Macro in list. The language of the parent module will define the language of the macro.
 - Optionally, add a brief description of the macro in the Description field.

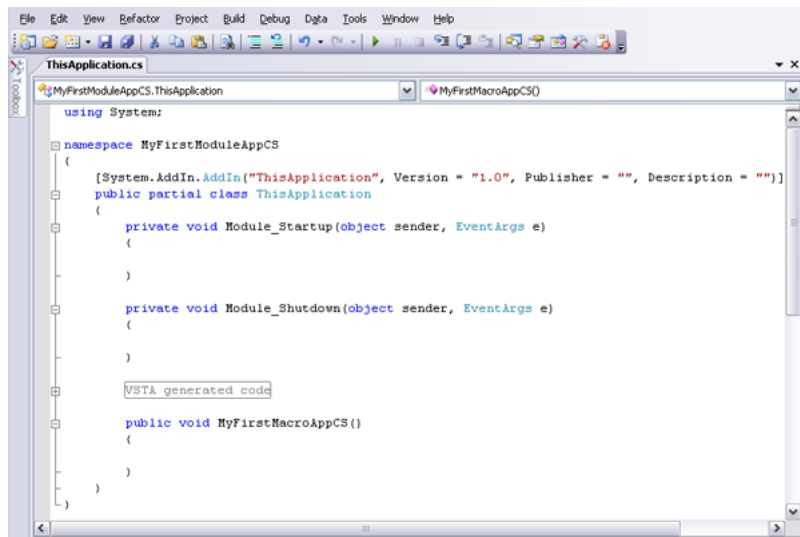


4 Click OK.

The new macro is placed in the parent module in the Macro Manager.



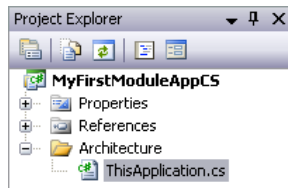
The Revit VSTA IDE application launches to write the macros. It displays a starting template for the macros in a specific programming language.



Notice that in this C# template for application-level macros, Revit VSTA has already:

- Included the necessary using directives.
- Identified the module namespace (MyFirstModuleAppCS in the graphic above).
- Started the ThisApplication class definition.
- Started the methods for Module_Startup() and Module_Shutdown().
- Started your new macro's method (MyFirstMacroAppCS in the graphic above), giving you the opportunity to add your implementation code between the braces.

Also, note that the Revit VSTA Project Explorer shows your context.



5 In the main window of the IDE, you can now enter your source code. See [Macro Source Code Examples](#) on page 1430.

6 Click File ► Save <macro name>, then close the Revit VSTA IDE.

7 Repeat steps 6 through 10 for any additional macros needed in the module.

NOTE Remember that you must successfully build and save module projects in the Revit VSTA IDE, before they will display in the Macro Manager's categorized list. See [Building Macros in the Revit VSTA IDE](#) on page 1432.

Optional Tools

- Click Description to view a description of a selected module or macro in its entirety. This is useful when the Description column of the Macro Manager is truncated.
- See [Modifying and Removing Modules and Macros](#) on page 1433.

Macro Source Code Examples

The following four code samples can be used to explore the Macro Manager tools and better understand how they interact with the VSTA IDE.

C# Application-Level Macro Code Example

In the IDE, use the following code for the method:

```
public void MyFirstMacroAppCS()
{
    Autodesk.Revit.Geometry.XYZ baseVec = this.Create.NewXYZ(1.0, 0.0, 0.0);
    Autodesk.Revit.Geometry.XYZ upVec = this.Create.NewXYZ(0.0, 0.0, 1.0);
    Autodesk.Revit.Geometry.XYZ origin = this.Create.NewXYZ(0.0, 0.0, 0.0);
    Autodesk.Revit.Enums.TextAlignFlags align = Autodesk.Revit.Enums.TextAlignFlags.TEF_ALIGN_LEFT | Autodesk.Revit.Enums.TextAlignFlags.TEF_ALIGN_TOP;
    string strText = "My First Macro, App level, C#!";
    double lineWidth = 4.0 / 12.0;
    Autodesk.Revit.Elements.View pView = this.ActiveDocument.ActiveView;
    this.ActiveDocument.BeginTransaction();
    this.ActiveDocument.Create.NewTextNote(pView, origin, baseVec, upVec, lineWidth, align, strText);
    this.ActiveDocument.EndTransaction();
}
```

Please note that because this application level macro is written to modify a document, you must begin a transaction (`this.ActiveDocument.BeginTransaction();`) and end the transaction (`this.ActiveDocument.EndTransaction();`) for it to run properly.

In the example, the Revit API Geometry.XYZ class is used to define a position (with X, Y, Z coordinates) for a text note that the macro will add the text box to the active view of the active document.

The macro placed text box



TIP Be sure to build your project in the Revit VSTA IDE, before trying to run it from the Macro Manager.

VB.NET Application-Level Macro Code Example

In the IDE, use the following code for the method:

```

Public Sub MyFirstMacroAppVB()
    Dim baseVec As Autodesk.Revit.Geometry.XYZ = Me.Create.NewXYZ(1.0, 0.0, 0.0)
    Dim upVec As Autodesk.Revit.Geometry.XYZ = Me.Create.NewXYZ(0.0, 0.0, 1.0)
    Dim origin As Autodesk.Revit.Geometry.XYZ = Me.Create.NewXYZ(0.0, 0.0, 0.0)
    Dim align As Autodesk.Revit.Enums.TextAlignFlags = Autodesk.Revit.Enums.TextAlign
    Flags.TEF_ALIGN_LEFT Or Autodesk.Revit.Enums.TextAlignFlags.TEF_ALIGN_TOP
    Dim strText As String = "My First Macro, App Level, VB.NET!"
    Dim lineWidth As Double = 4.0 / 12.0
    Dim pView As Autodesk.Revit.Elements.View = Me.ActiveDocument.ActiveView
    Me.ActiveDocument.BeginTransaction()
    Me.ActiveDocument.Create.NewTextNote(pView, origin, baseVec, upVec, lineWidth, align,
    strText)
    Me.ActiveDocument.EndTransaction()
End Sub

```

In this VB.NET example, we used the `Me` keyword pointer (instead of the `this` keyword pointer). Also we used a different `strText` value for the Text Note.

Please note that because this application level macro is written to modify a document, you must begin a transaction (`Me.ActiveDocument.BeginTransaction()`) and end the transaction (`Me.ActiveDocument.EndTransaction()`) for it to run properly.

TIP Be sure to build your project in the Revit VSTA IDE before trying to run it from the Macro Manager.

For this example, when you build the project in the Revit VSTA IDE, notice that you are building the `AppVisualBasic` project. Your Application-level VB.NET macro's code resides in `ThisApplication.vb`. You can use the IDE's Project Explorer to see its location on disk. To run your newly built macro, select it in Macro Manager and click Run. Then if necessary, right-click in the active view, and select Zoom to Fit from the menu to see the text note added by your macro.

The macro placed text box



C# Document-Level Macro Code Example

In the IDE, use the following code for the method:

```

public void MyFirstMacroDocCS()
{
    Autodesk.Revit.Geometry.XYZ baseVec = this.Application.Create.NewXYZ(1.0, 0.0, 0.0);
    Autodesk.Revit.Geometry.XYZ upVec = this.Application.Create.NewXYZ(0.0, 0.0, 1.0);
    Autodesk.Revit.Geometry.XYZ origin = this.Application.Create.NewXYZ(0.0, 0.0, 0.0);
    Autodesk.Revit.Enums.TextAlignFlags align = Autodesk.Revit.Enums.TextAlign
    Flags.TEF_ALIGN_LEFT | Autodesk.Revit.Enums.TextAlignFlags.TEF_ALIGN_TOP;
    string strText = "My First Macro, Doc level, C#!";
    double lineWidth = 4.0 / 12.0;
    Autodesk.Revit.Elements.View pView = this.ActiveView;
    this.Create.NewTextNote(pView, origin, baseVec, upVec, lineWidth, align, strText);
}

```

Notice the use of `this.Application` in this document-level macro. For related information, see the previous section about accessing the `Application` object from document-level macros.

TIP Be sure to build your project in the Revit VSTA IDE, before trying to run it from the Macro Manager.

For this example, when you build the project in the Revit VSTA IDE, also notice that you are building the DocCSharp project. Your document-level C# macro's code resides in ThisDocument.cs. You can use the IDE's Project Explorer to see its temporary location on disk. Recall that the code for successfully built document-level macros are stored in the RVT file after you save the RVT file. The project files are removed from the temporary location when you exit Revit.

The macro placed text box



VB.NET Document-Level Macro Code Example

In the IDE, use the following code for the method:

```
Public Sub MyFirstMacroDocVB()  
    Dim baseVec As Autodesk.Revit.Geometry.XYZ = Me.Application.Create.NewXYZ(1.0, 0.0, 0.0)  
    Dim upVec As Autodesk.Revit.Geometry.XYZ = Me.Application.Create.NewXYZ(0.0, 0.0, 1.0)  
    Dim origin As Autodesk.Revit.Geometry.XYZ = Me.Application.Create.NewXYZ(0.0, 0.0, 0.0)  
    Dim align As Autodesk.Revit.Enums.TextAlignFlags = Autodesk.Revit.Enums.TextAlignFlags.TEF_ALIGN_LEFT Or Autodesk.Revit.Enums.TextAlignFlags.TEF_ALIGN_TOP  
    Dim strText As String = "My First Macro, Doc Level, VB.NET!"  
    Dim lineWidth As Double = 4.0 / 12.0  
    Dim pView As Autodesk.Revit.Elements.View = Me.ActiveView  
    Me.Create.NewTextNote(pView, origin, baseVec, upVec, lineWidth, align, strText)  
End Sub
```

TIP Be sure to build your project in the Revit VSTA IDE, before trying to run it from the Macro Manager.

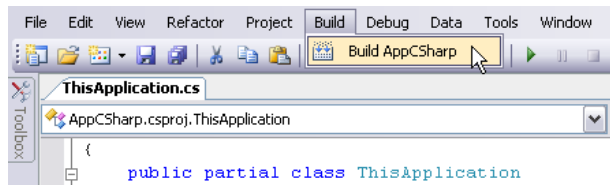
For this example, when you build the project in the Revit VSTA IDE, notice that you are building the DocVisualBasic project, and your Document-level VB.NET macro's code resides in ThisDocument.vb. You can use the IDE's Project Explorer to see its temporary location on disk. Recall that the code for successfully built Document-level macros are stored in the RVT file after you Save the RVT file. The project files are removed from the temporary location when you exit Revit.

The macro placed text box



Building Macros in the Revit VSTA IDE

- 1 Open the project that hosts the document-level macros. If you are only building application level-macros, skip to step 2.
- 2 Click Manage tab ► Macros panel ► Macro Manager to open the Macros Manager.
- 3 Select the either the Application tab (for application-level macros) or the tab named by the project (for document-level macros).
- 4 Expand the module containing the macros needed to be built.
- 5 Select the macros and click Edit.
- 6 In the Revit VSTA IDE, select the macro specific Build option from the drop-down list.



In this example, notice that you are building a macro named AppCSharp. The macro application-level C# macro's code resides in ThisApplication.cs. You can use the IDE's Project Explorer to see its location on disk.

7 Close the Revit VSTA IDE.

If your code is set up correctly, you should see a Build Succeeded message in the lower-left corner of the Revit VSTA application window. You do not build macros in the Macro Manager.

Modifying and Removing Modules and Macros

In the Macro Manager, select the Application tab (for application-level macros) or a Project tab (for document-level macros) of the macros to be modified.

Modules

To delete a module, select it, and click Delete. Deleting the module will permanently remove it and its associated macros.

To modify a module, select it, and click Edit. The IDE will open the module, and you can edit it and its associated macros.

Macros

To delete a macro, select it and click Delete. Deleting the macro does not permanently remove it. It will be commented out in the source code. To permanently delete the macro, it will need to be removed manually by editing it in the IDE.

To modify a macro, select it, and click Edit. The IDE will open the module and you can edit it, its module, and its associated macros.

Running Macros in the Macro Manager

- 1 Click Manage tab ► Macros panel ► Macro Manager.
- 2 Select a macro.
- 3 Click Run.

Optionally, double-click individual macros in the Macro Manager to run them.

Macros will run only from the Application tab and the currently active document, not those in inactive documents. Macros security must also be set appropriately. See [Macro Security](#) on page 1434.

Using the StepInto Option

You can debug your macros by using the StepInto option in Macro Manager.

- 1 Open the code for your macro in the IDE.
- 2 You can optionally set breakpoints in the macros. Click in the left margin of the code window, or click in the code and press *F9* or Toggle Breakpoint in the Debug menu. Break points will display as red circles.

- 3 In the Macro Manager, select your macro from the categorized list, and click StepInto. The IDE will enter debug mode and stop the macro at the first line.
 - Press *F10* to step through the macro code, line by line.
 - Press *F5* or Continue to move the next breakpoint if they were set in Step 2.

WARNING Avoid switching Windows users or allowing Windows to enter sleep mode while using Stepinto. In some cases, this can cause errors and unexpected data loss.

In the Revit VSTA IDE, you can use Watch, Locals, and other options to perform debugging tasks like checking variable values. For more debugging information, see the VSTA IDE Help.

NOTE Currently Module_Startup and Module_Shutdown cannot be debugged. Because Revit VSTA debugging is macro centric, the module must be loaded before debugging begins.

Macro Security

You have the option to enable and disable macros by default. This protects your work and computer from running dangerous malicious code unexpectedly. When working with macros, it is important to be wary of the risks involved with their vulnerabilities. Only run known macros from trustworthy sources.

Setting Application-level macro security

- 1 Disabling Application-level macros restricts access to both the Run and StepInto tools on the Macro Manager. You will still be able to see, edit, and build the code, but modifications will not change the current module status.

Click Manage tab ► Macros panel ► Macro Security.
- 2 Select the Macros tab.
- 3 In the Application Macros Security Settings section, select either Enable application macros or Disable application macros.
- 4 Click OK.
- 5 Close and reopen Revit Architecture.

NOTE Any changes to application-level macro settings will take effect after Revit Architecture is restarted. The setting will persist until it is changed.

Setting Document-level macro security

- 1 Disabling document-level macros restricts access to both the Run and StepInto tools on the Macro Manager for any project opened in Revit Architecture. You will still be able to see, edit, and build the code, but modifications will not change the current module status.


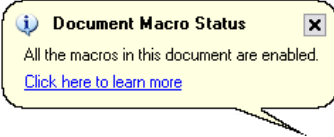

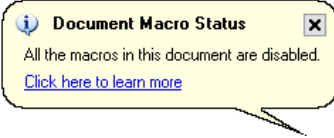
Click Manage tab ► Macros panel ► Macro Security.
- 2 Select the Macros tab.
- 3 In the Document Macros Security Settings section, select one of the following:
 - **Ask before enabling document macros.** This is the default setting. Macros are disabled, but you will be prompted to enable them, if macros are present when a Revit project is opened. You can then choose to enable macros whenever they are detected.
 - **Disable document macros.** Disables document-level macros when a project is opened. To enable macros in this state, you must close the project, adjust the Macro Security settings, and reopen the project.

- **Enable document macros.** Enables document-level macros when a project is opened. To disable macros in this state, you must close the project, adjust the Macro Security settings, and reopen the project.

You should avoid the Enable document macros setting if possible. You will not be warned when opening a document about macros and potentially dangerous and malicious code that can run. It is recommended that you use Ask before enabling document macros, if you are not familiar with Revit macros or frequently open projects from unfamiliar sources. The Enable document macros setting should only be used when you know the source of the embedded macros.

Document-level Macro Status and Warnings

To help you identify the current status of macro security, you are given status icons and notification prompts in the lower right corner of the Revit application frame.

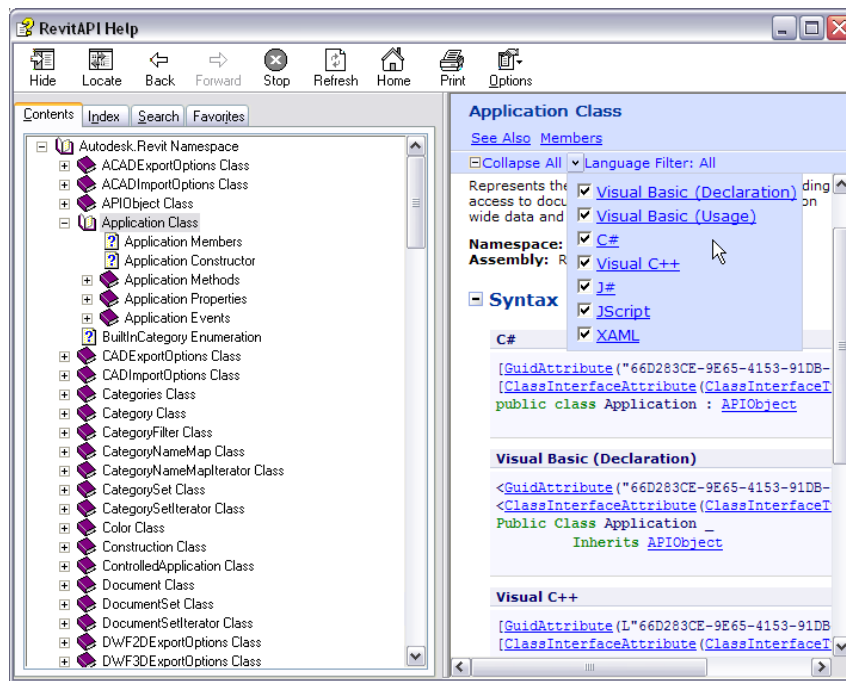
Macro Security Setting	Status Icon	Notification when Opened
Enable document macros		
Disable document macros		
Ask before enabling document macros	User-defined.	A warning dialog prompts you to either enable or disable the macros. The resulting answer displays the correct icon. This is the default setting.

Revit SDK, API Reference Documentation, VSTA Samples

The Revit Software Development Kit (SDK) contains useful resources to help you understand the Revit API and to create macros. The SDK includes the Revit API reference documentation, the full SDK API samples, and the Revit VSTA samples. The Revit SDK is available on:

- The Revit DVD
- The Autodesk web site, at <http://www.autodesk.com/revit-sdk>.
- The Autodesk Developer Network, <http://adn.autodesk.com>. If you are interested, please contact your Autodesk representative for information about getting an ADN account.

The SDK is packaged in a ZIP file. After unzipping the SDK and agreeing to the license text, look for the Revit*API.chm Help file. On a Windows computer, open the CHM file and refer to the classes, properties, and methods described there. For example:



Also see the Revit VSTA samples that are part of the SDK. You can find them under:

`\Revit <release> SDK\VSTA Samples\...`

The next section explains how to integrate the VSTA Samples into your Revit VSTA projects.

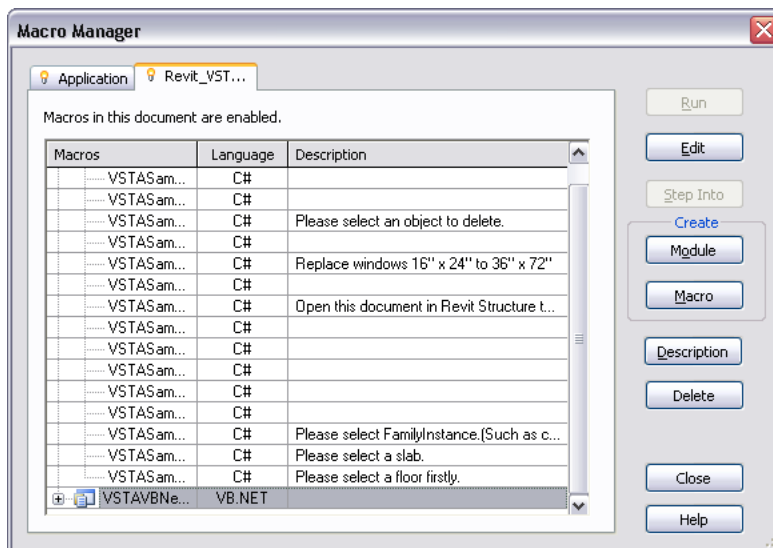
Using the Revit VSTA Samples from SDK

You can learn various API techniques by using the Revit VSTA samples provided with the SDK.

Copy and open the following Revit project files from `\Revit <release> SDK\VSTA Samples\`:

- Revit_VSTA_Samples.rvt
- Revit_VSTA_MEP_Samples.rvt
- Revit_VSTA_Family_Samples.rfa

Included in this RVT file are several document-level macros. In Revit, start the Macro Manager, select one of the document-level macros, and select Run. Note that when you open `Revit_VSTA_Samples.rvt` from the SDK, it may contain more samples than the ones shown in the following screen, and the macro methods may be named differently.



These macros have been preconfigured to run in Revit. In the Macro Manager, you can also select any of the VSTA sample macros, and click Edit to see the code created to run that sample. You can also select any of the VSTA sample macros and click Edit to see the code created to run that sample.

Revit VSTA Application-level macros samples are provided with the SDK in `\Revit <release> SDK\VSTA Samples\`:

- GetTimeElapsedd_CSharp
- GetTimeElapsedd_VBNet
- Rooms

Copy these directories into `C:\Program Files\Autodesk Revit Architecture 2010\Program\VstaMacros\AppHookup`, and then launch Revit.

NOTE Be sure the copied directories are writable. The application-level macros will not run correctly if they are read-only.

Revit API Differences

Quick Reference

The following table summarizes differences between the standard Revit API and the Revit Macro API.

Feature or Capability	Standard Revit API	Revit Macro API
Declaration	Must implement <code>IEternalCommand</code> interface and its <code>Execute</code> method.	Declare a public method with no parameters and void return type in the <code>ThisApplication</code> or <code>ThisDocument</code> class.
Application object	Access the <code>Application</code> object through <code>externalCommandData.Application</code>	The <code>this</code> keyword in C# points to the <code>Application</code> object for application-level macros, and points to the <code>Document</code> object for document-level macros. (Use the <code>Me</code> keyword in VB.NET). For document-level macros, <code>this.Application</code>

Feature or Capability	Standard Revit API	Revit Macro API
		ation points to the Application object (Me.Application in VB.NET).
new operator	Some Revit API objects can be created directly by new operator, such as Geometry.XYZ. For example: XYZ a = new XYZ(1.0, 0.0, 0.0)	The Revit API objects that can be created by the new operator in external commands cannot be created by the new operator in macros. Instead, they must be created by Application.Create.NewXXX methods. For example, in a C# document-level macro: XYZ a = this.Application.Create.NewXYZ(1.0, 0.0, 0.0); In a VB.NET document-level macro: Dim a As Autodesk.Revit.Geometry.XYZ = Me.Application.Create.NewXYZ(1.0, 0.0, 0.0) See the MyFirstMacro* examples in this topic.
Ribbon	API external applications can create RibbonPanels, RibbonItem, Pull-downButton and PushButton for each external command through an external application.	Not supported.
Types	APIObjectType APIObject = this.Application.Create.New APIObjectType()	APIObjectType APIObject = this.Application.Create.New APIObjectType()
	<p>1 typeof(APIObjectType) and APIObject.GetType() returns the RevitAPI type.</p> <p>2 type of(APIObjectType). ToString() and APIObject.GetType().ToString() returns "namespace. APIObjectType" (FullName).</p>	<p>1 typeof(APIObjectType) returns the proxy type, but APIObject.GetType() returns the RevitAPI type. So use APIObject.GetType() != typeof(APIObjectType) in Macro.</p> <p>2 typeof(APIObjectType). ToString() returns "namespace.APIObjectType" (FullName), but APIObject.GetType().ToString() returns "Type: APIObjectType".</p>
Generic Types	Supported	Not supported. The major items in the standard API that are not supported are the generic events supported on Autodesk.Revit.Application and Autodesk.Revit.Document and the batch creation utilities in Autodesk.Revit.Creation.ItemFactoryBase and Autodesk.Revit.Creation.Document.
SuspendUpdating	using (SuspendUpdating aSuspendUpdating = new SuspendUpdating(doc)) { }	SuspendUpdating aSuspendUpdating = app.Create.NewSuspendUpdating(app.ActiveDocument); aSuspendUpdating.Dispose(); If the SuspendUpdating object is not disposed, regeneration occurs when the transaction is closed. This might

Feature or Capability	Standard Revit API	Revit Macro API
		happen outside the macro code and thus the macro can't handle any errors.
Indexer Properties	<p>In C#, supported using methods named</p> <pre>get_Property(index) set_Property(index)</pre> <p>In VB.NET, C++ and other languages, supported using the indexer</p> <pre>Property[index]</pre>	<p>In both C# and VB.NET, supported using methods named:</p> <pre>get_Property(index) set_Property(index)</pre>

Integrating Macros into Revit VSTA

Let's walk through the steps to integrate a macro into a Revit VSTA project. You can skip this section if the samples described in the section [Using the Revit VSTA Samples from SDK](#) on page 1436 meet your needs.

This section explains where to create folders in the IDE projects that correspond to resources on the file system, how to add required references, and how to define properties. Those steps were done for you in the macros that were built into Revit_VSTA_Samples.rvt, which is provided on the SDK.

Add Required References

If your macro presents a user interface, you will need to add required references to your project. For example, in the SDK VSTASampleRooms macro, we need to reference:

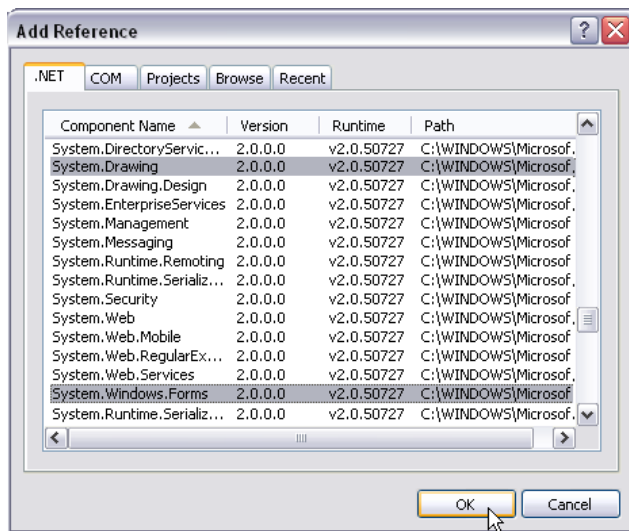
- 1 `System.Windows.Forms`
- 2 `System.Drawing`

Starting in the Macro Manager, select the project type and click Edit.

In the IDE, go to the Project Explorer. By default, it is docked on the right-side of the display.

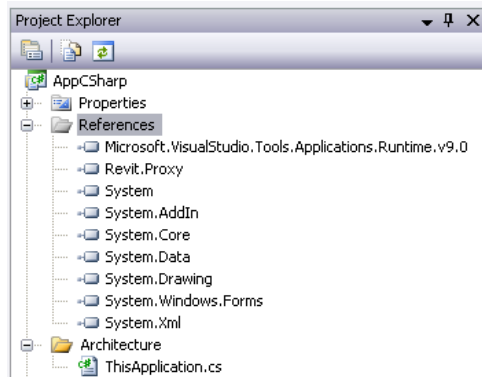
For the macro project (example: AppCSharp), right-click on the References section and select Add Reference from the menu.

In the Add Reference dialog, find and select `System.Drawing` and `System.Windows.Forms` on the list. Hold down the Ctrl key for the multi-select operation. For example:



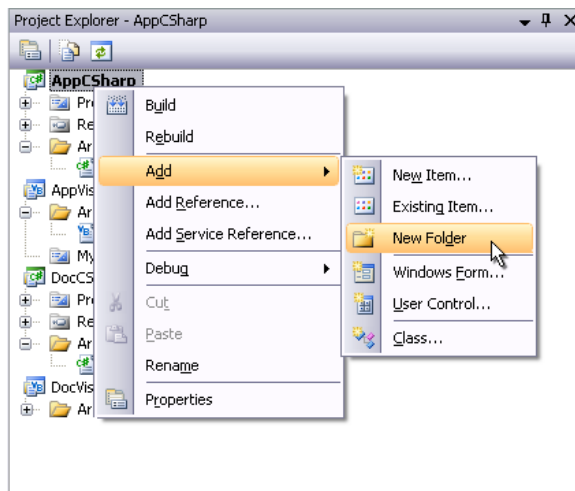
When you are ready, click OK.

The IDE's Project Explorer is updated with the references:



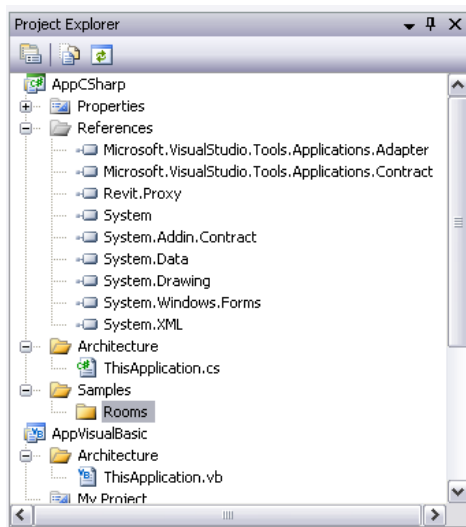
Create Folders in Revit VSTA IDE

In the IDE's Project Explorer, right-click on the macro project, and select Add ► New Folder from the menu. For example:



Name the folder. In this example, we call it Samples. Then right-click on the Samples folder entry, and click Add ➤ New Folder again to add a secondary folder, such as Rooms.

Here is the resulting Project Explorer screen:



Outside of the IDE, use Windows Explorer to navigate to the Revit installation folders, and find the VstaMacros folder. Notice that the corresponding \Samples\Rooms subfolders have been created in this location.

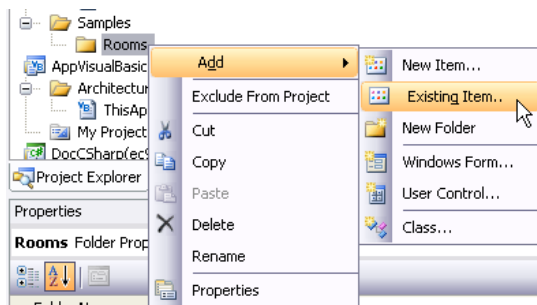
Copy Your Macro to File System Folder

Still outside of the Revit VSTA IDE, copy your macro's files to the subfolder you created.

NOTE If your macro uses a ResX file, copy it too.

Add Existing Files to Macro Project in IDE

Return to the Revit VSTA IDE. In the Project Explorer (to continue this example), right-click on the folder you created for your macro, and select Add ➤ Existing Item from the menu. For example:



In the resulting IDE dialog, browse to the corresponding subfolder on the file system (such as the Revit SDK VSTA Sample directory), under your Revit installation folder, select all the files that comprise the macro, and click Add.

In this example, the refreshed IDE Project Explorer for AppCSharp contains:

Resources.resx Properties

Note that one of the Revit VSTA samples, GridCreation, has a dependency on a resources.resx file. Before experimenting with the GridCreation sample, set the ResX file in the Revit VSTA IDE. This was already done for you in the document-level samples built into Revit_VSTA_Samples.rvt (from the SDK). However, for macros you develop yourself, you may need to define properties in the project's resources.resx file. This section shows an example.

In the Project Explorer, navigate to the Properties folder for your macro. For example: AppCSharp ► Samples ► GridCreation ► Properties.

Highlight the resources.resx file.

In the Properties pane, select the Custom Tool property, and enter `ResXFileCodeGenerator` in the value column. For example:

Restoring Revit.Proxy.dll

Revit.Proxy.dll is a required reference for the interaction between the Macro Manager and Revit VSTA IDE. If it is inadvertently removed from a module, the following procedure will restore it.

- 1 Select the module in the Macro Manager.
- 2 Click Edit.
- 3 In the Project Explorer of IDE, right-click on the references section, and select Add Reference.
- 4 In the Add Reference dialog, click the .NET tab.
- 5 Select RevitProxy.
- 6 Click OK.

The Revit.Proxy.dll is restored and the macro will build, debug, and run as needed.

Migrating SDK Samples to Revit VSTA

The Revit SDK contains two samples folders:

`\Revit <release> SDK\Samples\...`

`\Revit <release> SDK\VSTA Samples\...`

The programs in the SDK's `\Samples\` folder use the standard Revit API. We refer to these samples as the SDK sample code, as distinct from the Revit VSTA samples.

If you want to use the SDK sample code for macros, modifications are needed. Follow the steps in this section. For a programming language, we will show C# examples. However these instructions also apply to the VB.NET versions of the SDK samples.

Initial Steps

The initial steps to migrate standard API samples from the SDK into your Revit VSTA macro project are similar to the section [Integrating Macros into Revit VSTA](#) on page 1439. Except, instead of copying files from the SDK's `\VSTA Samples\<sample-name>\...` folders, you will copy files from the SDK's `\Samples\<sample-name>\...` folders.

To review, the steps are:

- 1 In the IDE, add required references.
- 2 In the IDE, create folders for the SDK samples you want to migrate.
- 3 In Windows Explorer, copy the SDK standard API samples' files to the corresponding file system folders.

- 4 In the IDE, add existing files to the macro project.

Update the SDK Samples' Code

In the Revit VSTA IDE, the `IEternalCommand` interface is not available or used. In the SDK standard API sample code, you must update the class that inherits from this interface:

- Remove the method parameters and the return of the `Execute` method.
- Update other code related to `ExternalCommandData`.

Code Example Before Edits

The following code snippet is from a program that uses the standard Revit API:

```
/// the operation. </returns>
public IEternalCommand.Result Execute(Autodesk.Revit.ExternalCommandData commandData,
                                     ref string message, ElementSet elements)
{
    try
    {
        // create a new instance of class data
        RoomsData data = new RoomsData(commandData.Application);

        // create a form to display the information of rooms
        using (roomsInformationForm infoForm = new roomsInformationForm(data))
        {
            infoForm.ShowDialog();
        }
        return IEternalCommand.Result.Succeeded;
    }
    catch (Exception ex)
    {
        // If there are something wrong, give error information and return failed
        message = ex.Message;
        return IEternalCommand.Result.Failed;
    }
}
```

Code Example After Edits

In the Revit VSTA IDE, we need to update the code as follows. This example shows an application-level macro. The method `RunSampleRooms()` is the entry for this VSTA sample. Notice that we used the `this` pointer to replace `commandData.Application`.

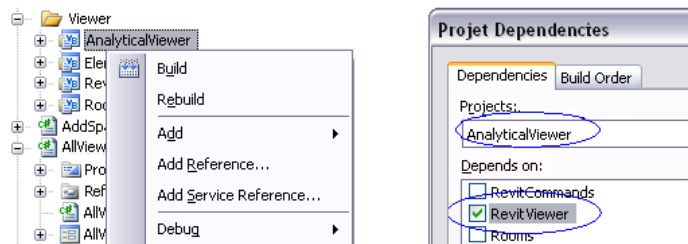
```
public void RunSampleRooms()
{
    try
    {
        // create a new instance of class data
        RoomsData data = new RoomsData(this);

        // create a form to display the information of rooms
        using (roomsInformationForm infoForm = new roomsInformationForm(data))
        {
            infoForm.ShowDialog();
        }
    }
    catch (Exception ex)
    {
        MessageBox.Show("Failed to run sample: " + ex.ToString());
    }
}
```

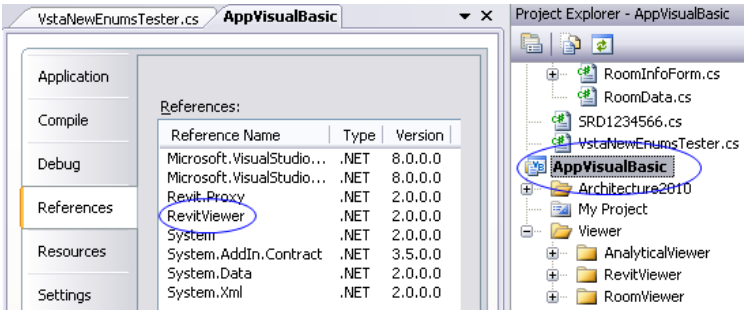
Additional Migration Notes for SDK Standard API Samples

- By default, the SDK sample namespace is: `Revit.SDK.Samples.<SampleName>.CS`. As you edit the sample code that came from the SDK standard API samples, be sure to change the namespace for Revit VSTA. For example, in `ThisApplication.cs`:
`namespace AppCSharp.csproj`
- The default project references in Revit VSTA projects only consist of basic references, such as `Revit.Proxy`. Remember to add other required references. For example, you have to add `System.Windows.Forms` and `System.Drawing` references when running samples that present a user interface.

- Some samples have resources that must be defined in the resources.resx file. GridCreation is one such sample. If you migrate the SDK standard API sample for GridCreation to Revit VSTA, be sure to set the `resx` property.
- Project build dependence is not supported within the Revit VSTA IDE. If you want to use other DLLs, you must compile that dependent sample project outside the Revit VSTA IDE. For example, in the SDK standard API samples, there are several samples related to Viewers, such as AnalyticalViewer and RoomViewer, which depend on references to RevitViewer. In the SDK sample's solution, you can set the project dependences as shown here:



However, we cannot set the project dependency due to a limitation in Revit VSTA. We cannot migrate the RevitViewer sample to VSTA. Therefore, you need to compile RevitViewer as an independent SDK sample, and then add its DLL as a reference in the Revit VSTA project:



- When you migrate SDK standard API samples to Revit VSTA, do not copy any Solution files (*.sln*) or existing project files (*.csproj or *.vbproj).
- Toolbar-related samples are unavailable in Revit VSTA.

Revit Macros FAQ

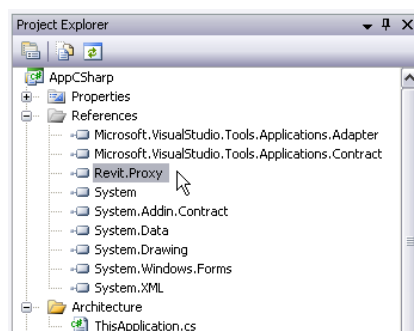
Quick Reference

This section answers frequently asked questions about Revit macros.

Question	Answer
I was expecting to see my newly created macro listed in the Macro Manager's categorized list, but it is not there. Why?	You must successfully build the macro project in the Revit VSTA IDE (use the Build menu), before your new macros will appear in the Macro Manager.
Do I need to add RevitAPI.dll as a reference when writing a new macro?	No. You do not need to reference Revit DLL files because this step was completed

Question**Answer**

for you. A Revit VSTA macro project uses `Revit.Proxy.dll` as a required reference. Revit macros will fail if you delete this reference in the IDE:



See [Restoring Revit.Proxy.dll](#) on page 1443.

Do I need to edit my `Revit.ini` files?

No. Revit knows the API for the macro support.

In the Revit VSTA IDE, I deleted a macro by removing its method in the `This*.cs` file or `This*.vb` file. However, the deleted macro's name still appears when I open the Macro Manager's categorized list again. How do I clear the name from the list?

You must build your edited project successfully before Macro Manager recognizes the removal.

Why didn't anything happen when I selected **File > New Project...** in the Revit VSTA IDE?

The IDE is an editor for the Macro Manager. Modules and macros are created on the Macro Manager, which are then edited in the IDE. Therefore, **File > Open Project** in the IDE is disabled.

What are the differences between application-level and document-level macros?

Application-level macros can be run on all opened Revit projects within a single instance of the Revit application. Document-level macro projects are stored within an RVT file. They can be loaded from the current active document and run on that document.

How do I access the `Application` object or the `externalCommandData` equivalent?

All the Application-level macros are associated with the `Application` object. In application-level macros, the `this` keyword pointer (in C#) or the `Me` keyword pointer (in VB.NET) returns the API `Application` object. In document-level macros, the `this` keyword or the `Me` keyword returns the API `Document` object. To access the `Application` object from a document-level macro,

Question	Answer
	use <code>this.Application</code> or <code>Me.Application</code> .
What should I include in the startup and shutdown methods: <code>Module_Startup</code> , <code>Module_Shutdown</code> , <code>Module_Startup</code> , and <code>Module_Shutdown</code> ?	<p>The <code>Module_Startup</code> method is called a module loads and <code>Module_Shutdown</code> is called when a module unloads. <code>Module_Startup</code> will be called only when the corresponding tab is selected or when the macro project is rebuilt.</p> <p><code>Module_Startup</code> is called when a Revit project opens and <code>Module_Shutdown</code> is called when the project document closes. You can add your initializing code in the <code>Module_Startup</code> methods and do the cleanup work in <code>Module_Shutdown</code> methods. For example, you can register event handlers at start up and unregister them at shutdown (which is the recommended way).</p>
How and why should I register and unregister my Revit event handler?	<p>As noted previously, the recommended way to do this in Revit VSTA is to register event handlers in the <code>*_Startup</code> method and unregister them in the <code>*_Shutdown</code> method. Every VSTA macro will be loaded and unloaded dynamically. When you debug a macro, if the event handler is not properly unregistered, Revit may call a wrong method (maybe an invalid memory address). Although Revit VSTA may prevent Revit from crashing in this scenario, any event handlers that are not properly unregistered may cause performance issues during your current Revit session.</p>
I have a dialog that does not seem to work correctly and is causing issues with Revit.	<p>Modeless dialogs operating outside the scope of a running API callback may cause problems. It is recommended that you avoid such callbacks to prevent instability in Revit.</p>
I want to experiment with the Startup and Shutdown methods and an event handler. Can you show me an example?	<p>The following sample code shows how to register an <code>OnDocumentNewed</code> event handler, which will automatically launch a message box when a new Revit project is created. Note: One of the VSTA samples provided on the Revit SDK may show an example of a document-level event handler's startup and shutdown. This FAQ shows Application-level event handler examples. Please note that 2010 events are not included with Revit VSTA IDE 2010.</p>

VB.NET example, Application-level:

Question	Answer
	<pre> Private Sub Module_Startup(ByVal sender As Object, ByVal e As System.EventArgs) Handles Me.Startup AddHandler Me.OnDocumentNewed, AddressOf Me.ThisApplication_On DocumentNewed End Sub Private Sub Module_Shutdown(ByVal sender As Object, ByVal e As System.EventArgs) Handles Me.Shutdown RemoveHandler Me.OnDocumentNewed, AddressOf Me.ThisApplica tion_OnDocumentNewed End Sub Private Sub ThisApplication_OnDocumentNewed(ByVal document As Autodesk.Revit.Document) System.Windows.Forms.MessageBox.Show("VB.NET Application event OnDocumentNewed") End Sub </pre> <p>C# Example, Application-level:</p> <pre> private void Module_Startup(object sender, EventArgs e) { this.OnDocumentNewed += new Autodesk.Revit.Events.Document NewedEventHandler(ThisApplication_OnDocumentNewed); } private void Module_Shutdown(object sender, EventArgs e) { this.OnDocumentNewed -= new Autodesk.Revit.Events.Document NewedEventHandler(ThisApplication_OnDocumentNewed); } void ThisApplication_OnDocumentNewed(Document document) { System.Windows.Forms.MessageBox.Show("C# Application event OnDocumentNewed"); } </pre>

Related Information about Revit Macros

Quick Reference

To learn more, please refer to the following resources:

- The Revit*API.chm Help file contains the Revit API .NET reference documentation. The API reference documentation is provided with the Revit SDK, which is on the product DVD and the Autodesk web site: <http://www.autodesk.com/revit-sdk>. Be sure to access the Revit API SDK for your release of Revit. As noted earlier in this topic, the SDK also includes the Revit VSTA samples.
- DevTV: Introduction to Revit Programming, is a video on [autodesk.com](http://www.autodesk.com) that you can download. The narrated video covers the Revit API for external commands and external applications. It does not describe the macros functionality with Revit VSTA, but should be of interest to developers who are looking for more details about the full Revit SDK API and its samples. See <http://www.autodesk.com/revit-sdk>, and look for the section that starts with “DevTV.”

- The Autodesk Developer Network (ADN), <http://adn.autodesk.com>, has information and expert advice about the full Revit API. If you do not already have an ADN login account, please contact your Autodesk representative.

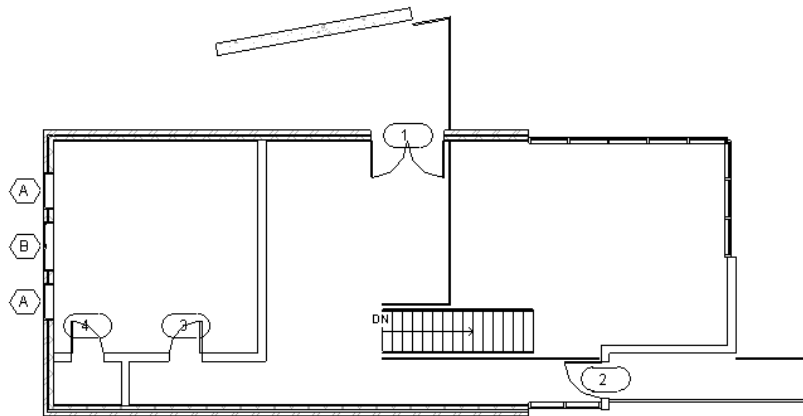
Glossary

This glossary defines terms that are used in the documentation to describe features and functions that are unique to Revit Architecture® or that are used in the design industries.

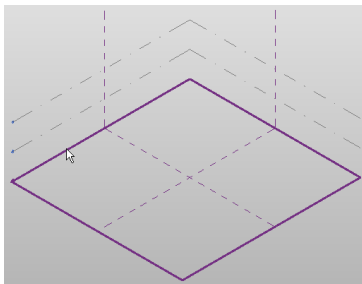
Glossary Terms

2D view A 2-dimensional (2D) representation of a building model displayed in the Revit interface. For example, floor plans and elevations are 2D views.

Compare with [3D view](#) on page 1452. See [Project Views](#) on page 125.

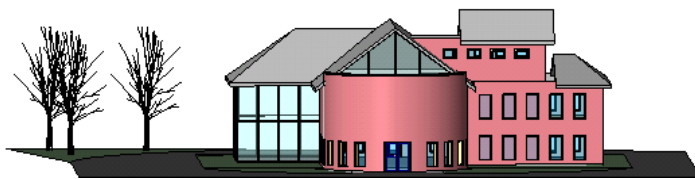


3D level A three-dimensional (3D) plane in the conceptual design environment on which to draw and manipulate forms.

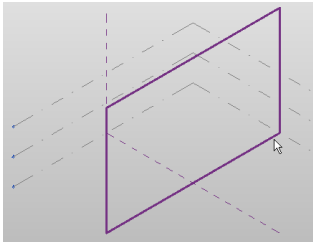


3D model A 3-dimensional (3D) representation of a building or other design.

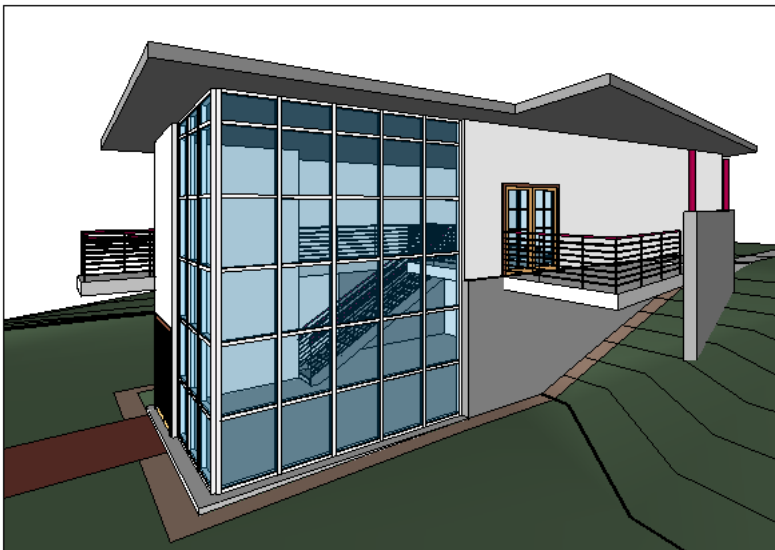
See also [building information modelling \(BIM\)](#) on page 1459.



3D reference plane Reference planes are displayed in the conceptual design environment in the 3D views.



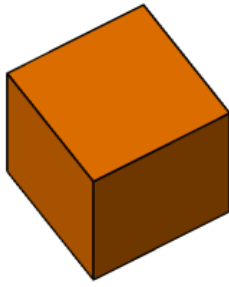
3D view A 3-dimensional (3D) representation of a building model displayed in the Revit interface. Compare with [2D view](#) on page 1451. For more information, see [3D Views](#) on page 156.



3ds Max An Autodesk product. 3ds Max is professional 3D animation software that provides animation, modelling, and workflow functionality for the most complex problems in design visualization and visual effects.

Revit Architecture can export 3D models for use in 3ds Max. See [Exporting to 3ds Max](#) on page 1373.

ACIS A solid modeling technology. An **ACIS object** is a geometric shape that is defined using this technology. For example, ACIS represents a cube as a single object (or shape) with 6 sides. Compare with [polymesh](#) on page 1520.



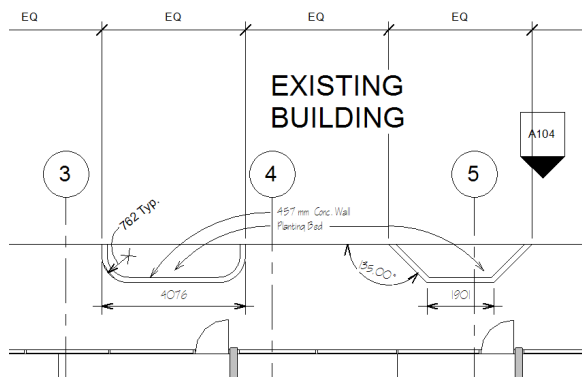
Revit Architecture can import ACIS objects contained in DWG, DXF, and SAT files. See [Importing ACIS Objects](#) on page 1391.

Revit Architecture can export 3D shapes as ACIS solids. See [Solids \(3D Views Only\)](#) on page 1352.

ADSK Autodesk Exchange File, the file format used by Autodesk applications to transmit design information. See [Exporting Building Sites](#) on page 1376 and [Importing Building Components](#) on page 1398 for workflows that use ADSK files.

annotation A 2D, view-specific element that you use to document a building or design. For example, symbols, tags, keynotes, and dimensions are annotations (also referred to as annotation elements). Annotation elements are always displayed at the same paper size regardless of view scale.

Compare with [model element](#) on page 1507 and [datum](#) on page 1469. For more information, see [Annotating and Detailing](#) on page 1087.

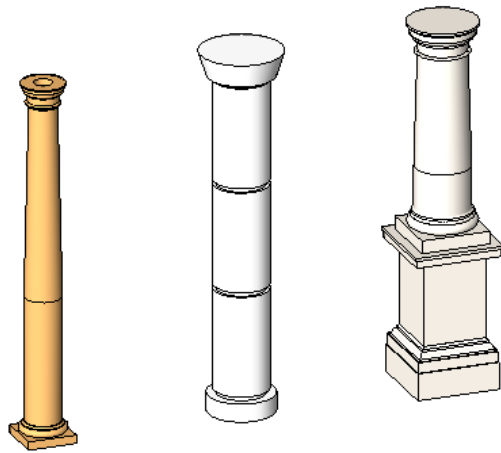


annotation schedule See [note block](#) on page 1511.

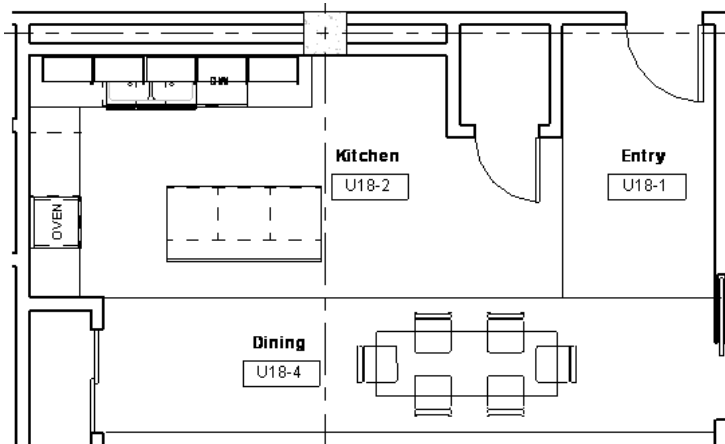
architectural column A column that adds architectural interest to a building. You can use architectural columns to model box-outs around structural columns and for decorative applications.

Compare with [structural column](#) on page 1542.

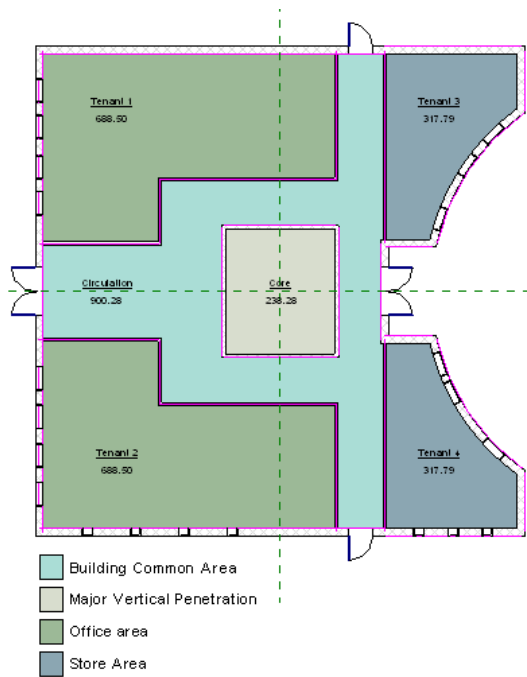
For more information, see [Architectural Columns](#) on page 756.



area Usable space that is defined by walls or boundary lines or both. In Revit Architecture, you can perform an area analysis to define spatial relationships in a building model. See [Area Analysis](#) on page 1008.



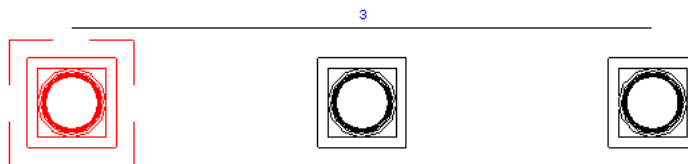
area scheme A set of spatial relationships in a building. For example, in an office building, you may want to distinguish between common space (such as lobbies, hallways, rest rooms, and kitchens), office space, and storage. In an apartment building, you may want to indicate rentable space and non-rentable space. After creating an area scheme, you can assign area types to individual areas in an area plan. For more information, see [Area Schemes](#) on page 1008.



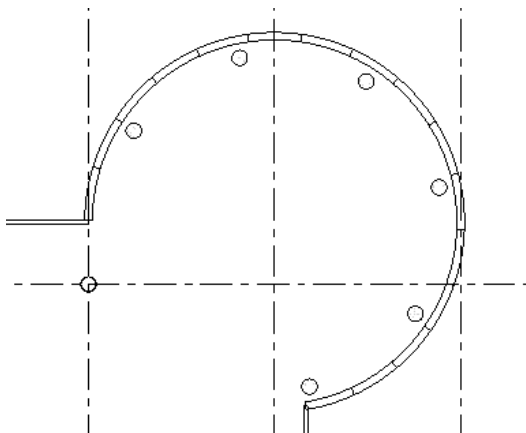
array An arrangement of elements in a building model. For example, in a large office, you can create an array of desks and chairs. In a structural design, you can create an array of beams or columns.

You can create a linear array, in which the elements are distributed evenly along a line, or a radial array, in which the elements are distributed evenly along an arc or a circle. See [Creating an Array](#) on page 365.

Linear array of columns



Radial array of columns

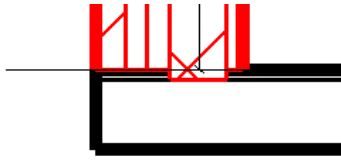


assembly code See [Unifomat assembly code](#) on page 1549.

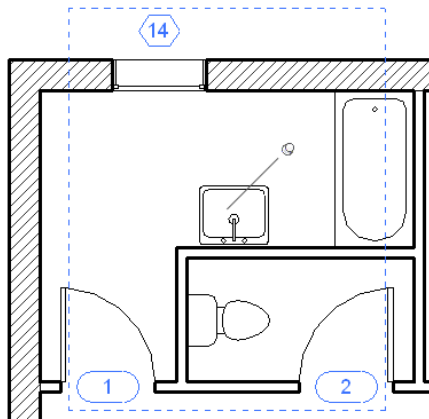
attach To explicitly join elements (such as walls or columns) to other modeling components.

For example, you can attach walls to floors, ceilings, and roofs. (See [Attaching Walls to Other Components](#) on page 651.) You can attach columns to roofs, floors, ceilings, reference planes, structural framing members, and other reference levels. (See [Attaching Columns](#) on page 757.)

The following image shows a floor attached to the structural layer of a wall.



attached detail group A group of view-specific elements that are associated with a model group. For example, an attached detail group may be comprised of door tags and window tags. See [Editing Elements in Groups](#) on page 354.



AutoCAD An Autodesk product. AutoCAD enables you to create, visualize, document, and share your ideas, from conceptual design through drafting and detailing. You can import AutoCAD files for use in Revit projects, and you can export Revit files for use in AutoCAD projects.

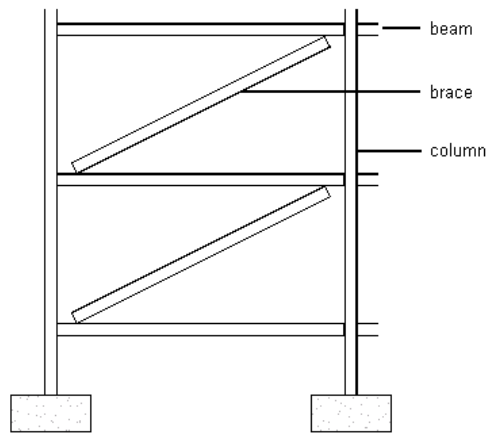
Autodesk® Seek A web service that lets you search for, download, and integrate product and design information into your drawing. You can also publish families to the Autodesk Seek website to make them available for other designers to incorporate into their designs. Autodesk Seek is currently available in English only.

AVI A stand-alone video file that contains an animation.

Revit Architecture can export solar studies and walkthroughs to AVI files. See [Exporting a Solar Study](#) on page 1246 and [Exporting a Walkthrough](#) on page 168.

baluster One of the small posts that make up a [railing](#) (for example, for a set of stairs).

beam A horizontal load-bearing element of a structure. Beams are often made of steel, wood, or concrete. For more information, see [Beams](#) on page 840.



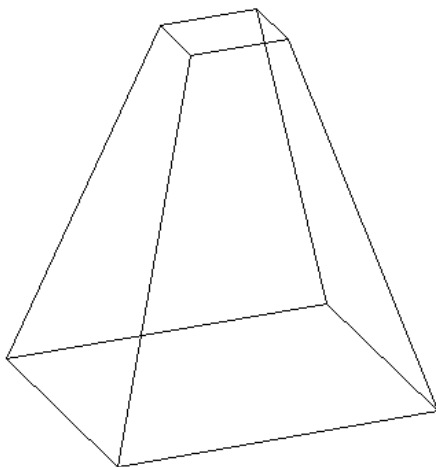
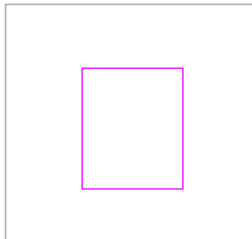
bearing wall A wall that supports a vertical load in addition to its own weight.

Compare with [non-bearing wall](#) on page 1511. For more information, see [Structural Walls](#) on page 906.

BIM See [building information modelling \(BIM\)](#) on page 1459.

blend A combination (blending) of 2 shapes to create a 3D shape. You can create blends using solid geometry and void geometry.

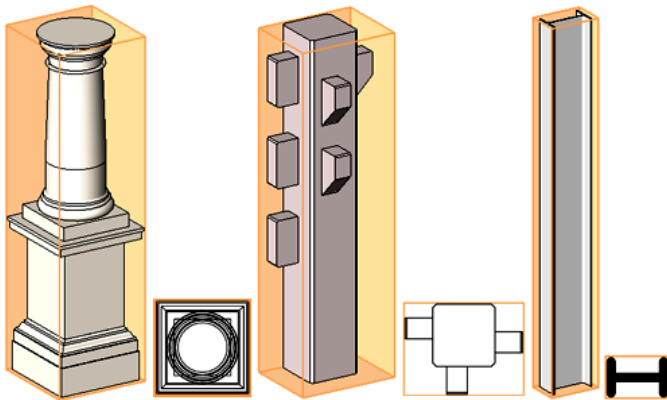
For example, the 2D shapes below are blended to create the solid extrusion that follows. See [Creating a Blend](#) on page 323.



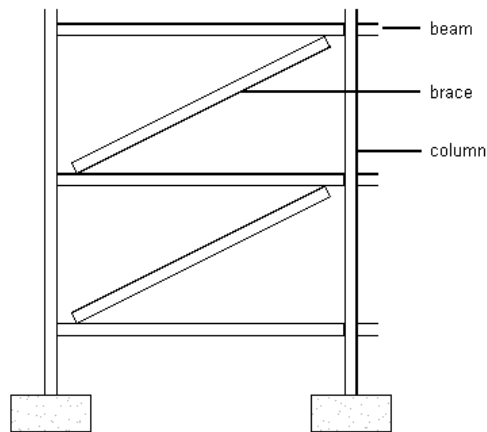
bounding box An invisible 3-dimensional rectangular space that contains all model elements, annotation elements, and datum elements defined in a family-based element.

The bounding box helps define the family origin of some elements, and aids joining and cutback of structural framing elements. See [Bounding Boxes](#) on page 863.

Bounding boxes of columns represented in orange

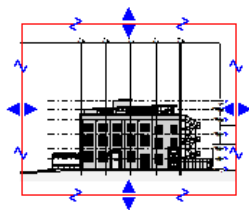


brace A diagonal structural element that is connected to beams and columns to help support the building. For more information, see [Braces](#) on page 893.

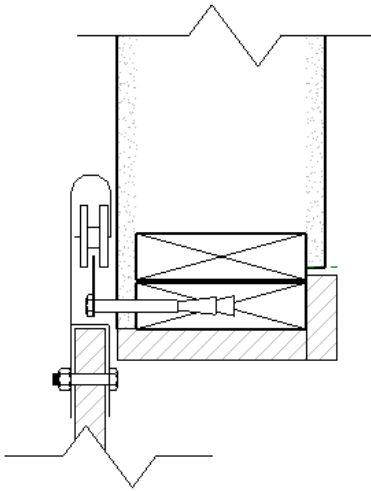


break control A Revit symbol that you can use to break a section line, break a schedule into multiple sections, or break a crop region into sections.

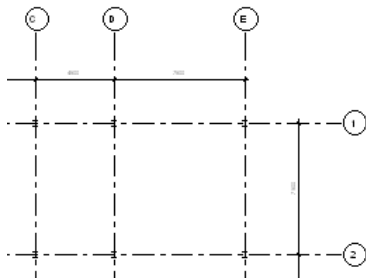
In the following elevation view, the blue Z-shaped break controls allow you to break the crop region into sections.



break line The Z-shaped line used in a drafting view or detail view to obscure parts of the drawing, to focus the drawing on a particular area. The following drafting view uses break lines above and below the section to obscure less intricate parts of the door assembly.



bubble A shape (such as a circle or cloud) that contains identification text for a grid, level, view title, callout, or annotation.



building footprint The gross building area plan at ground level that is exported to an ADSK file when exporting a building site to a civil engineering application, such as AutoCAD® Civil 3D®. See [Creating Gross Building Areas and Property Lines](#) on page 1378

building information modelling (BIM) A design methodology that maintains a single database of information about a building design. All information for a building design, from geometry to construction data, is stored in a project file. This information includes components used to design the model, views of the project, drawings of the design, and related documentation.

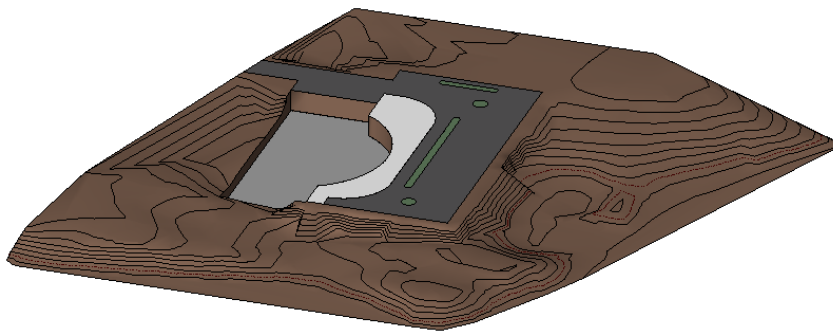
In a Revit project, every drawing sheet, 2D and 3D view, and schedule is a representation of information from the same underlying building model database. For more information, see [What Is a Project?](#) on page 117

Building Maker A conceptual design and modeling environment that takes any overall building form described conceptually, and maps it to building elements, such as roofs, curtain walls, floors, and walls. See [Massing Studies and Building Maker](#) on page 590.

building model A design created using building information modeling.

building pad A flat surface that is designed to be occupied by buildings and is prepared by grading, excavating, filling, or a combination of these.

In Revit Architecture, you can add a building pad to a toposurface, and then modify the structure and depth of the pad. For more information, see [Building Pads](#) on page 965.



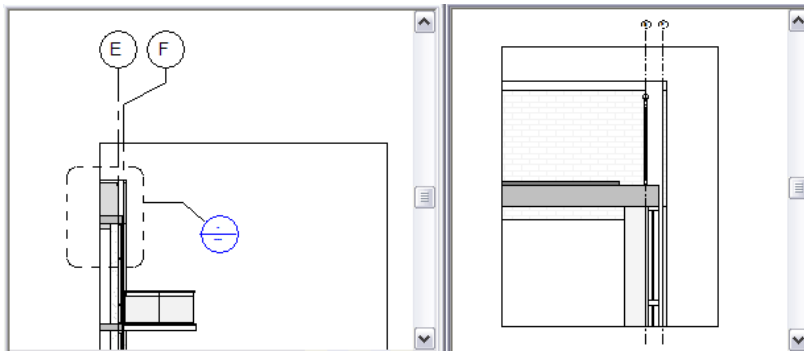
Buzzsaw An Autodesk product that is an online collaboration service. Using Buzzsaw, you can store, manage, and share project documents from any Internet connection, thus enhancing team productivity and reducing costs.

In Revit Architecture, you can use Publish tools to save sheets and views as DWG or DWF files, and upload these to a Buzzsaw project site in one step. See [Publishing to Buzzsaw](#) on page 1384.

CAD See [computer-aided design \(CAD\)](#) on page 1465.

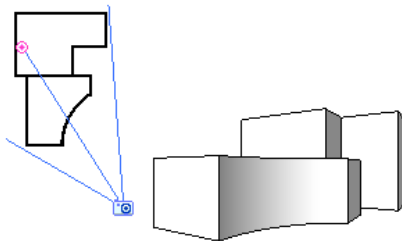
callout A detailed drawing of part of a view. In Revit Architecture, the callout appears in a separate view. In the callout, you can add annotations and detail, which will not display in the parent view. In the parent view, the callout area is marked with a callout tag.

The following views show a callout tag in a section view, and the detail view for the callout. For more information, see [Callout Views](#) on page 146.



camera A visualization tool that you use to create a 3D view of a building model. When you place a camera in a 2D view, you can control the target point, the camera level, and the focal point of the camera.

The following views show a camera positioned in a floor plan view, and the resulting 3D view. See [Modifying the Camera Position in a Perspective 3D View](#) on page 161.



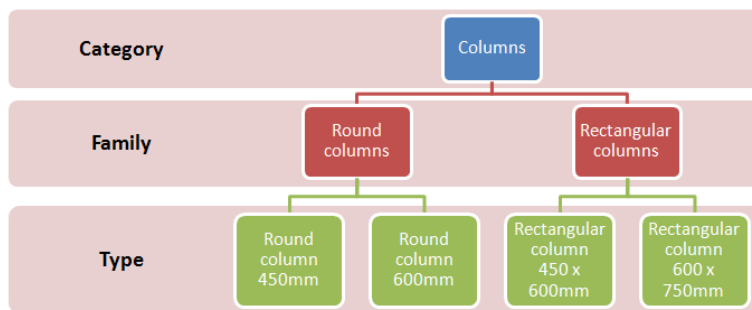
canvas See [drawing area](#) on page 1475.

casework Pre-built components, such as cabinets and cupboards for a kitchen or bathroom. Revit Architecture provides family types for casework.



category A group of elements that you use to model or document a building design. For example, categories of model elements include walls, windows, columns, and beams. Categories of annotation elements include dimensions, tags, and text notes.

Categories are organized into families of elements with similar purposes and characteristics. Families are further organized into types, as shown.



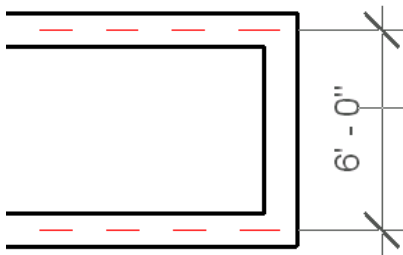
ceiling plan A drawing that shows the design of a ceiling.

For more information, see [Ceilings](#) on page 718.

centerline A line that indicates the middle of a dimension or model element (such as a column or a wall).

In Revit Architecture, you can use an element's centerline to measure, dimension, align, resize, specify constraints, and perform other functions in a building model.

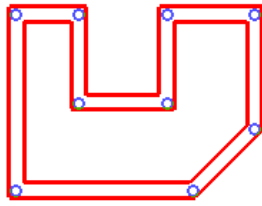
Measuring from the centerlines of walls



central file A master project file for a model on which multiple team members are working. The model can be subdivided into functional areas (worksets), such as interior, exterior, and site. The central file stores the current ownership information for all elements in the project, and acts as the distribution point for publishing work to the rest of the team. All users work in local copies of the file and periodically save changes to the central file so that other users can see their work.

For more information, see [Working in a Team](#) on page 1249.

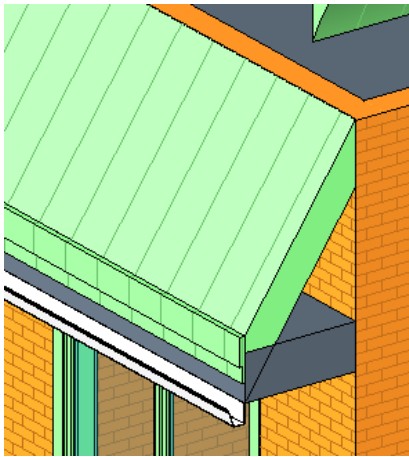
chain A linked set of lines or walls. When drawing walls or lines in a building model, you can simplify the process by drawing a chain. You can also select a chain of lines or walls to manipulate them simultaneously.



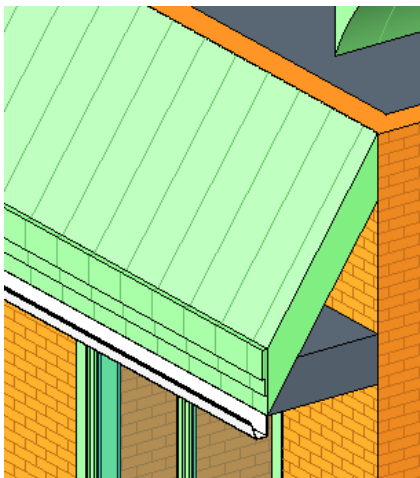
clean To resolve joins between 2 or more host elements that share a common face, such as walls and floors. When a view shows a coarse level of detail, Revit Architecture removes visible lines between the elements. When a view shows a fine level of detail, Revit Architecture shows precisely how the layers of compound walls or other structures join together. The cleaned join applies only to the current view.

See [Wall Joins](#) on page 651 and [Joining Geometry](#) on page 406.

Before joining the roof and the soffit



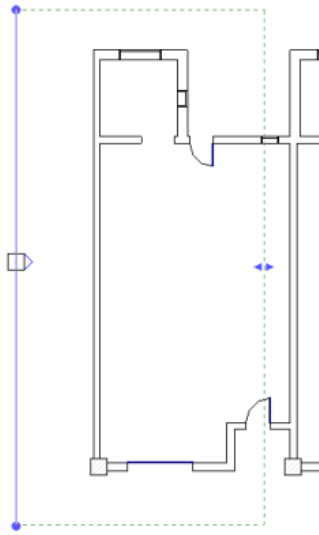
After joining the roof and the soffit



clip plane A vertical or horizontal plane that defines a boundary for a view. You can use top, bottom, left, and right clip planes to define a view. In elevation and section views, you can also use a far clip plane to define the depth of the view.

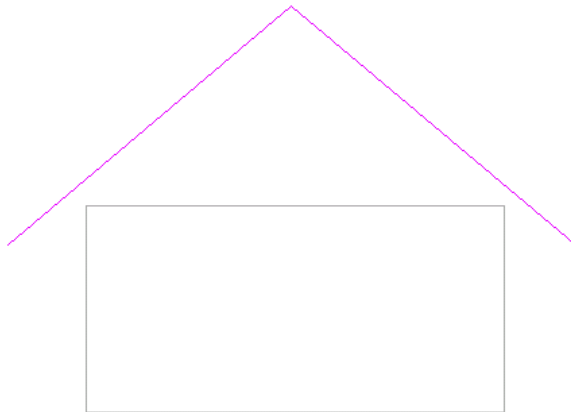
See [View Range](#) on page 247.

Green dotted lines define the clip planes for an elevation view



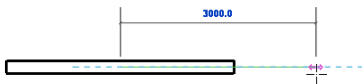
closed loop A sketched line that connects to itself, creating a 2-dimensional shape. A closed loop cannot contain coincident or intersecting segments.

In Revit Architecture, you sketch closed loops to create floors, ceilings, plan regions, openings in walls and roofs, solid extrusions, and other parts of a building design. In the following sketch, a closed loop defines the walls, ceiling, and floor. An open loop defines the roof. See [Sketching](#) on page 303.



collinear Passing through or lying on the same straight line.

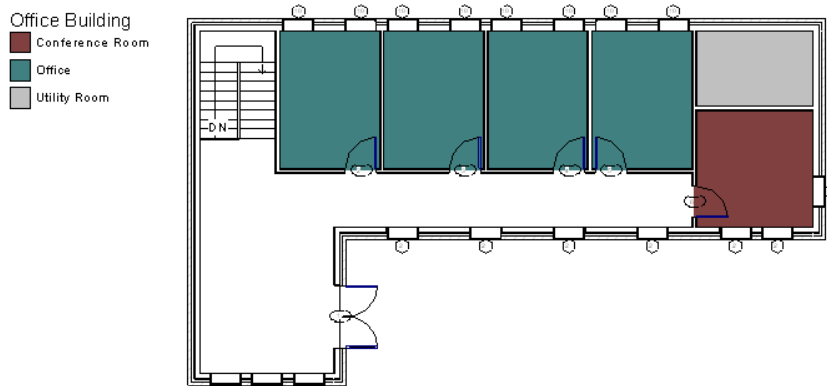
Sketching a line that is collinear with an existing wall



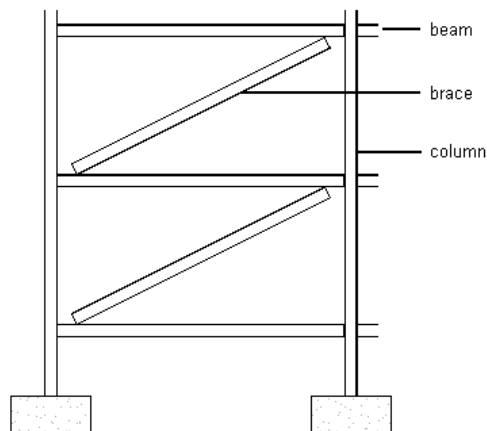
color scheme A set of colors and fill patterns used to graphically designate rooms or areas in a floor plan.

You can apply color schemes based on any parameter value for a room or area. For example, if you want to color rooms by department, set the Department parameter for each room to the desired value, and create a color scheme based on the values of the Department parameter. You can then add a color scheme legend to identify the department that each color represents.


For more information, see [Color Schemes](#) on page 1019.



column A vertical element in a building. Architectural columns add visual interest to a design. (See [Architectural Columns](#) on page 756.) Structural columns are vertical load-bearing elements in a structure. See [Structural Columns](#) on page 820.

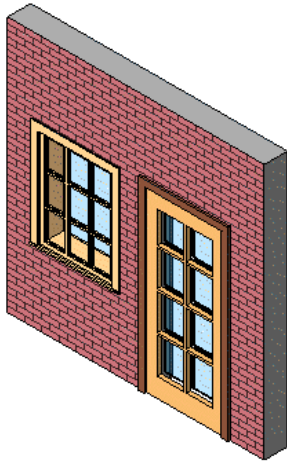


Communication Center A tool that displays links to information about product updates and announcements.

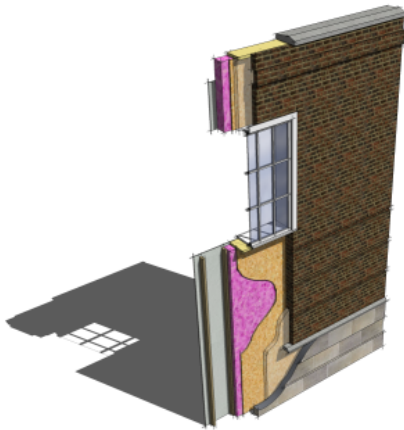
To access the Communication Center, click  in the InfoCenter toolbar in the upper right corner of the Revit window.

component A building element that is usually delivered and installed on site, rather than built in place. (Also referred to as a hosted component.)

For example, windows, doors, and furniture are components. In contrast, walls, floors, and roofs are built in place; these are called [hosts](#) or host elements. See [Hosted Components](#) on page 796.



compound wall A wall that consists of multiple vertical layers. Each layer can use a different material (such as concrete, insulation, and interior finish) and have a different function (such as structure, thermal layer, and substrate). See [Vertically Compound Walls](#) on page 639.



computer-aided design (CAD) The use of computer-based tools that assist engineers, architects, and other design professionals in their design work.

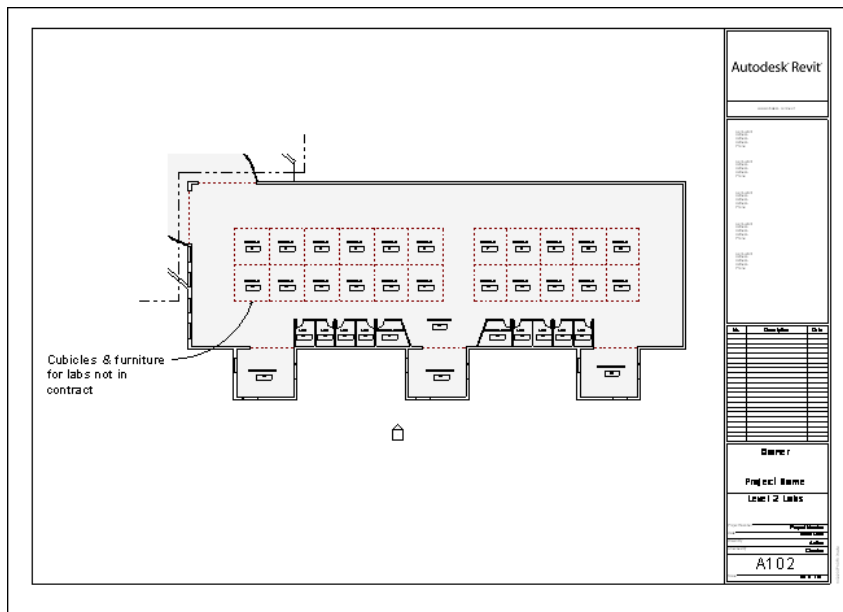
conceptual design environment A type of family editor that uses geometric form-making and direct manipulation tools to create in-place and loadable mass family elements.

constraint A parameter that defines a relationship between elements in a building design. For example, you can specify the top constraint for a wall as Level 2. If Level 2 moves upward, the height of the wall increases to maintain the relationship.

For more information, see [Constraints](#) on page 300.

construction document A document that communicates a building design to builders and contractors, so they can create the building.

Revit Architecture generates construction documents using the information about the building model stored in the project file, along with user-added annotation, detailing, and layout information. For more information, see [Preparing Construction Documents](#) on page 1029.

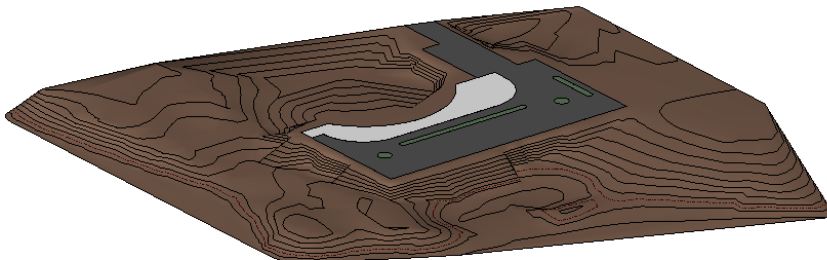


Construction Specifications Institute (CSI) An association that provides technical information, standards, continuing education, and other services to architects, engineers, contractors, and other building professionals. For more information, go to <http://www.csiet.org>.

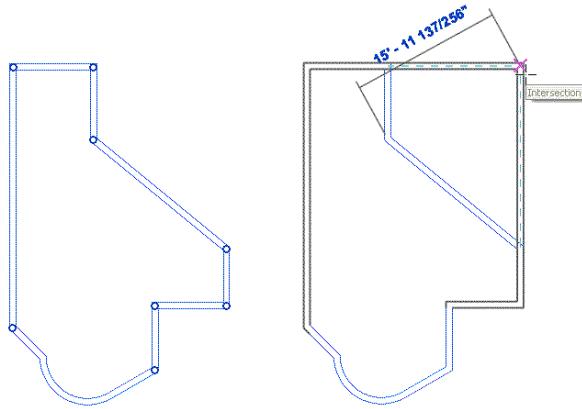
context menu See [shortcut menu](#) on page 1537.

contour line An imaginary line that connects points of equal elevation to describe the topography of a building site.

See [Site Design](#) on page 953.



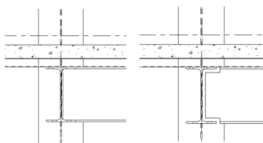
control A graphical icon in the Revit drawing area that you use to manipulate elements. For example, when you select a chain of walls, blue circles display. These blue circles are drag controls. You can drag such a control to change the shape of the walls.



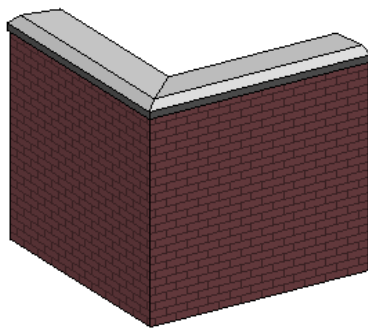
Other controls allows you to flip, lock, rotate, view, and change the shape or size of elements. See [Controls and Shape Handles](#) on page 349.

coping (1) In structural design, the process of cutting a piece of steel from a beam to fit it to a column.

Beam before coping is applied (left) and after coping is applied (right)

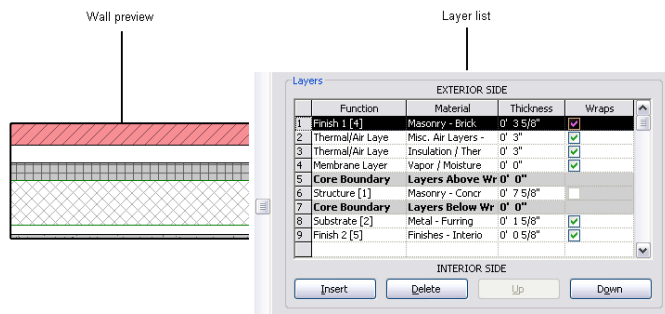


coping (2) In architectural design, a finishing or protective cap for an exterior wall.



core The structural part of a compound wall or other host element. When you use Revit Architecture to design a compound wall, you specify the layers and materials that compose the core of the wall, as well as the interior and exterior layers of the wall.

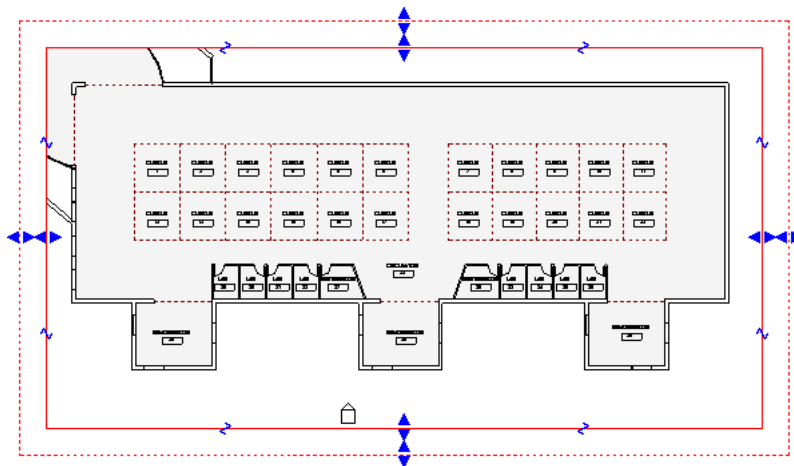
In the following illustration, the core is outlined in green in the wall preview. The layer list is where you define and change the layers in and around the core.



When aligning or dimensioning the wall, you can choose to measure from the center of the core or from the interior face or exterior face of the core. See [Vertically Compound Walls](#) on page 639 and [Dimensioning to Core in Compound Structures](#) on page 276.

crop To limit the boundaries of a view, omitting parts of the building model from the view. See also [crop region](#).

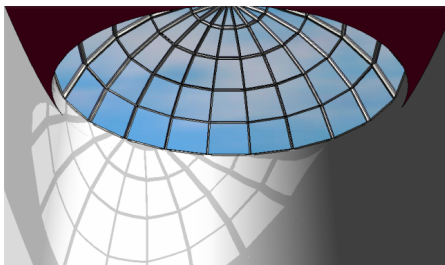
crop region A user interface mechanism that defines the boundaries of a view. Elements in the building model that are outside the crop region do not display in the view or on a sheet on which the view is placed. In the following floor plan view, the inner, solid red line indicates the model crop region. The outer, dashed red line indicates the annotation crop region. For more information, see [Crop Regions](#) on page 211.



CSI See [Construction Specifications Institute \(CSI\)](#) on page 1466.

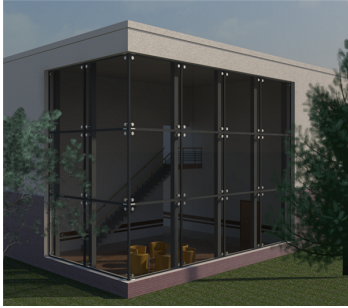
curtain system A building component consisting of panels, curtain grids, and mullions. A curtain system usually does not have a rectangular shape. (Compare with [curtain wall](#) on page 1468).

For more information, see [Curtain Systems](#) on page 785.



curtain wall An exterior wall consisting of panels connected by joints or mullions. The panels can be made of glass, brick, or other materials.

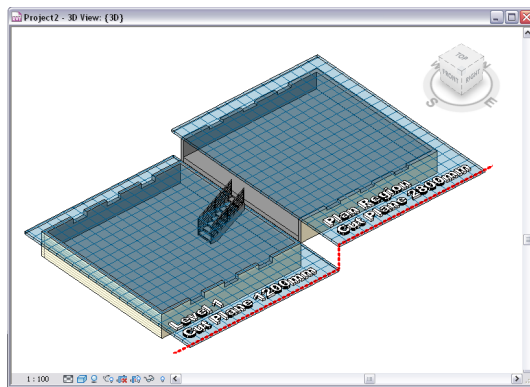
See [Curtain Walls, Curtain Grids, and Mullions](#) on page 766.



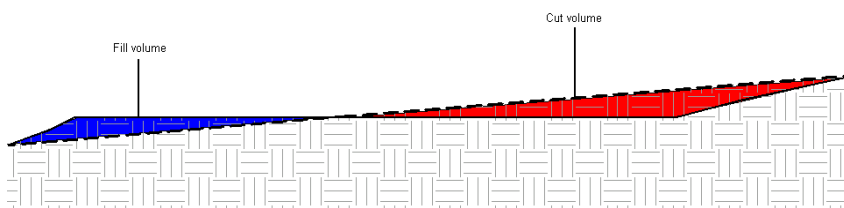
cut line style A graphic style applied to an element when a view (such as a section view) cuts through the element, so that you are seeing a representation of its interior surface. (Compare with [projection line style](#) on page 1522.)

For the cut line style of an element, you can specify the line weight, color, and pattern. See [Modifying Object Styles](#) on page 493 and [Override Cut Line Styles](#) on page 211.

cut plane A horizontal height at which certain elements in the view are shown in cross-section.



cut volume The amount of material that must be excavated and removed from a site to prepare it for construction. For example, in the following drawing, the red area indicates the cut volume, and the blue area indicates the fill volume required to level the site for a building. See [Reporting Cut and Fill Volumes on a Site](#) on page 964.



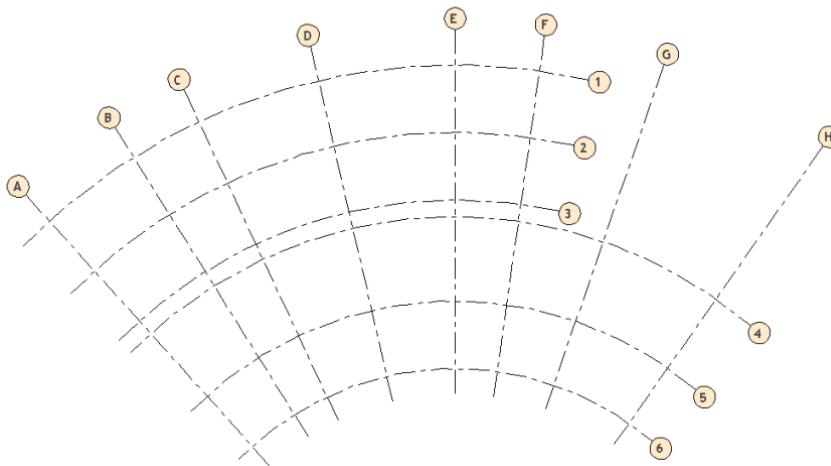
cutback The calculated adjustment in beam geometry that ensures beam ends meet without overlaying one another at a join. This is the visible gap seen in a steel beam connection within the Revit project.

See [Cutback](#) on page 865.

datum A non-physical item that is used to establish project context. Also called a **datum element**. Datum elements include levels, grids, and reference planes.

For example, the following image shows a grid, which is used for the placement of columns and other model elements. The grid is not a part of the building (such as a wall or a roof) but is used in a view to help design the building.

Compare with [annotation](#) on page 1453 and [model element](#) on page 1507. For more information, see [Annotating and Detailing](#) on page 1087.



datum extent The size of a datum plane (a plane for a level, grid, or reference line). Datum planes are not visible in all views. If the datum does not intersect a view plane, it will not be visible in that view. You can resize datum planes so that they are visible only in certain views.

For more information, see [Datum Extents and Visibility](#) on page 1108.

decals An image to display on a face of a model element. For example, you can use decals for signs, paintings, and billboards. In project views, a placeholder indicates the location of a decal. The full decal displays in a rendered image. The following rendered image shows a decal on the television.

For more information, see [Decals](#) on page 1215.



dependent view A copy of a view. Use dependent views when a view of the building model is too large to display on a single sheet, and you need to divide the model into smaller segments that fit on the sheets.

The dependent view remains synchronous with the primary view and other dependent views. When view-specific changes (such as view scale and annotations) are made in one view, they are reflected in all views.

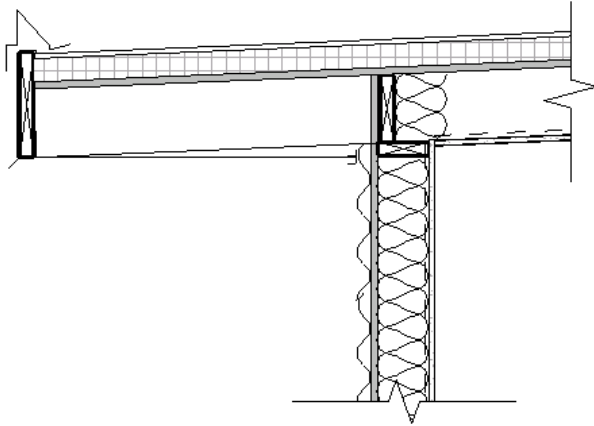
For more information, see [Duplicate Dependent Views](#) on page 192.

design option An alternative design for a project. Design options allow a team to develop, evaluate, and redesign building components within a single project file. You can develop design options to adapt to changes in product scope, to review other designs, or to show alternatives to a client.

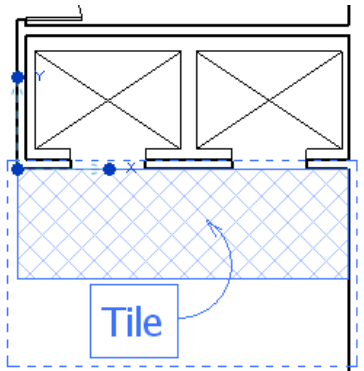
For more information, see [Design Options](#) on page 1305.

detail component A 2D element that you can add to a detail view or a drafting view. For example, you may want to add a metal stud or a shim to a drafting view. Revit Architecture provides over 500 detail component families, based on 16 CSI divisions. You can also create your own detail components.

See [Inserting a Detail Component](#) on page 1142.

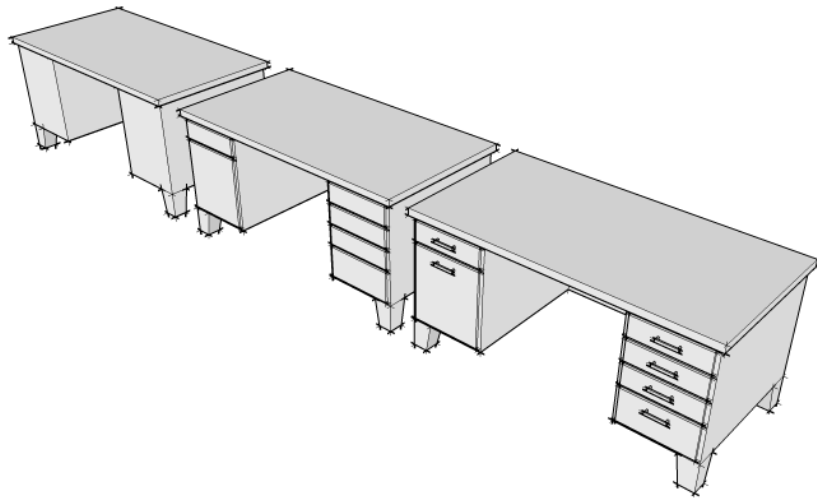


detail group A group of view-specific elements, such as text and filled regions. See [Editing Elements in Groups](#) on page 354.



detail level A Revit setting that determines the amount of geometry displayed in a view. Detail level settings include coarse, medium, and fine, where coarse shows the least detail and fine shows the most detail.

The following image illustrates the 3 detail levels for a desk. For more information, see [Detail Level](#) on page 511.

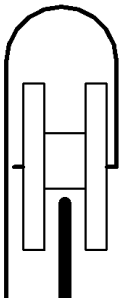


detail line A line that is used to create a detail drawing. A detail line is visible only in the view in which it is drawn. (Compare with [model line](#) on page 1508.)

You can use detail lines as follows:

- To detail a view with part of the model visible, such as in a wall section or callout
- In a drafting view to draw lines with no reference to the model
- To trace underlay elements

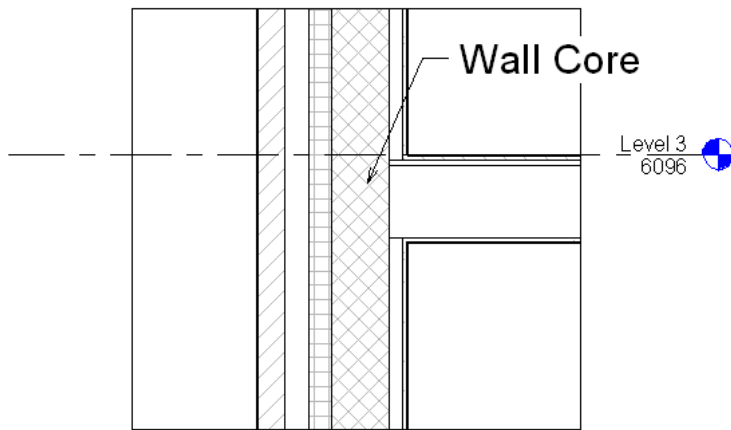
In the following drawing, the arc is a detail line drawn in a drafting view that shows details of the roller assembly for a sliding door. For more information, see [Detail Lines](#) on page 1154.



detail view A view of a model that displays as a callout or section in other views. This type of view typically represents the model in finer detail than shown in the parent view. It is used to add more information to specific parts of the model.

A detail view reflects geometry of the building model. If a related part of the building model changes, the detail view updates to reflect the change. (Compare with [drafting view](#) on page 1474.)

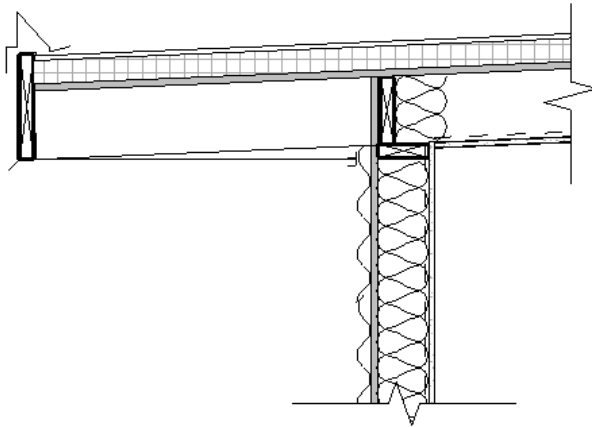
For more information, see [Detail Views](#) on page 1134.



detailing The process of adding information about parts of a building model. Details show how materials interconnect, providing information to the builders on how a design should be constructed.

For more information, see [Detailing](#) on page 1134.

Roof overhang detail

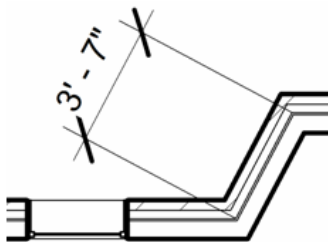


DGN A file format supported by MicroStation of Bentley Systems, Inc. Revit Architecture can import and export DGN files. For more information, see [Interoperability](#) on page 1341.

dimension A view-specific element that shows the size of an element or shows distances between elements or points in a building model.

As you place an element, Revit Architecture displays temporary dimensions so that you can place the element accurately. You can create permanent dimensions and lock them to specify and maintain a particular size or distance.

For more information, see [Dimensions](#) on page 263.



discipline A functional area (such as structural, mechanical, electrical, or architectural), or an area of expertise (such as architecture, structural engineering, or construction).

In a Revit project, you can assign disciplines to categories and to views. You can then control the visibility or graphic display of elements in a view based on assigned disciplines. For more information, see [Specifying Element Category Visibility](#) on page 202.

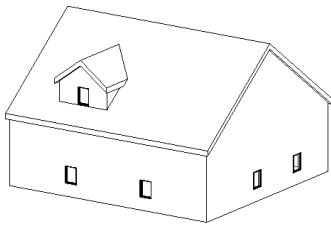
You can also specify project units by discipline and organize the Project Browser by discipline.

display mode See [model graphics style](#) on page 1507.

divided surface A face or surface of a form that has been divided into UV grids. The grids act as a guide in patterning the surface. Manipulating the divided surface also manipulates the parametrically dependant patterns and component families. See [Rationalizing Surfaces](#) on page 569.

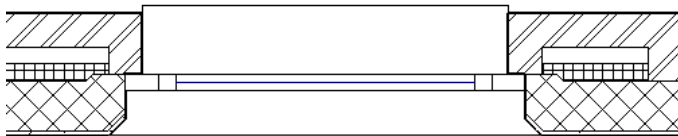
dormer A gabled extension that is built out of a sloped roof to hold a window.

For more information, see [Dormers](#) on page 688.



drafting pattern A symbolic representation of a material in a drawing. (For example, sand is represented by a stipple pattern.) You can place drafting patterns on flat and cylindrical surfaces, and you can define them for families. You can also place drafting patterns on cut component surfaces in plan views and section views.

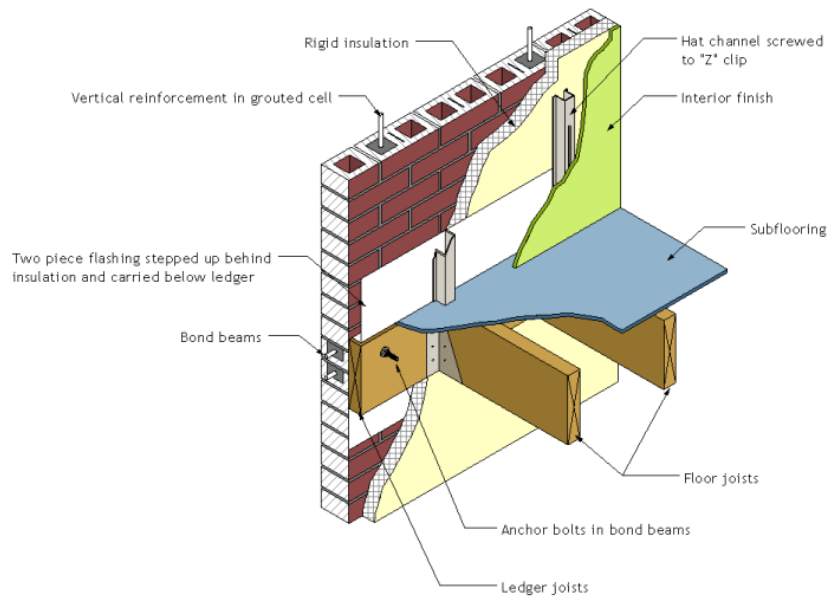
The following image shows a cross-section of a window in a wall, with different drafting patterns for interior and exterior layers of the wall. For more information, see [Fill Patterns](#) on page 459.



drafting view A project view that shows details not directly associated with the building model. For example, a drafting view can show how carpet transitions to tile, or details of a roof drain. A drafting view typically shows construction details that may not be apparent in other views.

A drafting view is saved with the project in which it is created, and it can be included on a sheet. However, a drafting view does not reflect the actual building model, and it does not update when the model changes. (Compare with [detail view](#) on page 1472.)

The following image shows a drafting view created using the 2D detailing tools in Revit Architecture. (It is not a 3D view.) For more information, see [Drafting Views](#) on page 1139.



drag control A graphical icon in the Revit drawing area that you drag to change the shape or size of an element in the building model. When you select an element, Revit Architecture displays its drag controls as blue circles or triangles.

For more information, see [Drag Controls](#) on page 349.

draw order The order in which elements display in a view, as if layered on a flat surface. You can move an element backward or forward in the draw order, or bring it to the front or back of a stack of elements. See [Sorting the Draw Order of Detail Components](#) on page 1156.

drawing area The part of the Revit user interface that displays views, sheets, schedules, and other representations of the building model. See [Using the Revit Interface](#) on page 85.

drawing list A schedule (list) of all drawing sheets in a project. The drawing list functions as a table of contents for the project. It is typically placed on the first sheet of a construction document set.

For more information, see [Drawing Lists](#) on page 1066.

Sheet Index	
Sheet Number	Sheet Name
A101	Site Plan/Floor Plan
A102	Unit 18
A103	Elevations
A104	Elevations
A105	Elev./Sect./Details
A106	Stairs/Details

drawing sheet See [sheet](#) on page 1536.

DWF Design Web Format, the Autodesk file format for publishing design data. It offers an alternative to generating PDF (Portable Document Format) files.

DWF files are significantly smaller than the original RVT files, making them easy to send by email or to post to a web site. Recipients can view DWF files using Autodesk DWF Viewer. See [Exporting to Design Web Format](#) on page 1355.

DWF markups A construction document that has been reviewed and revised or commented on (marked up). Typically, the reviewer is the project designer, a client, or another building professional.

When you export construction documents as DWF files, the files can be marked up electronically using a program such as Autodesk Design Review. You can link the markups back into Revit Architecture to see the desired changes. See [Linking DWF Markup Files](#) on page 1403.

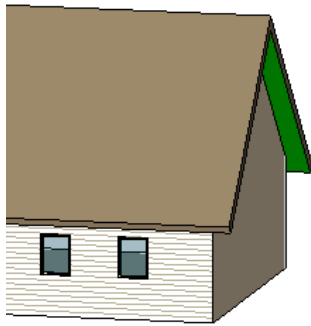
DWG A drawing file format supported by AutoCAD and other CAD applications. Revit Architecture can import and export DWG files. See [Interoperability](#) on page 1341.

DXF Drawing Exchange Format. An open file format that is supported by many CAD applications. A DXF file is a text file that describes a 2D drawing. The text is not encoded or compressed, so DXF files are generally large.

Revit Architecture can import and export DXF files. See [Interoperability](#) on page 1341.

eave The lower edge of a roof that overhangs an exterior wall.

The following drawing shows the eave of the roof in green. For more information, see [Eaves](#) on page 686.

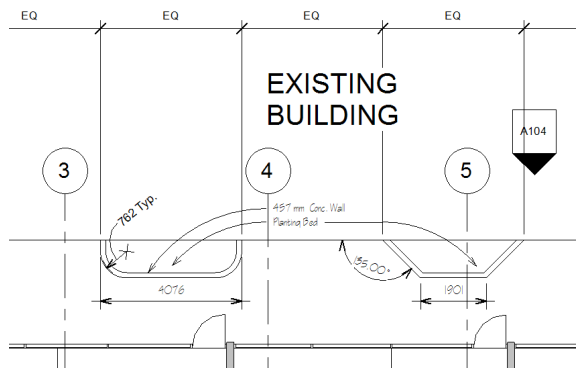


element An individual item in a building model.

Revit Architecture projects use 3 types of elements:

- **Model elements** represent the actual 3D geometry of a building. For example, walls, floors, and roofs are model elements.
- **Annotation elements** help to document the model. For example, dimensions, text notes, and section tags are annotation elements.
- **Datum elements** are non-physical items that are used to establish project context. For example, levels, grids, and reference planes are datum elements.

The following drawing includes model elements (walls, doors, planters), annotation elements (dimensions, text notes), and datum elements (grid lines). For more information, see [Building with Elements](#) on page 119.



element borrowing A Revit function for workshared projects. Element borrowing allows you to edit an element in a workset that you do not own. If another team member is currently editing the workset, that

team member is the owner of the workset and you must place a request to borrow the element. If no one owns the workset, permission to borrow is automatically granted.

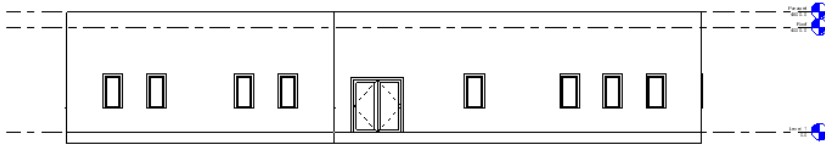
See [Borrowing Elements](#) on page 1259.

element properties Parameters or settings that control the appearance or behavior of elements in a project. Element properties are the combination of instance properties and type properties.

To view or change element properties, select the element in the drawing area, click Modify <element> tab ► Element panel ► Element Properties drop-down, and click Instance Properties or Type Properties. For more information, see [Element Properties](#) on page 120.

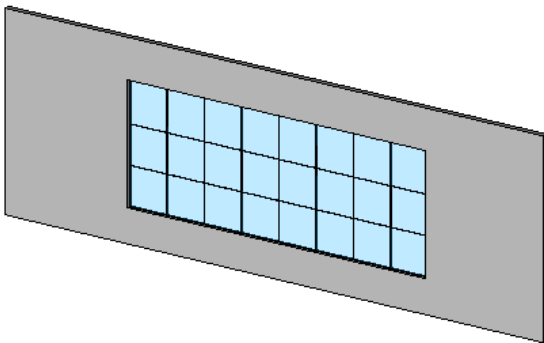
elevation An orthographic view of a vertical part of a building model. Typically, an elevation provides a side view of a building. Also called an elevation view.

For more information, see [Elevation Views](#) on page 131.



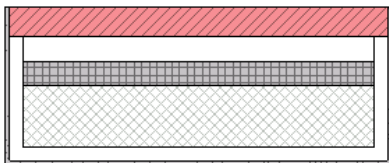
embedded wall A wall that is inserted into another wall of a different type or construction. Embedded walls are useful, for example, when you need to create a storefront on a building exterior.

The following image shows a curtain wall embedded in a host wall. For more information, see [Embedded Walls](#) on page 638.



end cap An end of a wall that does not join to another wall. The unjoined end of the wall is exposed.

You can specify whether compound wall layers wrap at end caps. For example, the following image shows a cross-section of a compound wall that uses interior wrapping at the end caps. See [Layer Wrapping](#) on page 815.



endpoint The end of a sketched line. See [Sketching](#) on page 303.

entourage An architectural term that refers to the landscaping and other environmental features shown in a rendering of a building. For example, entourage can include plants, trees, people, cars, and signs.

Revit Architecture provides a library of entourage families, and you can create or load additional entourage into a project. For more information, see [Plants and Entourage](#) on page 1203 and [Decals](#) on page 1215.



explode To disassemble an import symbol (which represents imported geometry) into its next highest level of elements. See [Exploding Imported Geometry](#) on page 1404.

export To convert information from a Revit project to another format, for use with another software application. For more information, see [Export](#) on page 1341.

extend To lengthen selected elements to meet a specified boundary. See [Trimming and Extending Elements](#) on page 390.

exterior The outside of a building, or the outside face of a surface.

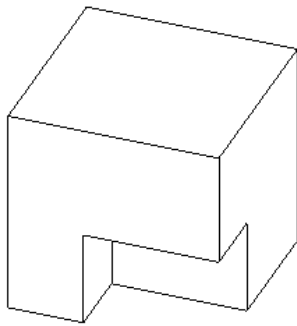
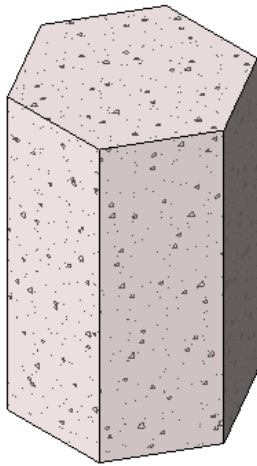
external reference An AutoCAD mechanism that allows the architect to reference other drawing files in an AutoCAD-based project. Also referred to as an xref.

See [Implications of Importing vs. Linking for Xrefs](#) on page 1388 and [Exploding Imported Geometry](#) on page 1404.

extrusion A method of defining 3D geometry for a building model.

You begin a solid extrusion by sketching 2D shapes on a plane. Revit Architecture then extrudes the sketch between a start point and an endpoint. See [Creating an Extrusion](#) on page 320.

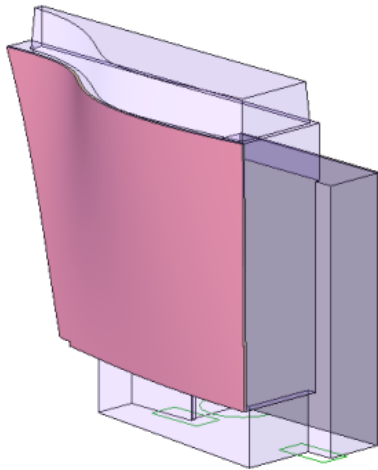
You can also create a void extrusion by cutting a shape out of a 3D solid. See [Creating an Extrusion](#) on page 320.



face A surface of a model element or mass.

You can apply paint, materials, and textures to each face of a model element (such as a wall). These details display when you render an image of the building model. See [Applying a Material to the Face of an Element](#) on page 411.

You can use mass faces as the basis for creating walls, roofs, curtain systems, and floors in a building model. The following image shows a mass face that is being used to create a wall. See [Creating Building Elements from Mass Instances](#) on page 615.



family A class of elements in a category. A family groups elements with a common set of parameters (properties), identical use, and similar graphical representation.

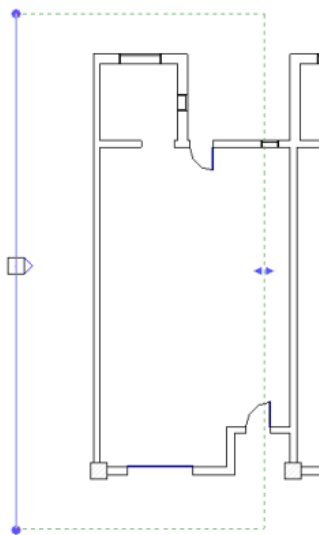
Different elements in a family may have different values for some or all properties, but the set of properties (their names and meaning) is the same. For example, a family of concrete round columns contains columns that are all concrete and round, but of different sizes. Each column size is a type within the Concrete Round Column family.

See [category](#) on page 1461 for examples of the hierarchy of categories, families, and types of model elements and annotation elements. For more information, see [Building with Elements](#) on page 119 and [Revit Families](#) on page 415.

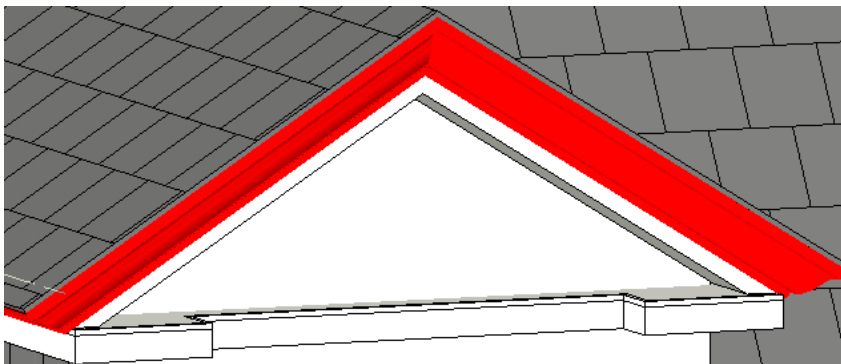
family type Also referred to as simply a **type**. See [family](#) on page 1480 and [type](#) on page 1547.

far clip plane The clip plane that is at the side of the view farthest from the start point of an elevation view, a section view, a 3D view, or a walkthrough view.

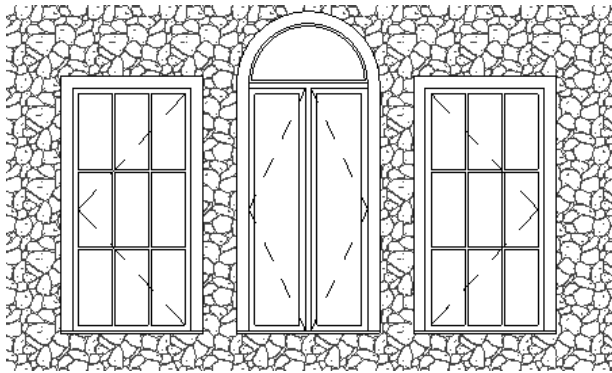
In the following floor plan, the green dotted line opposite the blue line represents the far clip plane for an elevation. See [Changing the Clip Plane in an Elevation View](#) on page 133.



fascia A board (or other covering) used to conceal the exposed ends of roof rafters. The fascia can be plain or decorative, as in the following illustration (shown in red). For more information, see [Fascia](#) on page 691.



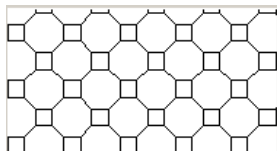
fenestration The stylistic arrangement of windows on the face of a building.



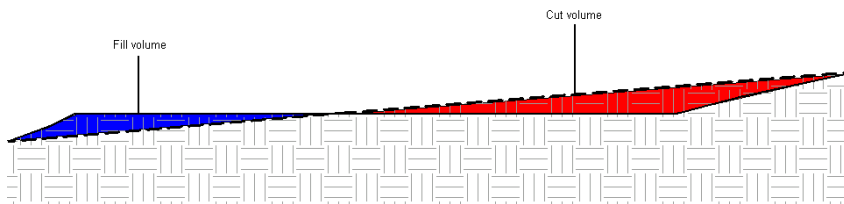
fill pattern A graphic design for surfaces that are cut or shown in projection. You can use fill patterns for model patterns and drafting patterns.

For more information, see [Fill Patterns](#) on page 459.

Floor fill pattern



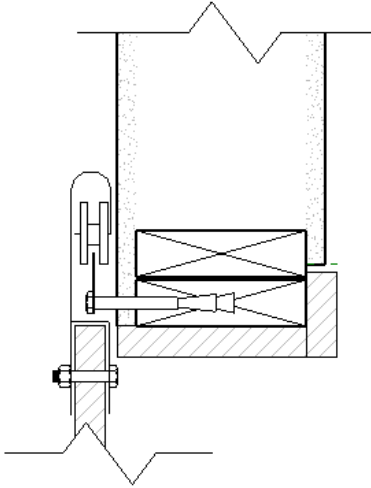
fill volume The amount of fill (material) required to prepare a site for construction. For example, in the following drawing, the red area indicates the cut volume, and the blue area indicates the fill volume required to level the site for a building. See [Reporting Cut and Fill Volumes on a Site](#) on page 964.



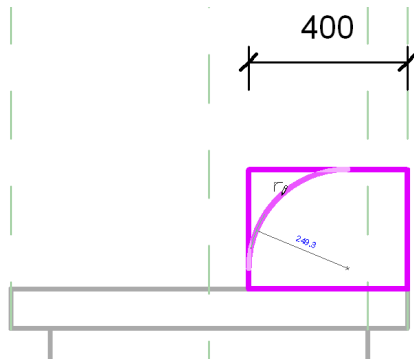
filled region A 2D, view-specific graphic. You can use filled regions to represent various surfaces, such as concrete or compacted earth. You can add a filled region to a detail view, a drafting view, or an annotation family. For each filled region, you can specify a boundary line style and a fill pattern.

For more information, see [Filled Region](#) on page 1153.

Filled regions in a drafting view



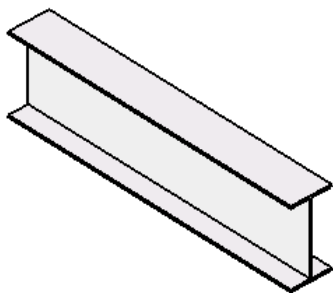
fillet A drafting term that refers to rounding a square corner, using a radius to define the curve. See [Sketching a Fillet Arc](#) on page 311.




filter A mechanism for eliminating or including the display or selection of elements in a view, based on their properties. In Revit Architecture, you can use filters in the following ways:

- To select or deselect elements in a view. See [Selecting Elements Using a Filter](#) on page 341.
- To override the graphic display and control the visibility of elements in a view. See [Controlling Visibility and Graphic Display of Elements Using Filters](#) on page 204.
- To control the display of elements based on their phase status: new, existing, demolished, or temporary. See [Phase Filters](#) on page 1333.

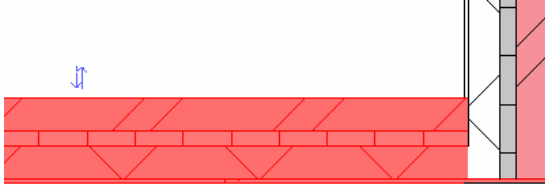
flange A ridge that projects at right angles from the edge of a beam to provide strength and rigidity.



flip control A graphical icon in the Revit drawing area that you can use to reverse the position or orientation of an element in the drawing area.

For example, when you click the flip control  for a compound wall, the wall flips over, so its layers reverse. See [Flipping Elements](#) on page 380.

Compound wall with flip control



flip grip Another name for a [flip control](#).

floor area face See [mass floor](#) on page 1503.

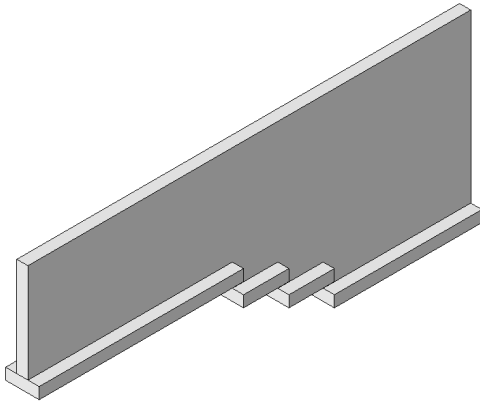
floor plan A 2D drawing of a building model that shows the layout of walls and other building components. In Revit Architecture, a floor plan is also referred to as a floor plan view.

See [Plan Views](#) on page 125.



focal point The point in the distance on which a camera is focusing. See [camera](#) on page 1460.

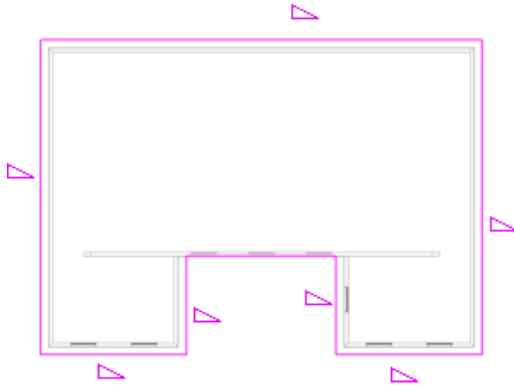
footing The base of a foundation that rests directly on the soil. The footing is generally wider than the foundation to distribute its load and provide additional stability for the building.



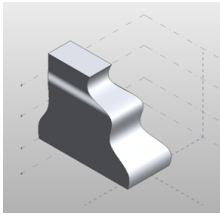
footprint The area covered by or required by an object. For example, the footprint of a toaster on your kitchen counter is the amount of countertop that the toaster covers.

In Revit Architecture, you can create a roof or floor based on the footprint of the walls. You can also sketch a 2D shape to represent the desired footprint of the walls, roof, floor, or stairway of a building.

In the following image, the pink lines indicate the sketched footprint of a roof for a building. The pink angles indicate the slope of the roof on each side.



form The various geometric shapes created in the conceptual design environment, for example, extrusions, sweeps and lofts.



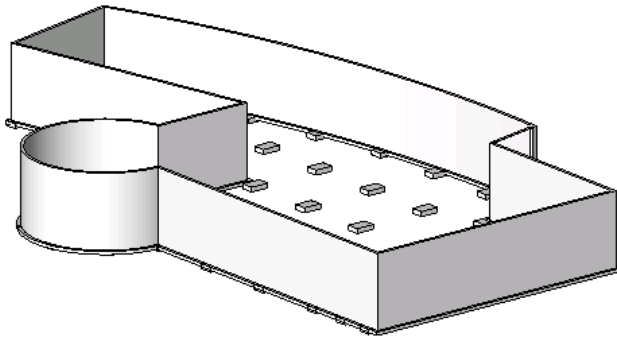
formula A mathematical equation used to determine the dimension of an object or a calculated value for a schedule. Formulas allow you to create parameters that depend on other parameters for their values. For example, you can create a width parameter that equals twice the height of an object.

The following type properties include a formula for the sill length of a new window family. See [Using Formulas for Numerical Parameters](#) on page 387.

Construction			
Wall Offset Top	50.0	=	
Wall Offset	50.0	=	
Sill Length	1900.0	=	Width - 2 * Wall Offset
Sash Width	50.0	=	

foundation The structural base of a building that provides stability and rigidity. A wall foundation usually rests on a footing. A slab foundation may rest directly on prepared ground.

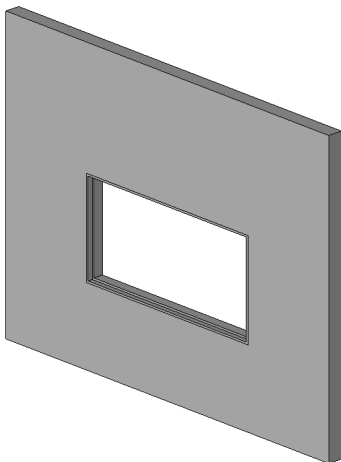
See [Wall Foundations](#) on page 915 and [Foundation Slabs](#) on page 940.



frame (1) In an animation, a single image (for example, in a walkthrough animation or a solar study).

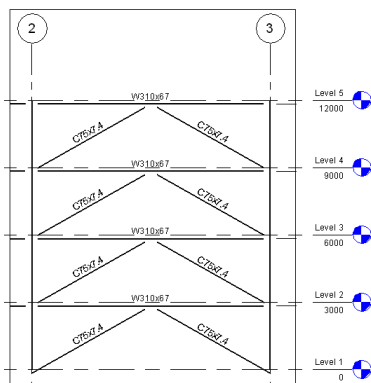
frame (2) In a building, a rigid structure built into a wall to hold a door, window, or other component. In Revit Architecture, you can specify the material and finish for a door frame.

Frame for a new window family



framing elevation An elevation view that shows the structural framing of a building model. You can work in a framing elevation when adding vertical bracing to the model, or for any task that requires quick work plane alignment to a grid or to a named reference plane.

See [Framing Elevation Views](#) on page 135.



full explode The process of completely disassembling an import symbol (which represents imported geometry) into Revit elements, including text, curves, lines, and filled regions. (Compare with [partial explode](#) on page 1516.)

See [Exploding Imported Geometry](#) on page 1404.

gable A triangular area of an exterior wall formed by 2 sloping roofs, from ridge to eaves.

For more information, see [Four-Sided Gable Roof](#) on page 701.



gbXML Green building XML, an open schema created to help building designers gather information about the energy consumption characteristics of building projects.

To perform energy analysis for a building model, you can export a Revit project to gbXML. Using a third-party application, analyze the resulting gbXML file to calculate the loads for the building model. See [Exporting Your Design to gbXML](#) on page 1372 or go to <http://www.gbxml.org>.

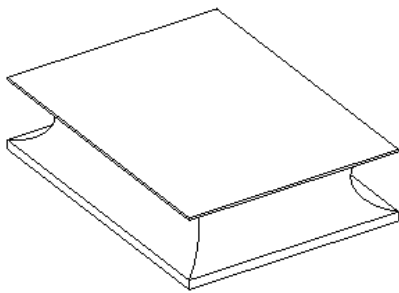
generic annotation Text that documents a building model. Generic annotations are usually related to a parameter for a model element or type.

You can create generic annotation families and nest them inside host model families, so that the annotations display in the project. This is useful if you want to include a label with a model family and display that label in the project.

generic model A family of geometry that does not fit into any of the other, pre-defined categories (such as columns, roofs, and floors). In a Revit project, an instance of a generic model is a model element.

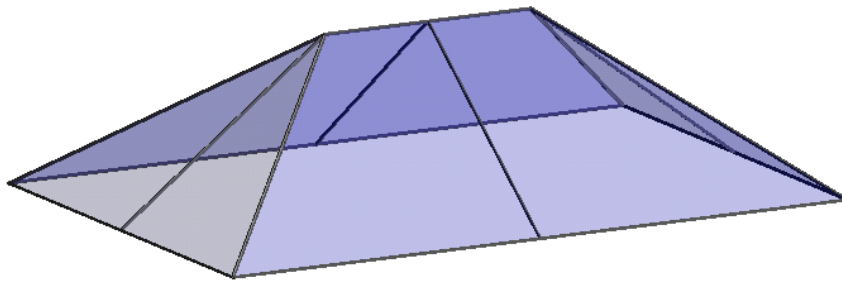
You can create a generic model as a loadable family, or as an in-place element that is specific to a project. (See [Revit Families](#) on page 415.) Revit Architecture provides templates for various types of generic model families.

geometry The shape or form of a surface or solid.

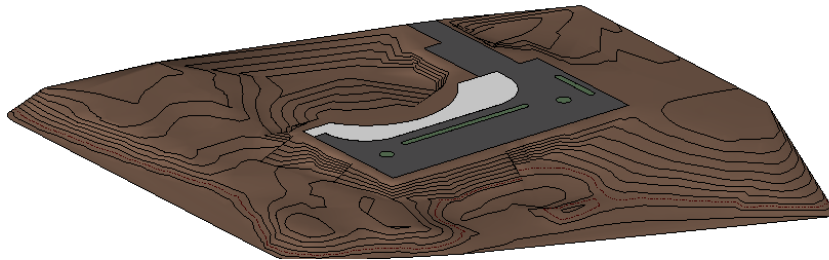


girder A beam used as a main horizontal support in a building or bridge. Girders are often made of steel, wood, or reinforced concrete.

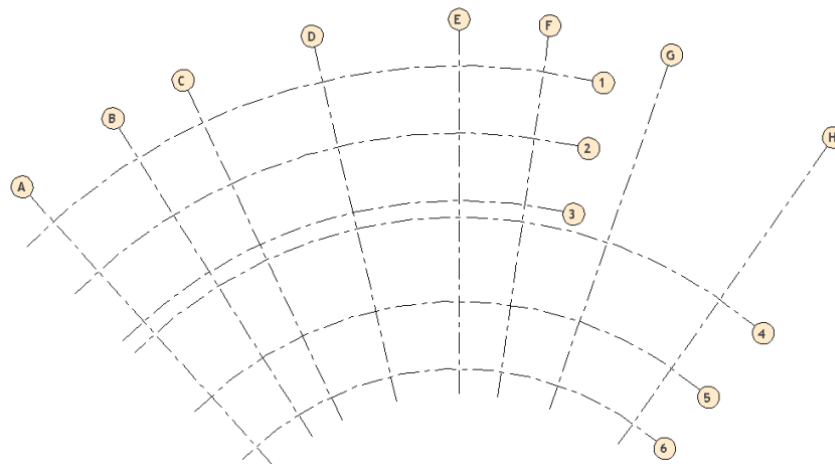
glazing Panes or sheets of glass set into sashes or frames (for example, for windows, doors, or mirrors). See [Adding Sloped Glazing](#) on page 680.



graded region A sloped area in a topographical surface.
For more information, see [Graded Regions](#) on page 960.



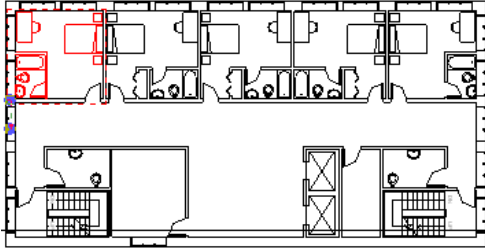
grid A series of lines that you can use to help draw or place elements in a building design. Grids are useful in the design and documentation phases of a project. In Revit Architecture, grids are datum elements.
For more information, see [Grids](#) on page 1093.



ground plane A horizontal plane that represents ground level in a building model.
In Revit Architecture, you can specify the ground plane when creating a solar study for 2D and 3D views. (See [Solar Studies](#) on page 1241.)

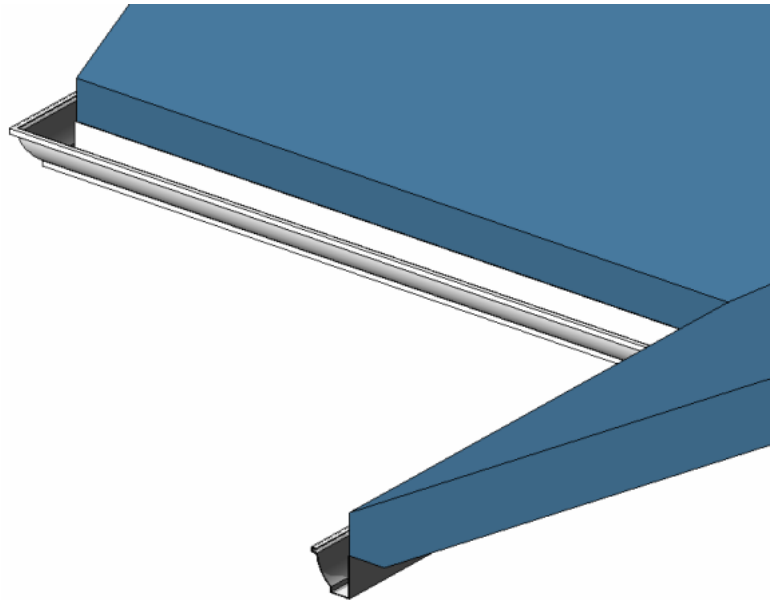
group A defined set of elements that can be placed as a unit in a building design. Grouping elements is useful when you need to create entities that represent repeating units or are common to many building projects (for example, hotel rooms, apartments, or repeating floors).
See [Editing Elements in Groups](#) on page 354.

Hotel room elements grouped and repeated



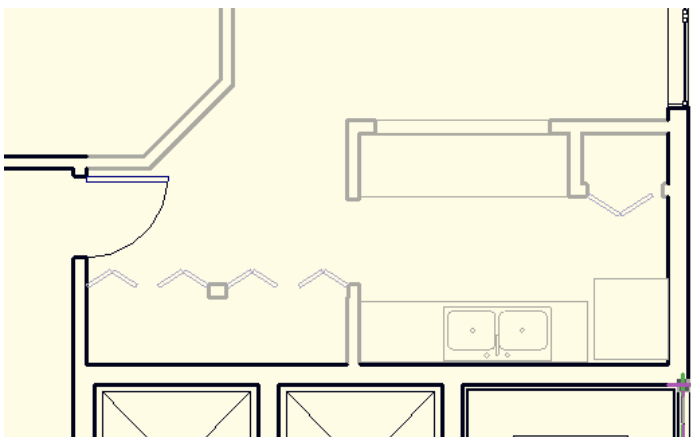
gutter A trough (often made of metal or plastic) along the edge of a roof. A gutter collects water off the eave and carries it to the down spout.

See [Roof Gutters](#) on page 697.

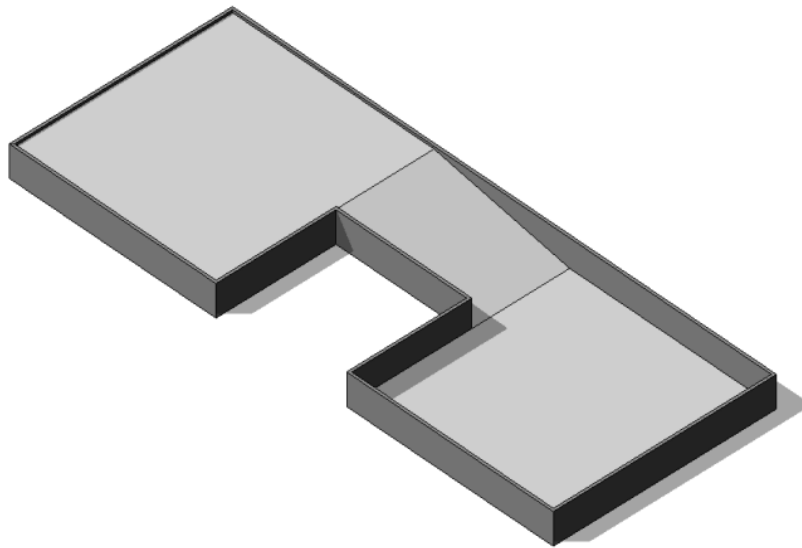


halftone A display color that blends the line color of an element with the background color of the view. For example, the following image shows some elements in halftone (gray) and others in black.

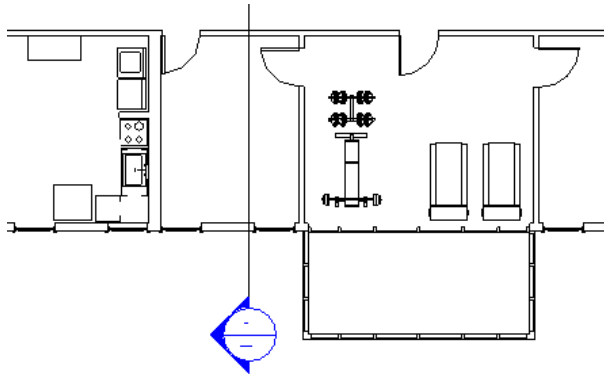
You can specify the halftone display properties using the Visibility/Graphics dialog. See [Visibility and Graphic Display in Project Views](#) on page 198 and [Halftone/Underlay](#) on page 497.



head (1) For elements that can slope (including roofs, ramps, floors, and ceilings), the upper end of the slope. For example, in the following illustration, the head is the upper end of the sloped floor.

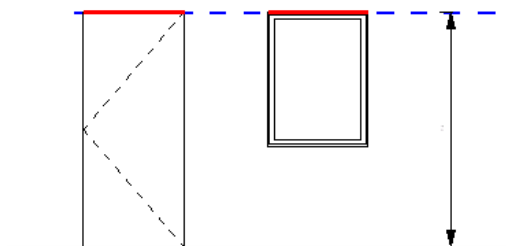


head (2) In Revit Architecture, the symbol that displays in a drawing to represent a component, such as a section, callout, elevation, grid, or level. For example, in a floor plan, you can double-click a section head to go to the section view. (In the following floor plan, the blue symbol is a section head.)



head (3) For windows and doors, the piece that goes across the top of the window or door to create the rough opening.

head height For windows and doors, a measurement from the floor to the top of the rough opening.



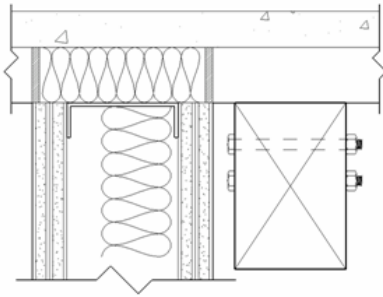
hidden element An element that you hide in a particular view.

See [Hiding Elements in a View](#) on page 208 and [Showing Hidden Element Lines](#) on page 245.

hidden line A dashed line representing an edge or surface that cannot be seen in a view.

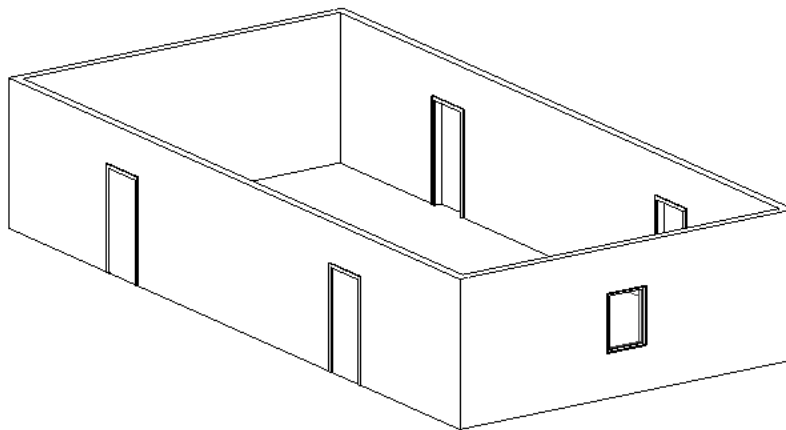
For example, in the following image, 2 bolts go through the stud. The view shows the hidden lines of one bolt but does not show the hidden lines of the second bolt.

See also [hidden line mode](#) on page 1490. For more information, see [Show Hidden Lines](#) on page 1155.



hidden line mode A model graphics style in which Revit Architecture hides the lines of elements that are obscured by other surfaces. (Compare with [wireframe](#) on page 1552.)

See [Hidden Line Model Graphics Style](#) on page 252.



highlight To move the cursor over an object in the drawing area so that Revit Architecture displays the object's outline in a different weight (bold) and color (such as gray instead of black). A description of the element displays on the status bar at the bottom of the Revit window. After a brief delay, the element description also displays in a tooltip near the cursor.

This highlighting indicates that the object is ready for selection. Click to select the highlighted object.

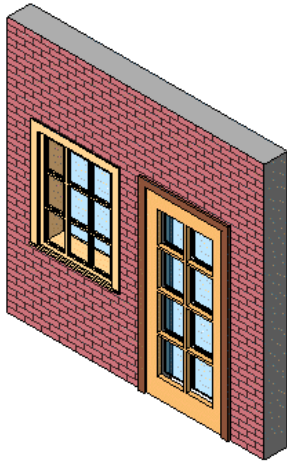
See [Selecting Elements](#) on page 339.

Wall before and after highlighting



host A model element that can accept (host) other components. For example, a wall is a host for windows and doors. A roof is a host for skylights and dormers. A host may also be referred to as a host element or a host component.

Compare with [hosted component](#) on page 1491.



hosted component A model element that can exist in a building model only if sponsored by another (host) element. Doors, windows, model lines, and components (such as furniture) are hosted components.

For more information, see [Hosted Components](#) on page 796.

i-drop An Autodesk feature that allows you to drag and drop content from a web page into a Revit session. Using i-drop, designers and developers have the power to create web pages that can easily be dragged and dropped into Autodesk design products that are i-drop enabled.

You can import CAD files into Revit Architecture using i-drop. See [Importing CAD Files Using i-drop](#) on page 1389.

IFC See [Industry Foundation Classes \(IFC\)](#) on page 1492.

imperial The British Imperial System of weights and measures.

When you install Revit Architecture, you specify whether you want to use imperial units (feet and inches) or metric units (meters and centimeters). You can also change the type of units used in a project. See [Project Units](#) on page 502.

import To bring information from another source into a Revit project. For example, you can import DWG files created using a CAD application (such as AutoCAD) into Revit Architecture. See [Import/Link](#) on page 1386.

import symbol A Revit element that contains all objects (such as blocks and xrefs) from an imported drawing. When you move the cursor over the imported objects, Revit Architecture shows information about the import symbol.

You can explode an import symbol to convert it into individual Revit elements. See [Exploding Imported Geometry](#) on page 1404.

imported categories Categories of elements that are derived from an imported drawing. See [Exploding Imported Geometry](#) on page 1404.

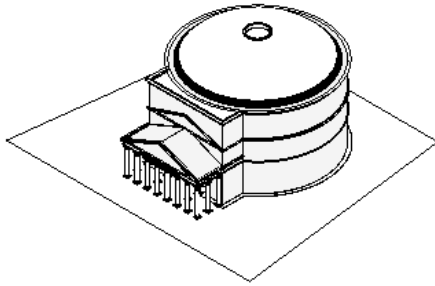
You can change the visibility and graphic display of imported categories. See [Visibility and Graphic Display in Project Views](#) on page 198.

in-place family A family of elements that is created within the context of the current project. An in-place family exists only in the project and cannot be loaded into other projects.

Using in-place families, you can create components that are unique to a project or components that reference geometry within the project. For example, to create a reception desk that must fit between several other items in a room, design the desk as an in-place furniture family. In a structural model, you might create an in-place family for a thickened structural floor, or a wall extrusion that conforms to a uniquely shaped architectural wall that it supports. If the original design ever changes, the in-place element changes accordingly.

The following dome roof was created as an in-place element. For more information, see [In-Place Elements](#) on page 434.

A dome roof created as an in-place element



Industry Foundation Classes (IFC) A file format developed by the International Alliance for Interoperability (IAI). IFC provides an interoperability solution between IFC-compatible software applications in the construction and facilities management industry. The format has established, international standards to import and export building objects and their properties.

Revit Architecture provides IFC import and export based on the latest IAI IFC data exchange standard. When you export a Revit building model to IFC format, the information can be used directly by other building specialists, such as structural and building services engineers.

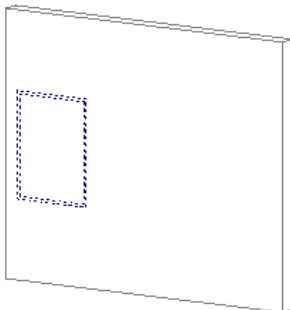
For more information about Revit Architecture and IFC, see [Exporting to Industry Foundation Classes \(IFC\)](#) on page 1367 and [Opening Industry Foundation Class \(IFC\) Files](#) on page 1397.

For more information about the IFC file format, go to <http://www.iai-international.org>.

infill element An insert that fills (patches) a hole in a host element after changes are made during different phases of a building project. For example, if you remove a window from a wall during a demolition phase, Revit Architecture fills the hole with an infill element. By default, the infill element has the same properties as the host element (the wall).

The following illustration shows a demolished window that has become an infill element. See [Infill Elements for Phasing](#) on page 1335.

An infill element replacing a demolished window



InfoCenter

You can use InfoCenter to search a variety of information sources with one query. You can also easily access product updates and announcements.

instance An individual occurrence of an element.

For example, when you place a wall in a building model, the wall is an instance of the wall type. If you change parameters for the wall instance, the changes affect only that wall. If you change parameters for the

wall type, the changes affect all walls (instances) of that type, including existing walls and new walls that you create in the future.

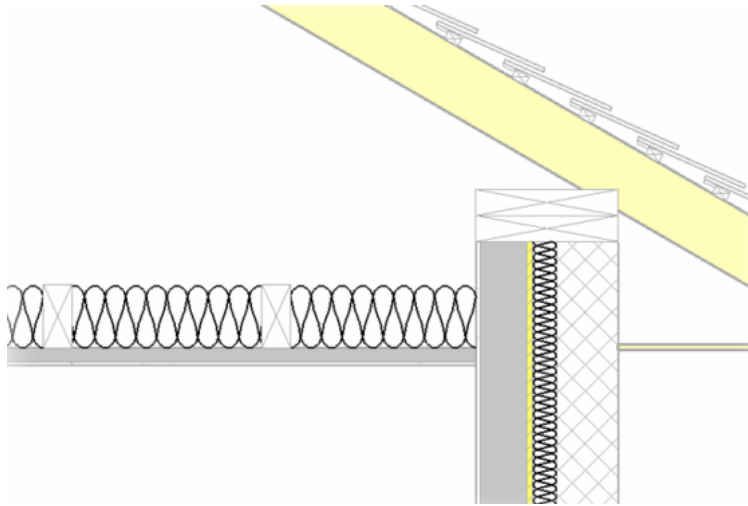
instance parameters Settings that control the appearance or behavior of an individual element in a project. The instance parameters and type parameters of an element combine to establish its element properties. Instance parameters are also called instance properties.

For more information, see [Modifying Type Properties](#) on page 121.

instance properties See [instance parameters](#).

insulation Material that has insulating properties designed to help a building retain heat in winter and prevent heat gain in summer. In Revit Architecture, you use a detail component to represent insulation in 2D drawings.

For more information, see [Insulation](#) on page 1133.



interior The inside of a building, or the inside surface of an object.

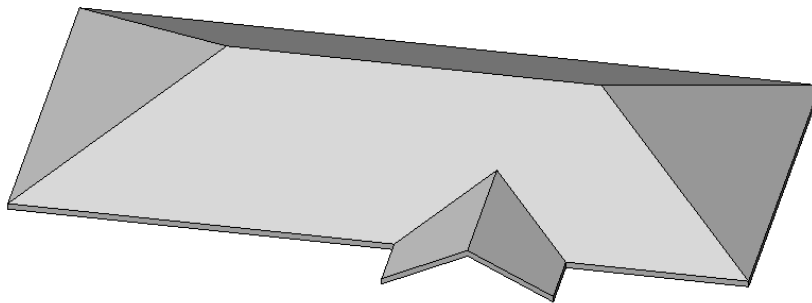
interoperability The ability of Revit Architecture to interact with other software applications. Examples of interoperability include importing files from other applications into a Revit project, and exporting a Revit project to a file format that can be used by other applications.

For more information, see [Interoperability](#) on page 1341.

isolate To display only a certain element or type of element, so that you can work with it in a particular view without being distracted by other elements in the design.

See [Temporarily Hiding or Isolating Elements or Element Categories](#) on page 209.

A roof that has been isolated from the rest of the building model

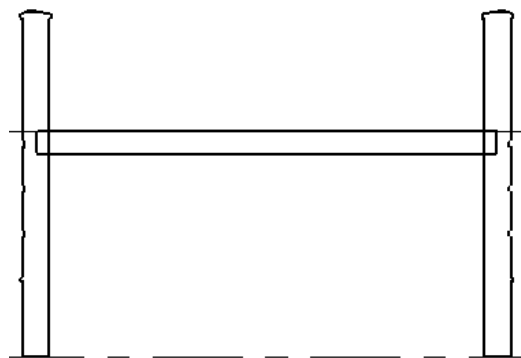


join The intersection where 2 or more elements share a common face.

join (2) To resolve intersections between elements that share a common face. The level of detail for the view determines the detail of join geometry that is shown.

The following images show geometry before they are joined (top) and after they are joined (bottom) in a view with a coarse detail level. See [Joining Geometry](#) on page 406.

Before joining geometry

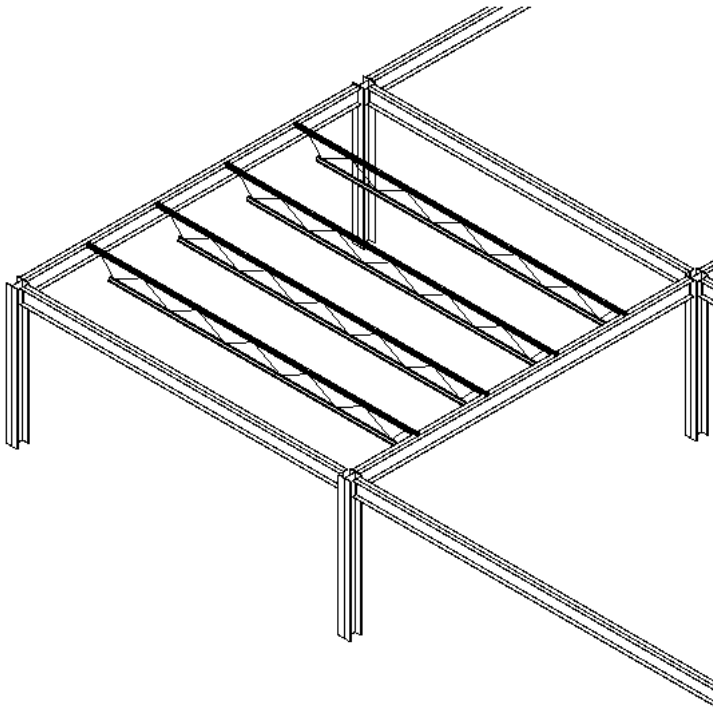


After joining geometry



joist A beam that supports a floor or ceiling. Joists are generally made of wood, steel, or concrete. They are often set parallel from wall to wall or across or abutting girders.

See [Structural Usage of Beams](#) on page 842.



key schedule A table of information that you create to simplify or automate data entry in other, larger schedules. A key schedule can reduce the time required to produce a larger schedule and help to generate accurate cost estimates.

For example, a room schedule for an apartment building might list 100 rooms with the same floor, wall, and base finishes. In a key schedule you can define Room Style keys, such as Public, Service, and Units. Each key specifies different floor, wall, and base finishes for its room style. Rather than manually specifying finishes for all 100 rooms, you can assign a room style to each room. When you create a room schedule, fields in the schedule automatically update with the appropriate finishes, based on the assigned Room Style keys.

For more information, see [Key Schedules](#) on page 173.

Key schedule listing finishes for different types of rooms

Room Style Schedule			
Key Name	Base Finish	Floor Finish	Wall Finish
Public	As Selecte	As Select	As Selected
Service	As Selecte	As Select	As Selected
Units	As Selecte	As Select	As Selected

In a room schedule, assigning a room type to an individual room

U17-6	Gallery	Level 1	15 m²	(none)
U17-7	Bedroom	Level 1	23 m²	(none)
U17-8	Bath	Level 1	9 m²	Units
101	Building Entry	Level 1	12 m²	(none)
102	Storage	Level 1	5 m²	(none)
103	Corridor	Level 1	18 m²	(none)
104	Corridor	Level 1	46 m²	(none)
105	Storage	Level 1	11 m²	(none)
106	Stair	Level 1	12 m²	(none)

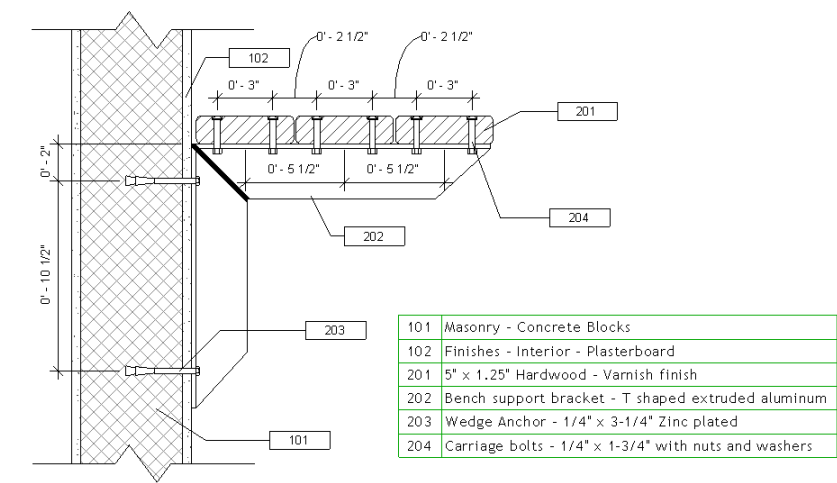
keynote legend A list of keynote numbers and the corresponding keynote text. (See [keynoting](#).)

If you choose to annotate model elements using keynote numbers only, you can use a keynote legend to provide descriptive text for each keynote number. By using a keynote legend, you avoid cluttering the drawing with text.

For more information, see [Keynote Legend](#) on page 1120.

keynoting A method of annotating drawings to identify building materials, describe assembly instructions, or provide special instructions or explanations. Keynotes help to standardize information related to the building design and can help reduce clutter in drawings.

In Revit Architecture, each sheet can display its own keynote legend, or all keynotes for the project can be documented on one sheet. For more information, see [Keynotes](#) on page 1117.



label A text placeholder added to tags or title blocks. You create a label as part of a tag or title block family while in the Family Editor. When you place the tag or title block in the project, you replace the label with the actual value for that instance.

For example, the following title block template contains labels that indicate the type of information to be entered on a sheet. When you create a sheet, the labels are replaced with actual values.

Owner
Project Name
Project Number
Date: Issue Date
Drawn By: Name
Checked By: Checker
Sheet Number:
A101

landing A platform between sets of [stairs](#), or the floor at the head or foot of a ramp or a set of stairs.

layer (1) In Revit Architecture, the adjacent materials of a compound structure, such as a wall. You can define the layers in a compound structure. See [Compound Structure](#) on page 813.

layer (2) In AutoCAD, a mechanism for defining, organizing, and controlling the display of drawing objects. When you export a Revit project to a CAD format, you can create a layer mapping file to map Revit categories and subcategories to CAD layers. See [Exporting Layers](#) on page 1360.

layer mapping file A text file that maps each Revit category or subcategory to a preconfigured layer name for the CAD software. For example, a Revit door object automatically maps to the A-DOOR layer in AutoCAD. The layer names are preconfigured in the text file, but you can change them. You use a layer mapping file when exporting a Revit project to a CAD format. See [Exporting Layers](#) on page 1360.

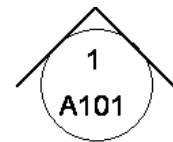




leader A line that connects an annotation to an element or part of the building model in a view. Also referred to as a leader line.

In Revit Architecture, you can control the line weight, style, and color of the leader, as well as its position, shape, and arrowhead.

legend A table that provides descriptions or information about symbols used in drawings.

In Revit Architecture, you can create a legend and include it on multiple sheets. See [Legend Views](#) on page 168.

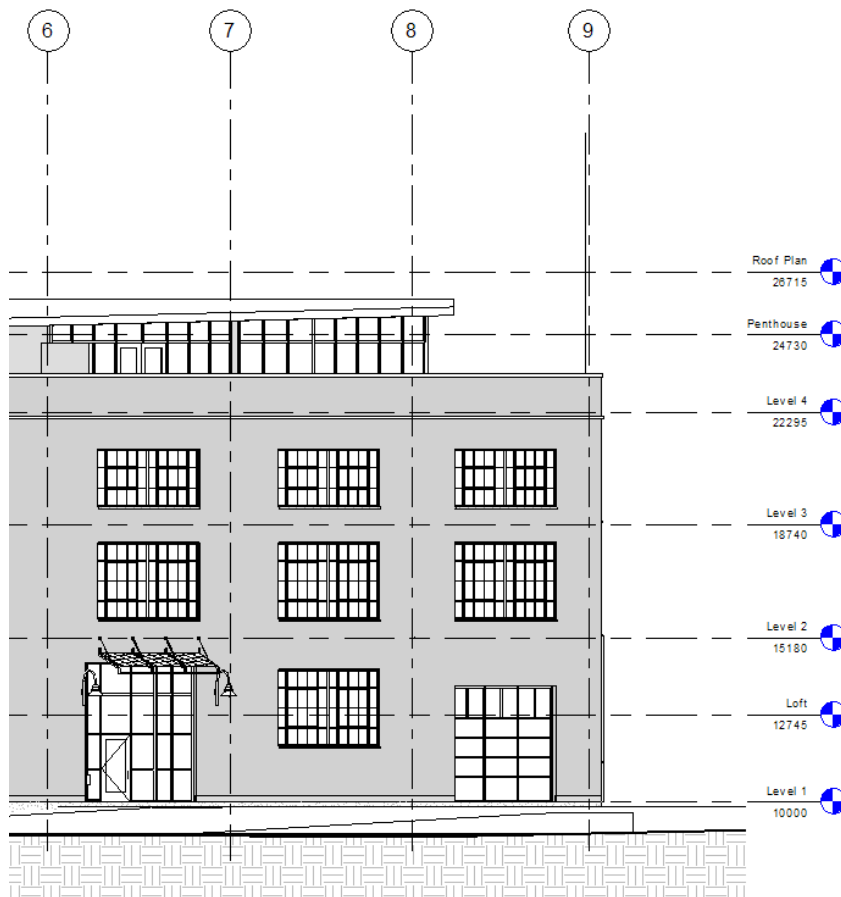
Symbol legend for use on construction documents

	SIM Detail Callout
Name Elevation	 Level Indicator
	Door Tag
	Window Tag
	Sheet Keynote

level A finite horizontal plane that acts as a reference for level-hosted elements, such as roofs, floors, and ceilings.

In Revit Architecture, you define a level for each vertical height or story within a building, or other needed reference of the building (for example, first floor, top of wall, or bottom of foundation). You can add levels in a section or elevation view.

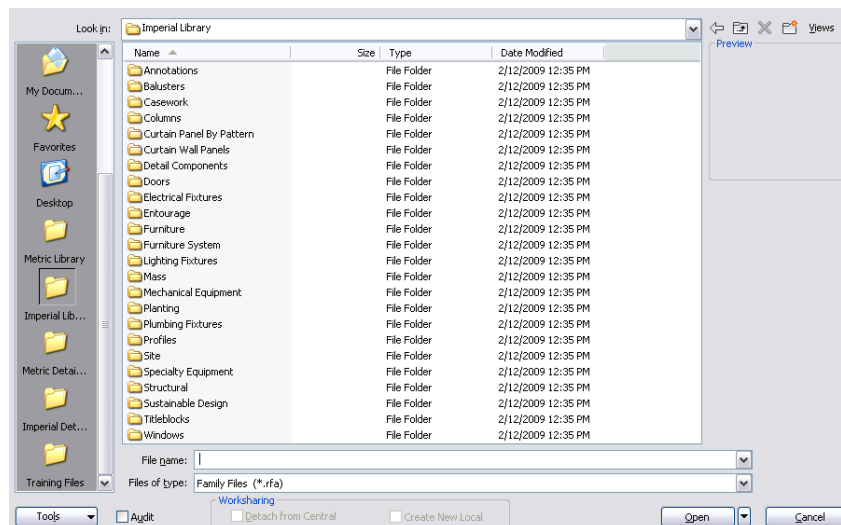
For more information, see [Levels](#) on page 1101.



library A collection of predefined resources that you can use in a Revit project.

For example, you can access libraries of templates, detail components, entourage, materials, and families of model elements and annotation elements. Revit Architecture provides some libraries. Other libraries are available on the Internet.

Family categories in the Imperial library



line pattern A series of dashes or dots alternating with blank spaces.

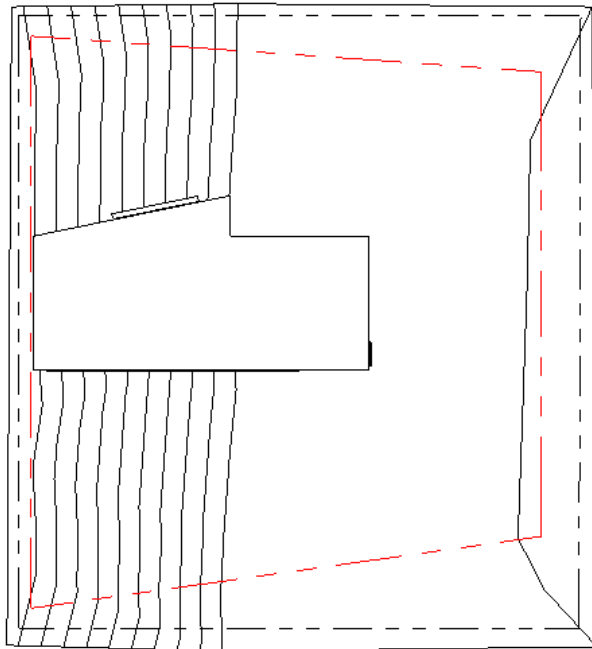
In the building industry, construction documents often use different line style conventions to convey information and to differentiate one line from another. For example, dimensions may use thin solid lines, while callout bubbles use heavy dashed lines.

You can specify the line pattern as part of the line style for many types of lines used in Revit Architecture. (See [line style](#) on page 1499.)

To define line patterns, click Manage tab ► Settings drop-down ► Line Patterns. For more information, see [Line Patterns](#) on page 496.

line style A line of a particular pattern, weight, and color, used to indicate different effects. For example, in the following site plan, a red dashed line indicates the zoning setback.

Revit Architecture predefines several line styles and uses them for default purposes. You can change these and add your own line styles to suit your needs and preferences. For more information, see [Line Styles](#) on page 494.

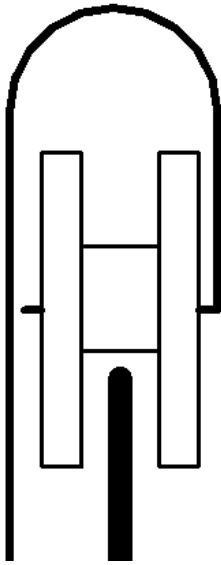


line weight The thickness of a line.

You can specify the line weight as part of the line style for model lines, perspective lines, and annotation lines used in Revit Architecture. (See [line style](#) on page 1499.) To define line weights, click Manage tab ► Settings panel ► Line Weights.

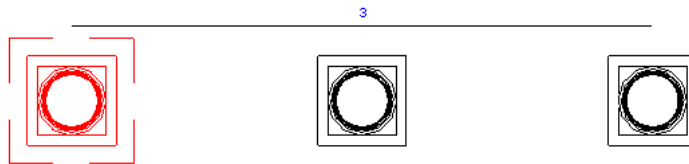
For more information, see [Line Weights](#) on page 495.

Detail of roller assembly
using lines of different
weights



linear Arranged in a line.

For example, when you create a linear array, the elements in the array are arranged along a straight line. See [Creating a Linear Array](#) on page 366.

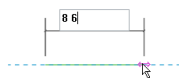


link To connect a file to a Revit project. When a linked file is updated, the updated information is automatically made available in the Revit project. Linking avoids the need to re-import updated information into the project.

In Revit Architecture, you can create a link between projects. You can also link CAD files and DWF markup files to a Revit project. See [Import/Link](#) on page 1386 and [Working with Linked Models](#) on page 1277.

listening dimensions A Revit feature that allows you to specify a value for a dimension as you sketch an element in a view. You specify a start point for the element, start sketching in the desired direction, type the exact dimension desired, and press *Enter*. Revit Architecture draws the element to the specified length.

The following image shows the text box that appears when you start to type a listening dimension. For more information, see [Listening Dimensions](#) on page 283.



load To transfer a file or a collection of information from an outside location into a Revit project.

In Revit Architecture, you can load groups, templates, detail components, entourage, materials, families of model elements and annotation elements, and other project information.

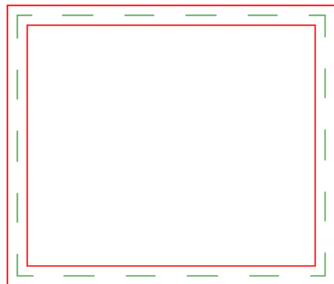
See also [library](#) on page 1498.

local file A copy of the project file that resides on the computer system of the team member who is working on the file. When worksharing is used to distribute project work among team members, each member uses a local file to work on his or her workset (functional area). Team members periodically save their changes to the central file so that others can see the changes and update their local files with the latest project information.

For more information, see [Working in a Team](#) on page 1249.

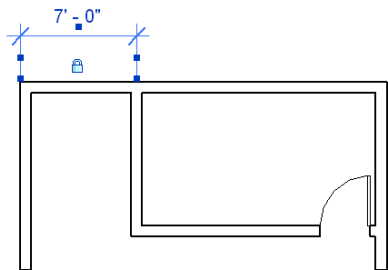
location line A vertical plane in a wall that is used for dimensioning. You create a wall by sketching the location line of the wall in a plan view or a 3D view. You specify what to use for the location line in the element properties of the wall: the wall centerline, core centerline, interior or exterior wall face, or interior or exterior face of wall core.

In the following illustration, the green dashed lines indicate the location line of the wall. See [Walls](#) on page 633.



lock To secure a dimension or the location of an element so that it cannot be changed. When you select a locked dimension or element, a lock control displays next to it.

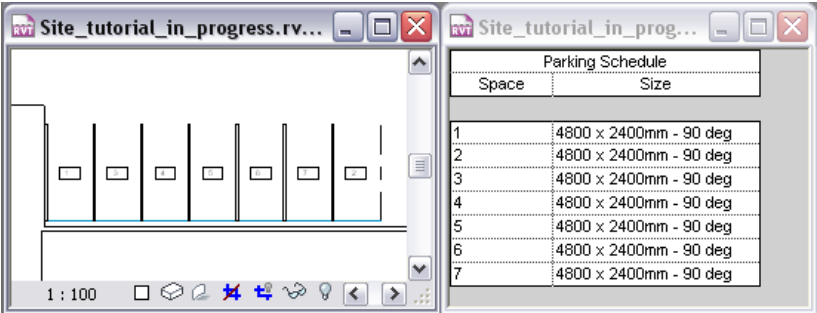
The following drawing shows a locked dimension. See [Locking Permanent Dimensions](#) on page 272.



You can also use the Pin tool to restrict the movement of elements. See [Preventing Elements from Moving](#) on page 382.

mark A unique identifier that you assign to an element in its properties. (Compare with [tick mark](#) on page 1546.)

You can include marks in schedules and tag labels. For example, the following site plan shows marks for individual parking spaces. These marks are also listed in the parking schedule.



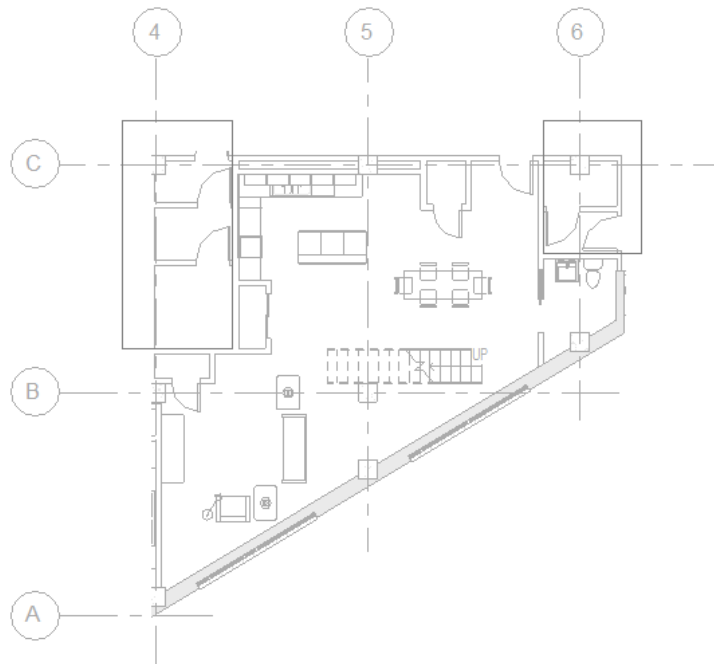
markup Comments or revision instructions from someone who reviewed a building design.

When you publish construction documents as DWF files, the files can be marked up electronically using a program such as Autodesk Design Review. Then the markups can be linked back into Revit Architecture to display the desired changes. See [Linking DWF Markup Files](#) on page 1403.

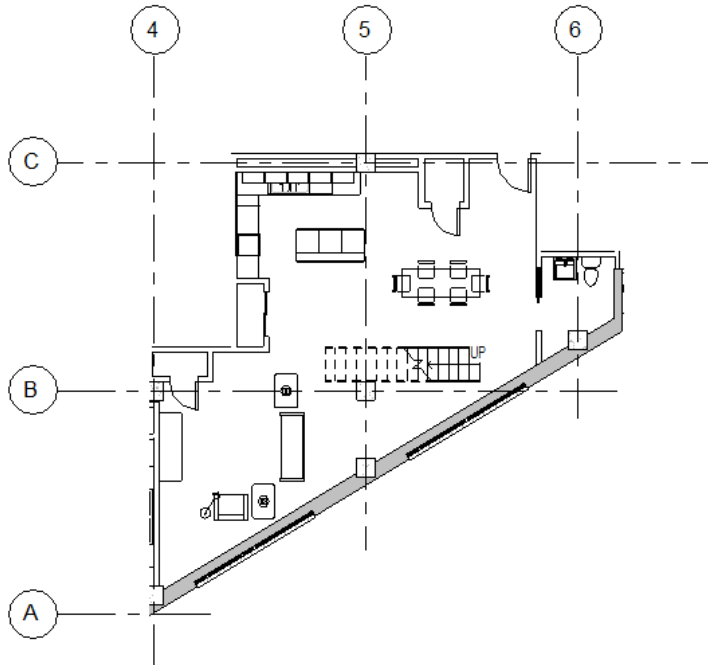
masking region A defined area that obscures elements in a view. Masking regions are useful when you are creating a model family from an imported 2D DWG file, and you need the model element to obscure other elements when placed in a view. You can also use them to hide parts of a drawing.

For more information, see [Masking Regions](#) on page 1147.

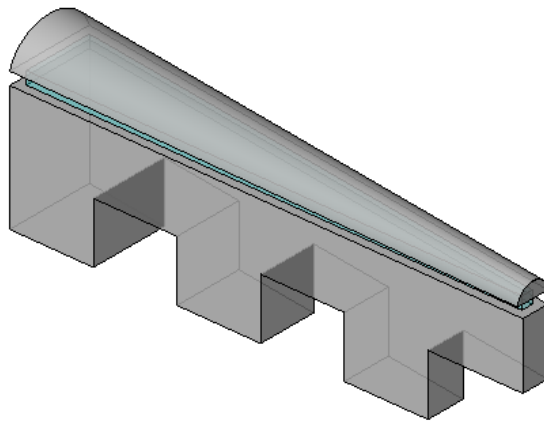
Masking regions sketched in upper corners



Unit plan view with upper corners masked



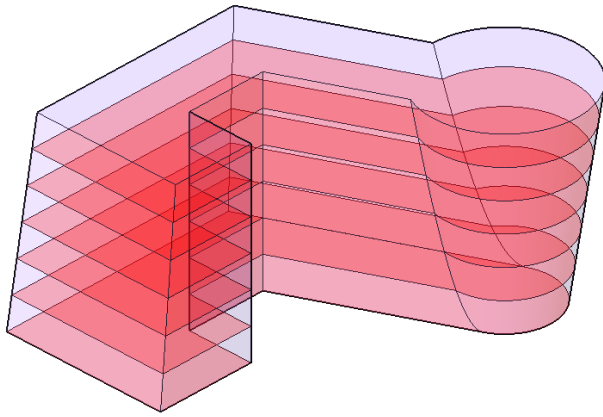
mass A 3-dimensional shape used in the initial design of a building model. See [Massing Studies](#) on page 589.



mass face See [face](#) on page 1479.

mass floor An interior horizontal surface in a mass. During the conceptual design stage of a building project, a mass floor represents a story in the building.

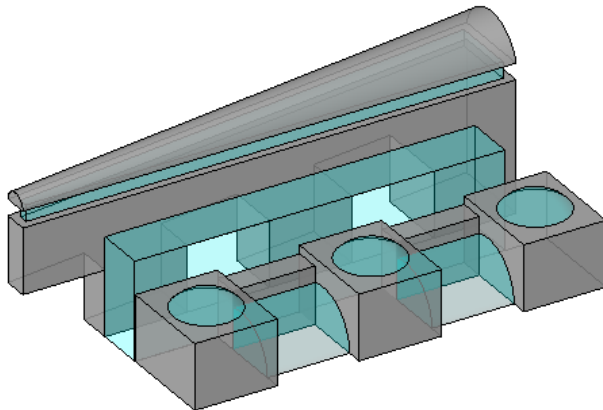
You can divide masses into mass floors to perform various types of analysis on the design. See [Analyzing a Conceptual Design](#) on page 594.



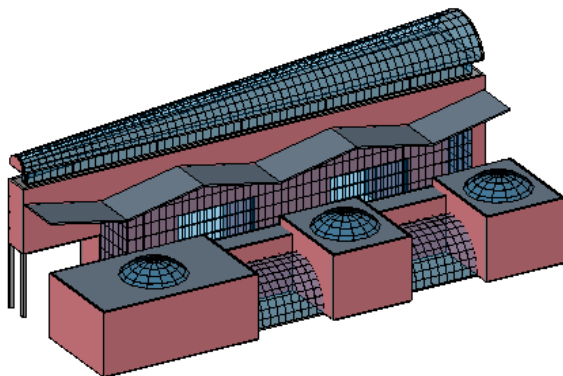
massing study One or more masses in a Revit project. Massing studies allow you to explore design ideas by using shapes to conceptualize a building model. When your conceptual design is complete, you can add building elements directly to these shapes.

See [Massing Studies](#) on page 589.

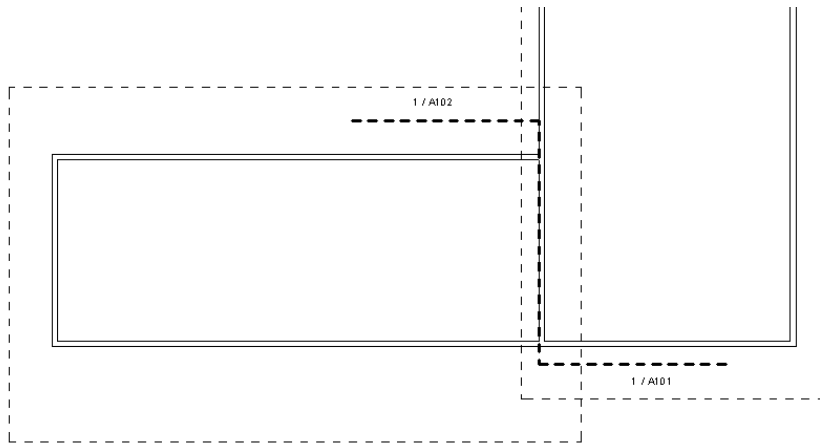
Massing study used as the basis for a building design



Final building design



matchline A sketch line that indicates where to split a view for a dependent view, as shown. See [Duplicate Dependent Views](#) on page 192.



material The substance of which an element is made.

In Revit Architecture, the material assigned to an element determines how the element appears in a view or rendering. Revit Architecture includes several materials in the default project templates, or you can define your own. You can specify the color (in a shaded view), texture (in a rendered image), surface pattern (in a projection), and fill pattern (in a cut view).

See [Materials](#) on page 468.



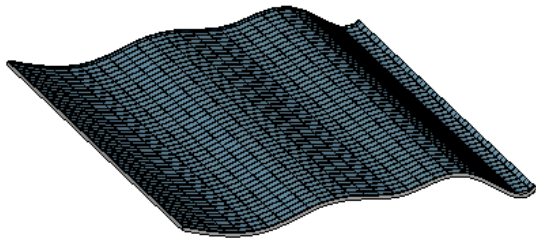
material takeoff schedule A list of the subcomponents or materials of any Revit family. Material takeoff schedules have all the functionality and characteristics of other schedule views, but they allow you to show more detail about the assembly of a component. Any material that is applied to a component within Revit Architecture can be scheduled.

For more information, see [Material Takeoff Schedules](#) on page 174.

Roof Material Takeoff				
Family and Type	Material: Description	Material: Area	Material: Cost	Estimated Cost
Basic Roof: Wood Joist - Insulation on Plywood Deck - EPDM	EPDM	595 m²	16.00	9522921.98
Basic Roof: Wood Joist - Insulation on Plywood Deck - EPDM	Plywood	595 m²	13.40	7975447.16
Basic Roof: Wood Joist - Insulation on Plywood Deck - EPDM	Rigid Insulation	595 m²	50.80	30235277.30
Basic Roof: Wood Joist - Insulation on Plywood Deck - EPDM	Wood Joist	595 m²	5.35	3184227.04
Grand total: 8		2381 m²		50917873.49

Max See [3ds Max](#) on page 1452.

mesh A grid of lines used to approximate a surface (for example, when rendering an image).



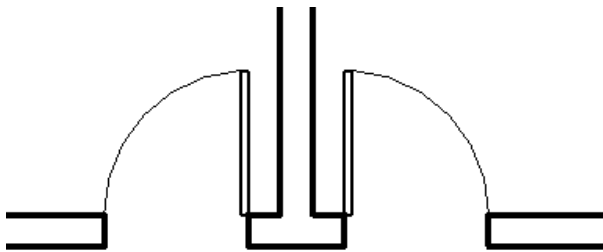
metric A standard of measurement that is based on the meter.

When you install Revit Architecture, you specify whether you want to use imperial units (feet and inches) or metric units (meters and centimeters). You can also change the type of units used in a project. See [Project Units](#) on page 502.

mirror To reverse the position of a selected model element, using a line as the mirror axis.

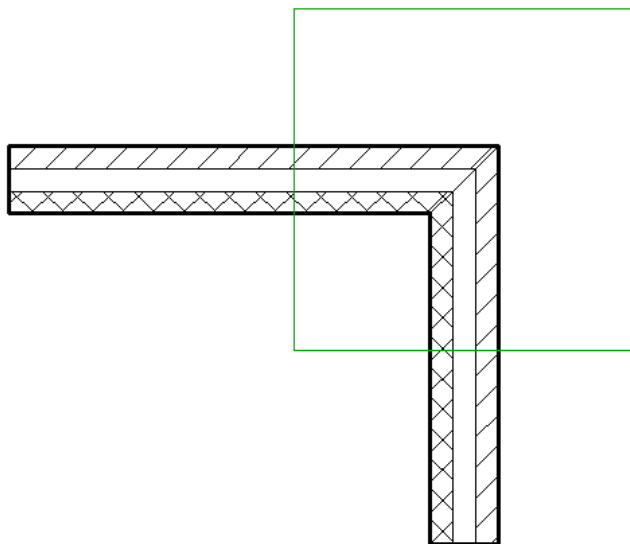
For example, if you mirror a wall on a reference plane, the wall flips opposite the original wall. You can pick the mirror axis or draw a temporary axis. Use the Mirror tool to flip a selected element, or to make a copy of an element and reverse its position in one step.

The following image shows the results of mirroring and copying a door, using the center wall as the mirror axis. See [Mirroring Elements](#) on page 380.



miter A joint at a 45-degree angle, or evenly angled between the joined elements. Mitering can apply to walls, wall sweeps, railings, structural floors, roof fascia, curtain wall mullions, and other model elements.

When 2 walls join, you can edit the wall join using a miter joint or other joint styles. See [Editing Wall Joins](#) on page 653.



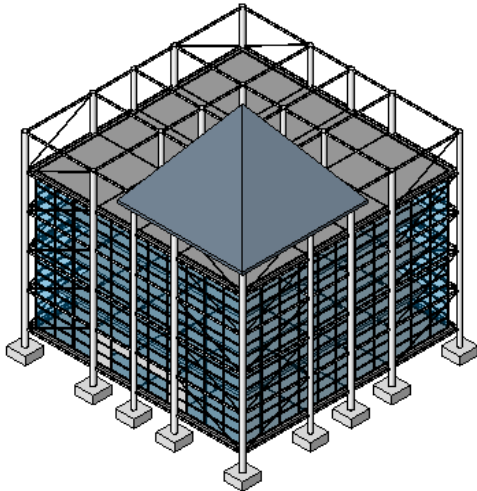
model A representation of a building or other design.

See also [building information modelling \(BIM\)](#) on page 1459.

model element An element in a building model that represents actual 3D geometry. For example, walls, windows, doors, and roofs are model elements.

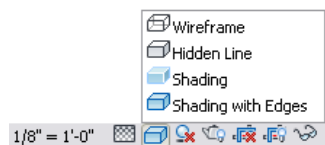
Compare with [annotation](#) on page 1453 and [datum](#) on page 1469. See also [element](#) on page 1476.

For example, the following image shows only model elements. It does not include annotation elements (such as dimensions or text notes) or datum elements (such as grid lines or levels). See [Building with Elements](#) on page 119.



model graphics style A method of displaying model elements in views. For example, you can choose to display a model using wireframe, hidden lines, shading, or shading with edges.

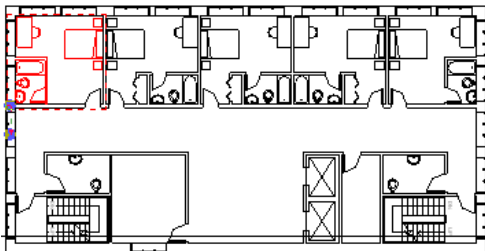
You can specify the model graphics style for a view using the View Control Bar at the bottom of the Revit window. For more information, see [Model Graphics Styles](#) on page 250.



model group A set of model elements that are placed together in a building design. Model groups are useful when you need to create entities that represent repeating units or are common to many building projects (such as hotel rooms, apartments, or repeating floors).

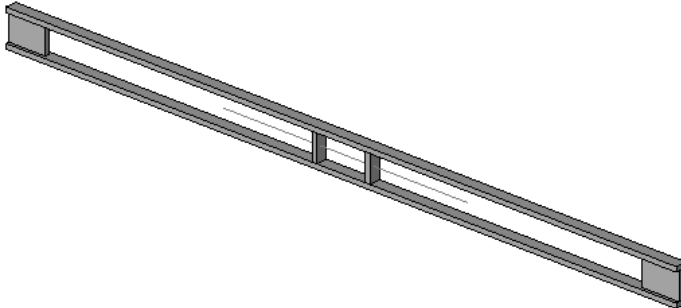
Compare with [attached detail group](#) on page 1456 and [detail group](#) on page 1471.

The following illustration shows a model group (highlighted in red) that has been placed in multiple hotel rooms. See [Editing Elements in Groups](#) on page 354.

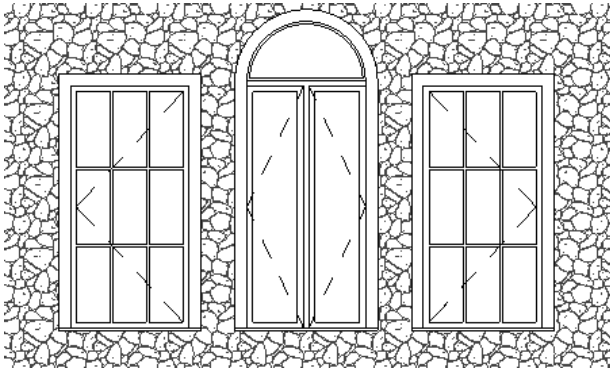


model line A model element that exists in 3D space and is visible in all views of a Revit project. You can use model lines to represent 3D geometry in a building design, such as cords or cables that secure a tarp. You can sketch straight, curved, arc, circular, fillet, and tangent lines. (Compare with [detail line](#) on page 1472 and [symbolic line](#) on page 1544.)

The following truss uses a model line to represent the beam stick symbol. For more information, see [Model Lines](#) on page 805.

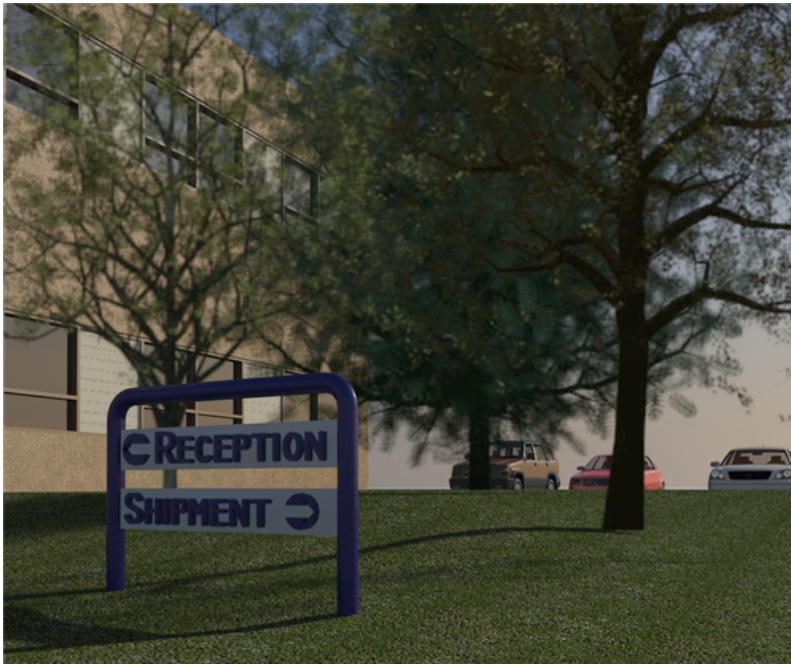


model pattern A graphic design that is applied to the surface of a model element. Model patterns represent the actual appearance of an element, such as brick coursing or ceramic tile on a wall. They are fixed with respect to the model and scale with the model. See [Fill Patterns](#) on page 459.



model text Text used in a building model, such as for signage. You can add model text in a project view and in the Family Editor for families that can be represented in 3D, such as walls, doors, windows, and furniture. An instance of model text is a model element.

Model text is not available for families that can only be represented as 2D, such as annotations, detail components, and profiles. You can specify properties for model text, including font, size, and material. For more information, see [Model Text](#) on page 793.



modelling The process of representing a design.

See also [building information modelling \(BIM\)](#) on page 1459.

moment The amount of rotation at an axis caused by downward force applied to a beam at a distance from its supporting members.

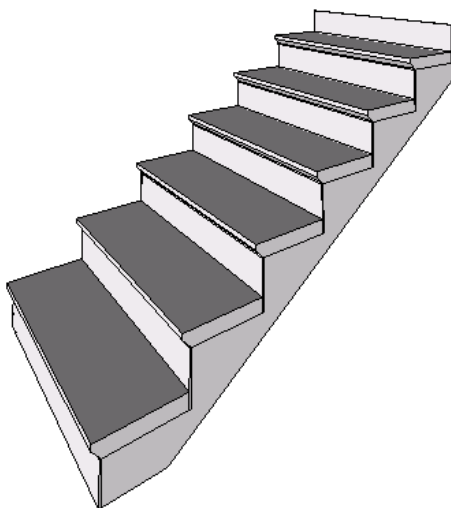
A **moment connection** is a connection that is designed to transfer moment and other forces between a beam and its supporting members.

In Revit Architecture, you can specify moment parameters for a beam, including the moment connection start and moment connection end.

See [Moment Symbols](#) on page 852.

monolithic stairs Stairs that consist of one solid piece of material, such as concrete.

In Revit Architecture, you can specify that stairs are monolithic in the stair type properties. You can also specify the material for monolithic stairs. See [Stair Type Properties](#) on page 738.



mullion In Revit Architecture, a vertical or horizontal strip between panels of a curtain wall or curtain system.

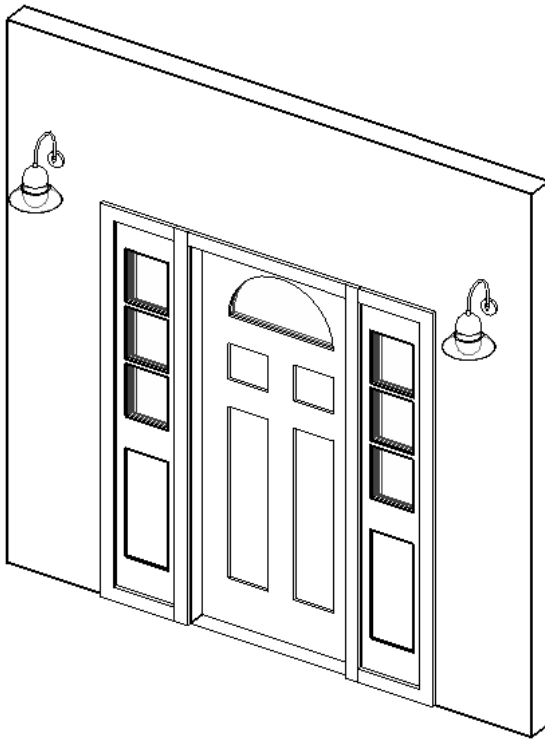
For more information, see [Mullions](#) on page 775.



nested family A family that consists of instances of other families (subcomponents). The subcomponents can belong to the same category (for example, various window types) or different categories (for example, an exterior door and two lighting fixtures). You create nested families using the Family Editor.

The following nested family includes a door, 2 sidelights, and 2 lighting fixtures.

For more information, see [The Families Guide](#) on page 418. See also [shared family](#) on page 1536.



non-bearing wall A wall that supports no additional vertical load except its own weight. Non-bearing walls can be used to define and divide spaces in Revit Architecture.

Compare with [bearing wall](#) on page 1457. For more information, see [Structural Walls](#) on page 906.

note block A list of all instances of annotations. Also referred to as an annotation schedule.

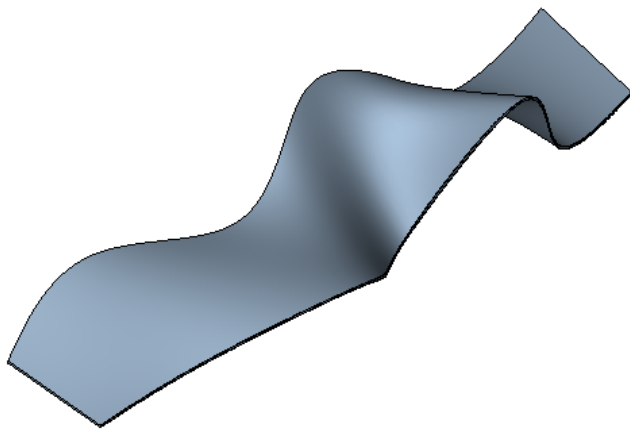
Note blocks are useful for listing notes that are applied to elements in a project. For more information, see [Annotation Schedules \(Note Blocks\)](#) on page 175.

Sample note block

Exterior Construction Notes	
Mark	Description
A	Seal existing doors and insulate.
B	Repair existing door surround. Contact Historic Preservation District official for specific requirements.
C	Clean and repair stone parapet cap as required.
D	Clean and repair existing stone trim as required.
E	Remove all existing windows. Clean opening and repair as required for new window installation.
F	Clean exterior brick wall. Tuckpoint as required.
G	Clean existing concrete loading dock. Repair as required.
H	Saw cut existing brick wall. Clean cut and repair wall as required.

NURB surface Non-uniform rational B-spline. A mathematical model commonly used in computer graphics for representing and generating curves and surfaces.

In Revit Architecture, you can create roofs and curtain systems on NURB surfaces. See [Creating Building Elements from Mass Instances](#) on page 615.



object A model element, annotation element, datum element, or imported element in a project.

object style A set of characteristics that define the line weight, line color, line pattern, and material for a category of model elements, annotation elements, or imported objects in a project.

For more information, see [Object Styles](#) on page 493.

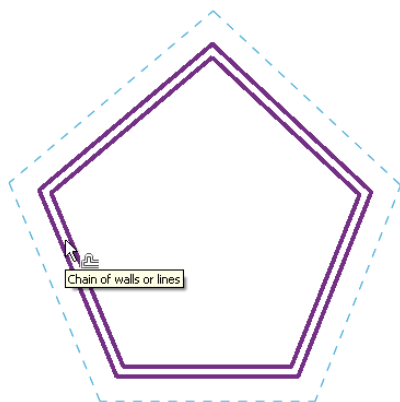
ODBC Open Database Connectivity. ODBC is a general export tool that works in conjunction with many software drivers.

You can export information about model elements in a Revit project to an ODBC database. See [Exporting to ODBC](#) on page 1362.

offset A uniform distance from an element or line, along which the element or line will move, or a new element or line will be created.

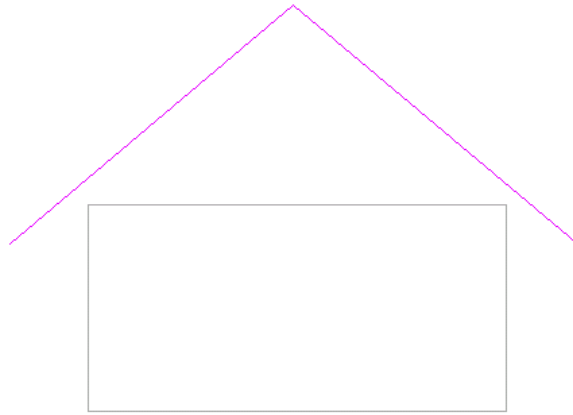
For example, when creating walls, you might specify an offset of 5 meters. When you select an existing wall, Revit Architecture draws a new wall 5 meters from the selected wall.

The following illustration shows that, when you move the cursor near the outside of a chain of walls, Revit Architecture draws a preview line to show the offset from the walls. See [Moving Elements with the Offset Tool](#) on page 374.



open loop A sketched line that does not connect to itself. Instead, it leaves an open space between the start point and endpoint of the line.

In Revit Architecture, you use open loops to sketch a roof by extrusion and to split toposurfaces and faces. In the following sketch, a closed loop defines the walls, ceiling, and floor. An open loop defines the roof.



Options Bar Part of the Revit interface that provides context-sensitive settings and functions, depending on the tool currently in use. In the Revit window, the Options Bar is located below the ribbon and above the drawing area.

See [Using the Revit Interface](#) on page 85 and [Options Bar](#) on page 99.

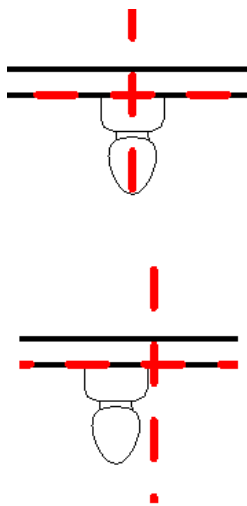
orientation The state of being aligned with (or facing the same direction as) a particular item or direction. For example, in Revit Architecture you can change the orientation of a view to True North, or you can change the orientation of a compound wall to reverse the order of its layers.

origin A fixed starting point, or the point in a coordinate system where the axes intersect.

In Revit Architecture, you use an origin for many functions, such as positioning a linked project, creating a custom fill pattern, positioning a group, resizing walls, or sketching lines for a new family.

The origin of each element is defined in the family file for the element. When you place an element in a project, Revit Architecture uses the origin defined for the selected family type when snapping to snap points and lines.

Toilet with center origin (top), and toilet with offset origin (bottom)



orthogonal At right angles to, or perpendicular to.

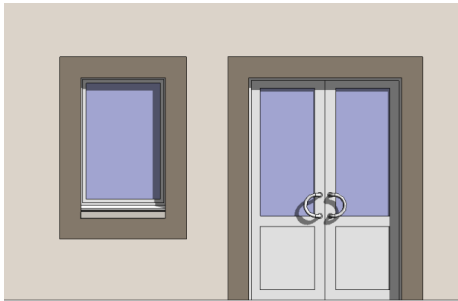
orthographic view A 3D view that shows a building model in which all components are the same size, regardless of the camera's distance from them.

Compare with [perspective view](#) on page 1517. For more information, see [3D Views](#) on page 156.



paint To apply a material to a surface of a model element. In Revit Architecture, you can paint walls, floors, roofs, and masses.

In the following image, the wall, door, door frame, and window frame are painted different colors. See [Applying a Material to the Face of an Element](#) on page 411.

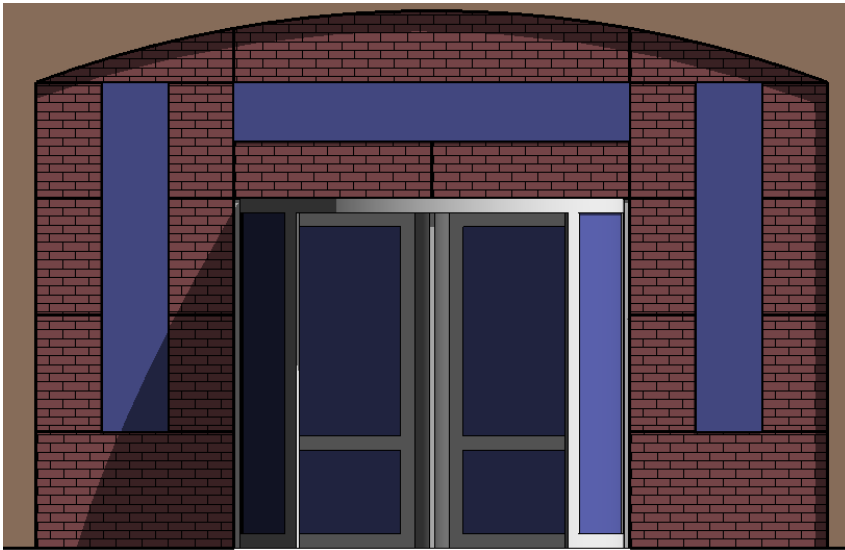


pan In a 3D context, pan moves the camera left and right.

In a 2D context, pan scrolls the view. If you are using pan with an active view on a sheet, pan scrolls the sheet view, not the active view on the sheet.

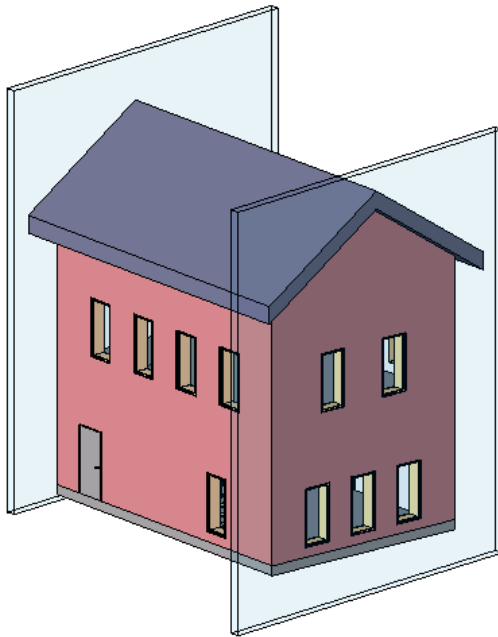
See [Navigating Views](#) on page 217.

panel In Revit Architecture, a section of a curtain wall or a curtain system. Panels are separated by mullions. Panels can consist of glass or different types of walls. See [Wall Panels in Curtain Walls](#) on page 779.



parallel view A view whose plane is parallel to the plane of another view. (Compare with [perpendicular view](#) on page 1516.)

For example, a Level 1 floor plan is parallel to a Level 2 floor plan. An east elevation view is parallel to a west elevation view. The following drawing illustrates the parallel planes that are used for the east and west elevations. For more information, see [Propagating Dependent View Configuration](#) on page 197 and [Datum Extents and Visibility](#) on page 1108.



parameter A setting that determines the appearance or behavior of an element, type, or view. Also called a property.

See [Element Properties](#) on page 120 and [View Properties](#) on page 259.

parametric Controlled by parameters.

In a Revit project, parameters define the relationships between elements of the building model. These relationships are created automatically by Revit Architecture and by you as you create the design. As you work in drawing and schedule views, Revit Architecture collects information about the building model. The

Revit parametric change engine automatically coordinates changes in all model views, drawing sheets, schedules, sections, and plans.

For more information, see [What Is a Project?](#) on page 117.

partial explode The process of disassembling an import symbol (which represents imported geometry) into its next highest level of elements: nested import symbols. A partial explode yields more import symbols, which, in turn, can be exploded into elements or other import symbols. (Compare with [full explode](#) on page 1486.)

See [Exploding Imported Geometry](#) on page 1404.

PAT A file format for fill patterns. A pattern file is a text file that contains definitions for model or drafting patterns in a project. See [Custom Pattern Files](#) on page 466.

pattern component Nested family which is applied to populate buildable architectural components across a large variety of geometric divided and patterned surfaces. It can contain both 2D and 3D geometry which create intelligent and flexible parametric components. See [Pattern Component Families](#) on page 578.

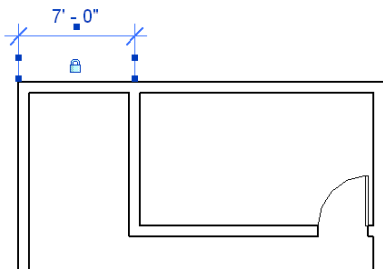
patterned surface A divided surface (see [Rationalizing Surfaces](#) on page 569) on which geometric shapes have been applied. These patterns become part of the surface and (depending on their shape) will require a specific number of grid cells when applied. See [Patterning Surfaces](#) on page 575.

PDF Portable Document Format. An open file format (originally created by Adobe Systems) that supports electronic information exchange.

In Revit Architecture, you can print construction documents as PDF files. You can then share the construction documents with team members, view them online, or print them. See [Printing to PDF](#) on page 1084.

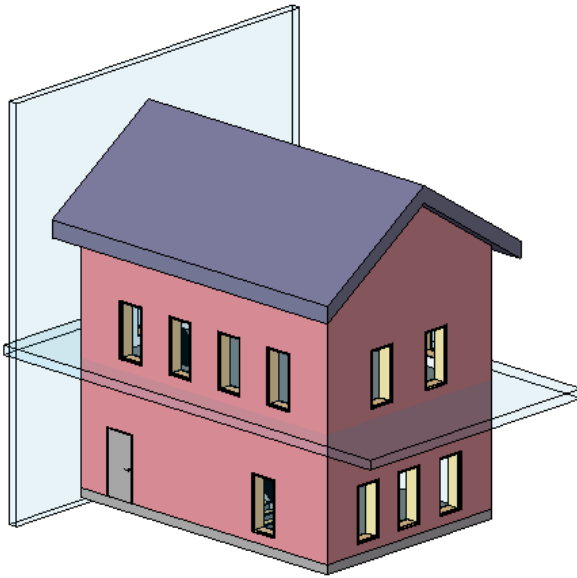
permanent dimension A dimension that specifies a particular size for an element or a distance between elements or points. Permanent dimensions always display in the view in which they are created. (Compare with [temporary dimension](#) on page 1545.)

You can lock permanent dimensions so that they cannot be changed without first unlocking them. You can also control the placement of the witness lines for dimensions. For more information, see [Permanent Dimensions](#) on page 264.



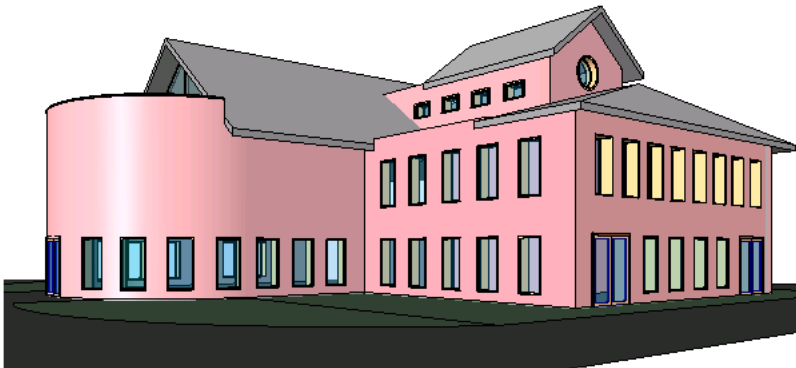
perpendicular view A view whose plane is at a right angle to the plane of another view. (Compare with [parallel view](#) on page 1515.)

The following image illustrates the perpendicular planes on which a floor plan and an elevation are based. For more information, see [Propagating Dependent View Configuration](#) on page 197 and [Datum Extents and Visibility](#) on page 1108.



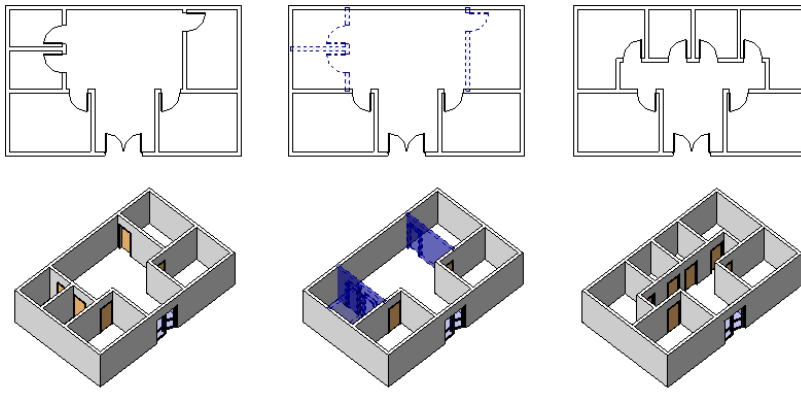
perspective view A 3D view of a building model, in which components that are further away appear smaller than those that are closer. In Revit Architecture, you create a perspective view by placing a camera in a 3D view. (See [camera](#) on page 1460.)

Compare with [orthographic view](#) on page 1514. For more information, see [3D Views](#) on page 156.



phase A stage or time period in the construction process of a building project. Typical phases include existing construction, demolition, remodeling, and new construction.

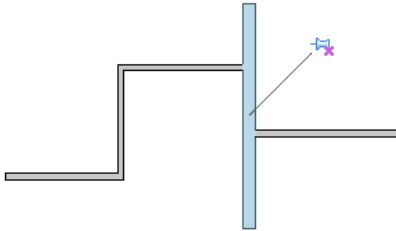
Revit Architecture tracks the phase in which views or components are created or demolished, and lets you apply phase-specific filters to views so you can define how the project appears during various stages of work. The following project views show different phases of construction for one project. See [Project Phasing](#) on page 1331.



pick box See [selection box](#) on page 1533.

pin To restrict the movement of an element using the Pin tool.

When you pin an element, you cannot move it by dragging or using the Move tool. However, changes in other attached elements may result in movement of the pinned element. See [Preventing Elements from Moving](#) on page 382.

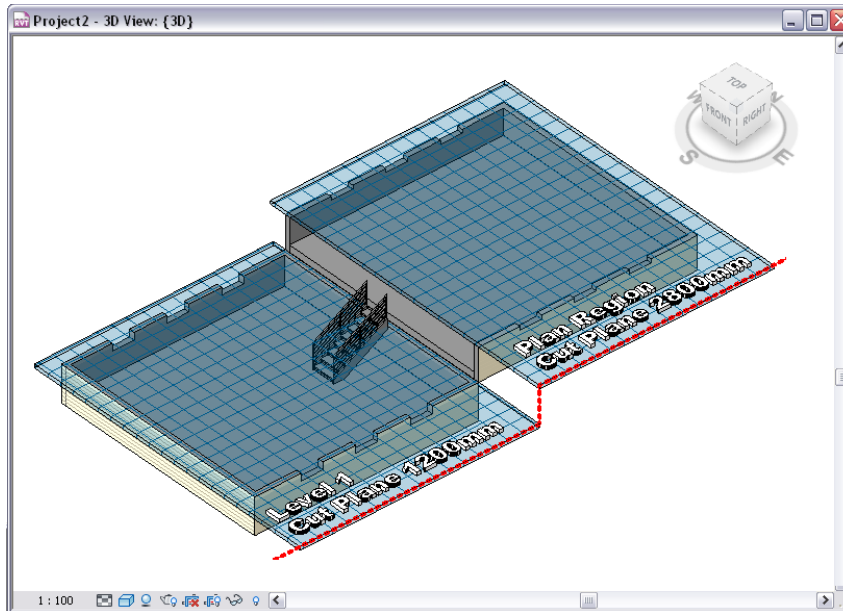


plan A 2D drawing of a building model that shows the layout of walls, rooms, and other building components. A floor plan presents a view of the building as though you are looking down on it from above, with the roof and intervening levels removed. A reflected ceiling plan is a drawing that shows the ceiling in a building design. See [Plan Views](#) on page 125.



plan region Part of a plan view that has a different view range from the overall view. Plan regions are useful for split level plans or for displaying inserts above or below the cut plane.

For more information, see [Plan Region](#) on page 129.



plan view A view of a floor plan or a reflected ceiling plan for a building model.

For more information, see [Plan Views](#) on page 125.

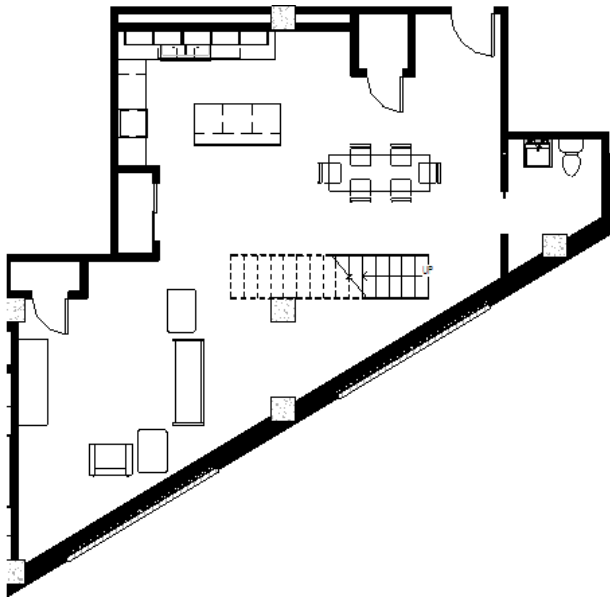
planting Vegetation used to create a landscape around a building design. Revit Architecture provides a library of planting families. You can also create or download additional plants.

For more information, see [Plants and Entourage](#) on page 1203.

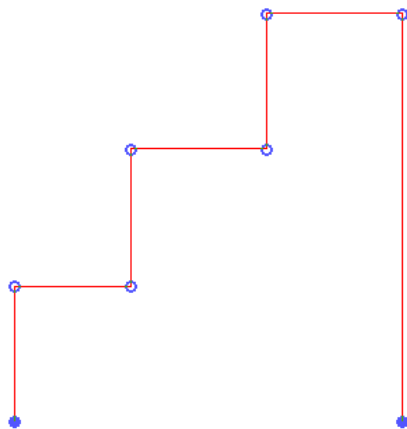


poche A fill pattern that represents a cut surface. (pronounced po-shay)

In Revit Architecture, you can specify the coarse poche material to display in 3D views. You can also specify the poche depth for a cross-section of earth in topography elements. In the following floor plan, the poche for the walls is a solid fill pattern.

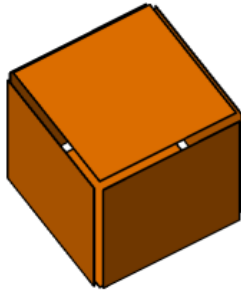


polyline A set of connected straight line segments. Polylines typically define open loops. See [Export Rooms and Areas as Polylines](#) on page 1353.



polymesh A 3D shape consisting of multiple polygons that are joined (meshed) together. For example, a polymesh cube consists of 6 square surfaces that are joined together to form the cube shape. This is sometimes referred to as face-based geometry.

Compare with [ACIS](#) on page 1452. For more information, see [Solids \(3D Views Only\)](#) on page 1352.



post A vertical support for a [railing](#).

See [Controlling Placement of Balusters and Posts](#) on page 749.

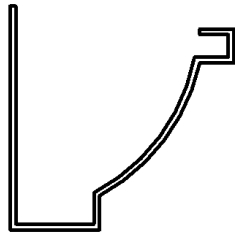
primary view The view on which one or more dependent views are based. The dependent views remain synchronous with the primary view and other dependent views, so that when view-specific changes (such as view scale and annotations) are made in one view, they are reflected in all views.

See [Duplicate Dependent Views](#) on page 192.

profile A series of 2-dimensional lines and arcs that form a closed loop. Use profiles to define cross-sections for railings, balusters, soffits, cornices, and other sweep-defined objects.

See [The Families Guide](#) on page 418.

Gutter profile



project A Revit file that contains all information about a building design.

For more information, see [What Is a Project?](#) on page 117.

project base point The project base point defines the origin (0,0,0) of the project coordinate system. It also can be used to position a building on a site and for locating the design elements of a building during construction.

See [Project Base Points and Survey Points](#) on page 1302.

Project Browser Part of the Revit interface that shows a logical hierarchy for all views, schedules, sheets, families, groups, and linked Revit models in the current project.

For more information, see [Project Browser](#) on page 93.

Project North The top of the view in the drawing area. When producing solar studies or rendered images, change the view orientation from Project North to True North to create accurate sunlight and shadow patterns for the project.

See [Rotating a View to True North](#) on page 449.

project parameters User-defined fields that you add to multiple categories of elements, sheets, or views in a project. These parameters are specific to the project and cannot be shared with other projects.

For example, you can create a project parameter named Approved By for views. In the properties for each view, you can enter a value for this parameter to indicate who approved the view.

You can use project parameters in multi-category or single-category schedules. However, you cannot use project parameters in tags for model elements.

Compare with [shared parameters](#) on page 1536. For more information, see [Project Parameters](#) on page 458.

project standards The settings used in a project that you want to apply to another project. Project standards include family types, line weights, materials, view templates, and object styles. See [Transferring Project Standards](#) on page 446.

project template A set of initial conditions for a project. Revit Architecture provides several templates, and you can create your own templates. Any new project based on a template inherits all families, settings (such as units, fill patterns, line styles, line weights, and view scales), and geometry from the template. Templates use the file extension RTE.

See [Creating a Custom Project Template](#) on page 445.

project view A representation of a building model. A Revit project file contains a database of information about a building model, and a project view is one way of looking at that information. Also called a view.

The Project Browser lists the views available for a project. These can include floor plans, ceiling plans, elevations, sections, detail views, drafting views, 3D views, walkthrough views, legend views, schedules, renderings, and sheets.

For more information, see [Project Views](#) on page 125.

projection line style A graphic style applied to an element when a view displays the element, so that you are seeing a representation of its exterior surface. (Compare with [cut line style](#) on page 1469.)

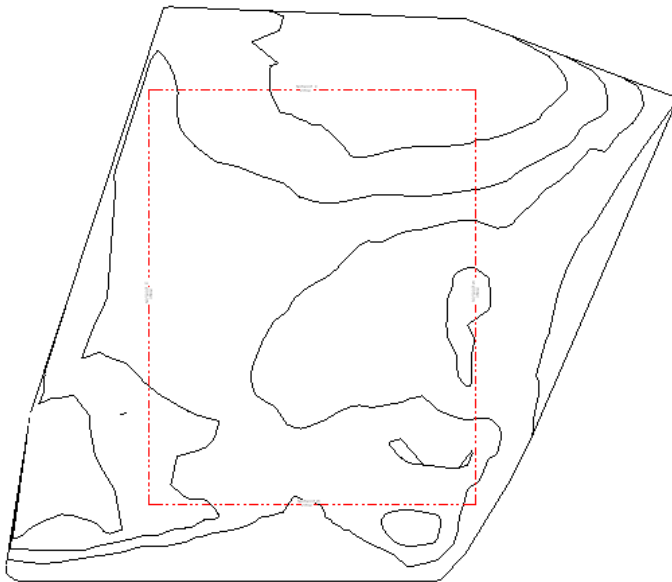
For the projection line style of an element, you can specify the line weight, color, and fill pattern. See [Modifying Object Styles](#) on page 493.

property A setting that determines the appearance or behavior of an element, type, or view. Also called a parameter.

For more information, see [Element Properties](#) on page 120 and [View Properties](#) on page 259.

property line The boundary of a plot of land or the site for a building project.

For more information, see [Property Lines](#) on page 962.



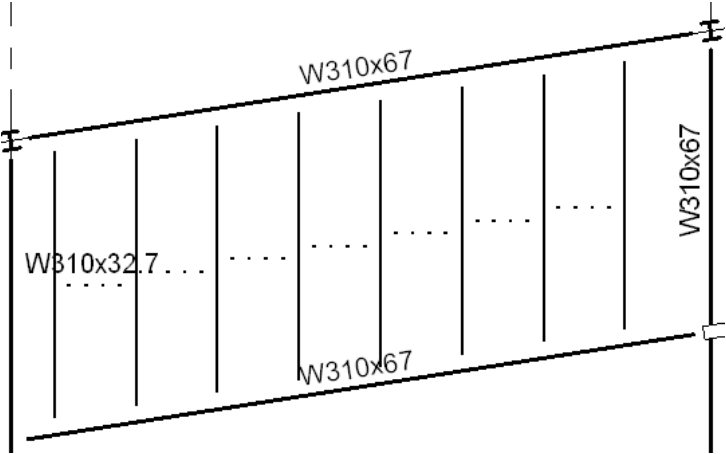
proxy graphics Representations of AutoCAD objects. Revit Architecture supports proxy graphics from AutoCAD files. Unlike AutoCAD objects, proxy graphics have no intelligence.

See [Importing or Linking CAD Formats](#) on page 1387.

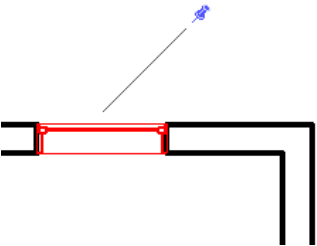
purlin A longitudinal structural member in a roof. Purlins support the loads from the roof deck or sheathing. They are supported by the principal rafters or building walls (or both).

In Revit Architecture, when you use the Beam tool to add beams between joists, the structural usage of the beams is automatically set to purlin, and their display within the plan view adjusts accordingly. In the following floor plan, the dotted lines indicate purlins placed along the midpoints of the joists.

See [Structural Usage of Beams](#) on page 842.



pushpin A user-placed control that provides a quick way to allow or prevent changes to the position of an element. After you place a pushpin, you cannot move the element until you unpin it by clicking the pushpin control. See [Preventing Elements from Moving](#) on page 382.



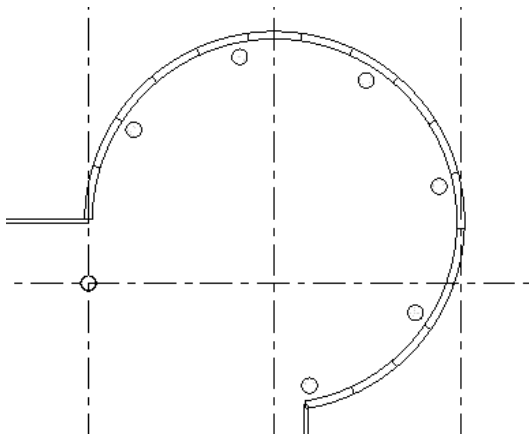
quantity The number or amount of building materials used in a project. Schedules can calculate the quantities of individual items or materials needed to complete a project. You can use this information to estimate costs and plan purchases.

For example, the following window schedule indicates the quantities of each type of window in a building.

Building Window Schedule					
Type Mark	Count	Height	Width	Level	Comments
A	9	1830	3734		
B	2	1830	3048	Level 3	
C	1	1830	2438	Level 3	
D	2	1830	1626	Level 1	
E	4	2438	3048		
F	1	1830	2438	Level 2	
G	3	2438	1626	Level 1	
H	11	2438	3734		

radial Arranged along a radius or arc.

In Revit Architecture, when you create a radial array, the elements in the array are arranged along a curve.

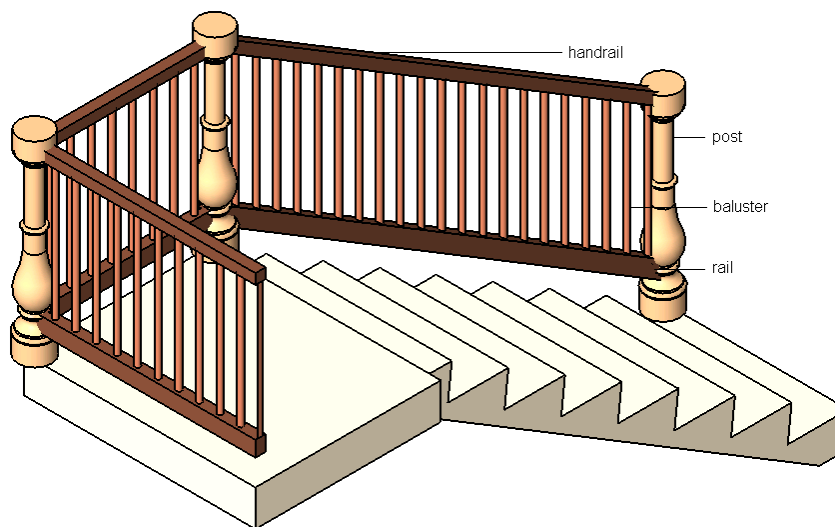


rail A hand rail, or a horizontal bar extending between posts in a [railing](#).
See [Railings](#) on page 746.

railing A barrier consisting of horizontal rails supported by posts and balusters.

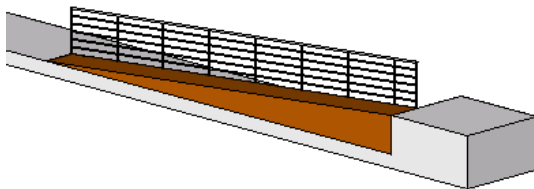
In Revit Architecture, you can add railings as free-standing components to levels, or attach them to host elements (such as floors, ramps, or stairs). For more information, see [Railings](#) on page 746.

Parts of a railing



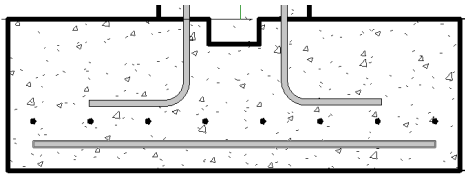
ramp A sloped floor or passageway.

For more information, see [Ramps](#) on page 742 and [Sloped Floors](#) on page 710.



RCP view See [reflected ceiling plan view](#) on page 1526.

rebar A steel rod or bar used in reinforced concrete construction. The following detail of a footing shows typical usage of rebar in walls and foundations.



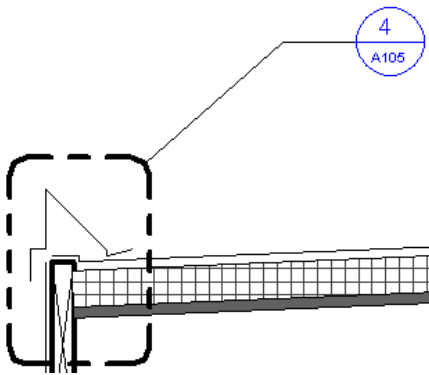
reference elevation An elevation tag that refers to an existing elevation or drafting view. When you add a reference elevation to a project, Revit Architecture does not create a new view for it. Instead, the reference elevation uses an existing elevation, allowing you to indicate different areas that have identical elevations. You can place a reference elevation in a plan or callout view.

For more information, see [Reference Elevation](#) on page 134.

reference label Text displayed in a callout tag when a reference callout is created in the plan view, or text displayed in a section head when a reference section is created in the plan view.

See [Reference Sections](#) on page 142 and [Reference Callouts](#) on page 154.

Reference callout with callout tag

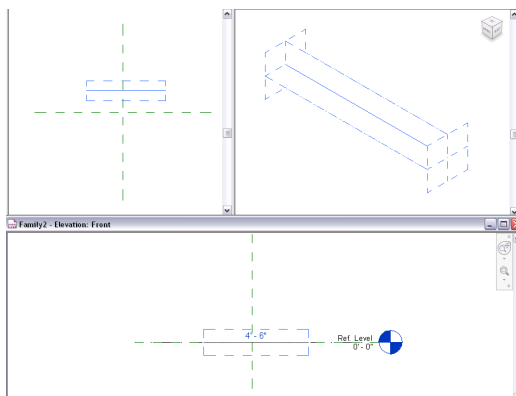


reference line A line used when designing families of model elements or placing elements in a building model. When you draw a reference line in a view, the line is visible in other, related views.

A straight reference line provides 4 planes to sketch on. One plane is parallel to the work plane of the line itself, another is perpendicular to that plane, and the remaining 2 are at the ends of the line (perpendicular to the ends). All planes go through the reference line.

A curved reference line (for example, an arc or a spline) has 2 planes at the ends of the element.

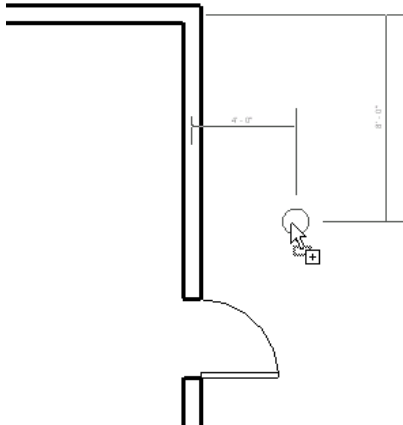
The following image shows a selected reference line (and its reference planes) in multiple views. For detailed information about reference lines, see [The Families Guide](#) on page 418.



reference plane A 2-dimensional plane used when designing families of model elements or placing elements in a building model.

See also [reference line](#) on page 1525. For more information, see [Reference Planes](#) on page 1106.

reference point (1) A point in the current view that you can use for positioning or dimensioning a model element. When you move the cursor near a reference point, Revit Architecture displays a temporary dimension between the element being placed and the reference point. To display different reference points, press *Tab*. When you are creating a family and you use a reference plane with the Is Reference property turned on, the reference plane can be used as a reference point for dimensions. For more information, see [The Families Guide](#) on page 418.



reference point (2) Provides a specific reference location in the 3D workspace of the conceptual design environment. You place these points to design and plot lines, splines, and forms. Reference points may be free (unattached), hosted by an element, or driving (element geometry modifying). See [Reference Points](#) on page 540.

reference section A section tag that refers to an existing section view. When you create a reference section, Revit Architecture does not create a new view in the project. Instead, the reference section uses an existing section, allowing you to indicate different areas that have identical sections.

You can place reference sections in plan, elevation, section, drafting, and callout views. Reference sections can refer to section views, callouts of section views, and drafting views. For more information, see [Reference Sections](#) on page 142.

referencing view The parent view of a callout or section; that is, the view from which a callout or section originates.

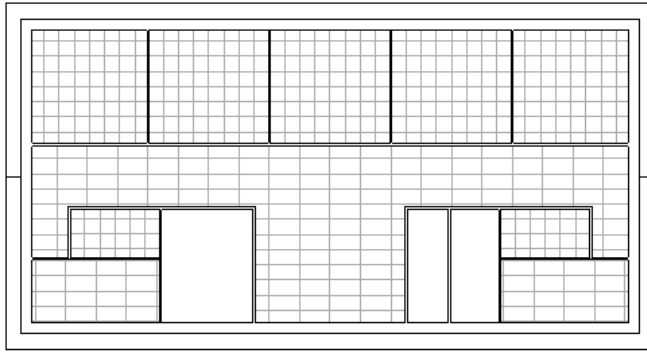
The **referencing sheet** is the sheet on which the referencing view displays. The **referencing detail** corresponds to the detail number assigned to a callout or section in its view properties. Values for referencing sheet and referencing detail occur in view properties and sheet properties. You can create labels for these values and include them in callout tags or section tags to create a cross-referencing documentation system for a Revit project.

See [Referencing a Drafting View](#) on page 1141 and [Referencing a Callout View](#) on page 1137.

referring view A view in which the annotation symbol for the current view is visible. For example, if you use the Find Referring Views tool for an elevation view, Revit Architecture lists all views in which its elevation symbol is visible. See [Finding Referring Views](#) on page 255.

reflected ceiling plan view A drawing that shows the ceiling in a building design. Also called an RCP view. When you add a level to a building model, Revit Architecture automatically creates an RCP view for it. See [Plan Views](#) on page 125 and [Ceilings](#) on page 718.

RCP view with ceiling grids



rehost To move a component from one host to another. For example, you can use the Rehost tool to move a window from one wall to another wall.

For more information, see [Rehosting](#) on page 811.

rendering The process of generating a photorealistic illustration of a building design. Rendered images are often used to present building designs to clients. Revit Architecture renders 3D project views with various effects, such as lights, plants, decals, and people.

For more information, see [Rendering](#) on page 1163.

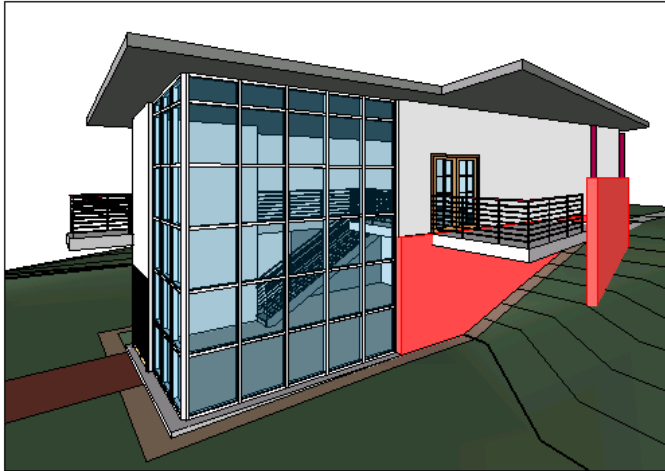


resize To change the size of a model element. For example, in Revit Architecture you can resize a wall or a foundation to adjust to changing specifications. See [Resizing Elements](#) on page 383.

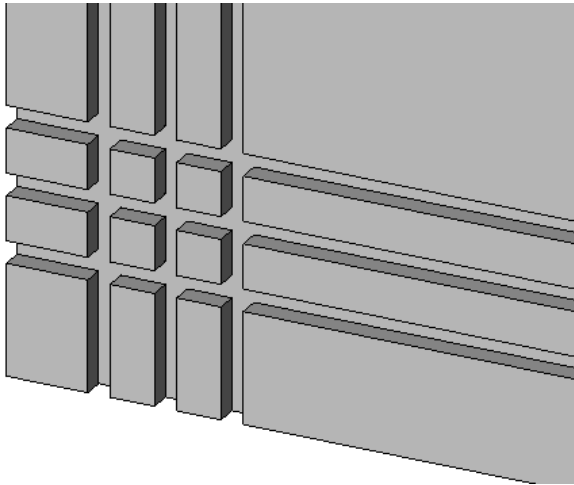
retaining wall A wall that holds back earth (for example, at the edge of a terrace or excavation).

In Revit Architecture, you can specify that a wall type functions as a retaining wall in the type properties. See [Adding Retaining Walls](#) on page 636.

Building with retaining walls (shown in red)



reveal (1) A decorative cutout in a wall. See [Wall Reveals](#) on page 669.



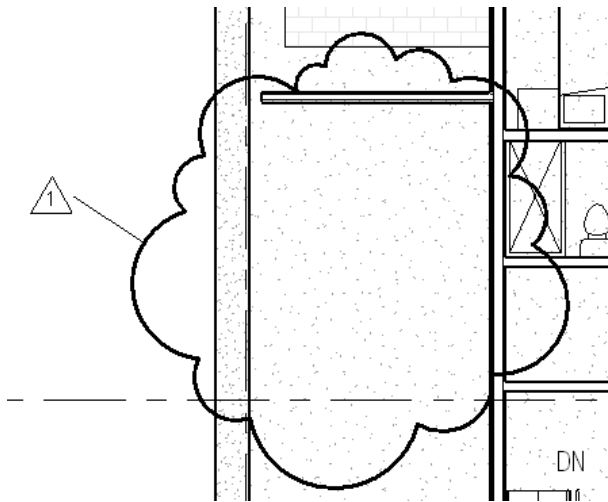
reveal (2) To display in a view. After hiding elements, you can reveal (redisplay) them in a view. See [Revealing and Unhiding Hidden Elements](#) on page 209.

revision A change to a construction document or building design. Revit Architecture provides tools (revision clouds and revision schedules) that enable you to include revision information on sheets.

For more information, see [Revisions](#) on page 1069.

revision cloud A graphic (shaped like a cloud) that indicates changes in a construction document. In Revit Architecture, you can sketch revision clouds in all views except 3D views. The cloud is visible only in the view in which it is sketched.

For more information, see [Revision Clouds](#) on page 1075.



revision schedule A list of changes made to a building design or construction document. A revision schedule displays in the title block of a sheet. As you add views with revision clouds to sheets, the revision schedule updates with information about the corresponding revisions.

For more information, see [Revision Schedules on Sheets](#) on page 1078.

Revision Schedule			
Number	Date	Description	Issued to
1	11/17/2006	Flipped the door (Mark 26)	Phil
2	11/05/2006	Moved the window (Mark 05) along the East wall	Joe
3	10/03/2006	Added a wall profile on the exterior walls (Level 1 & 2)	Peter

revision table See [revision schedule](#).

Revit Architecture An Autodesk product. Revit Architecture is a building design and documentation system that uses building information modeling to coordinate changes across all aspects of an architecture project.

Revit MEP An Autodesk product. Revit MEP optimizes mechanical/electrical/plumbing (MEP) systems engineering through data-driven system sizing and design. It provides a building information modelling design and documentation solution for MEP engineering.

Revit Structure An Autodesk product. Revit Structure integrates a physical model for layout, coordination, and documentation with an independently editable analytical model for building design and analysis. Using a single building information model and dynamic linking to third-party analysis applications, Revit Structure integrates and coordinates structural design and documentation.

revolve Solid geometry that turns (revolves) around an axis. For example, you can use the Revolve tool to design a dome roof, a column, or door knobs.

See [Creating a Revolve](#) on page 326.



RFA The file format for a Revit family. (See [family](#) on page 1480.)

See [The Families Guide](#) on page 418.

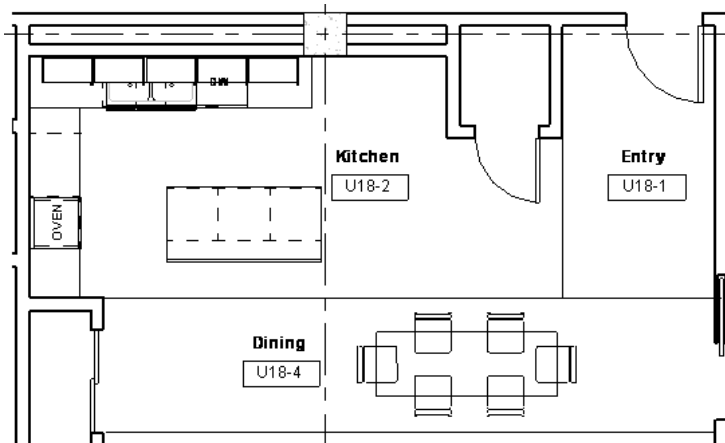
riser The vertical face of a step in a set of [stairs](#).

room A defined space in a building, used for a specific purpose and separated from other areas by walls, partitions, or [room separation lines](#).

For more information, see [Rooms](#) on page 977.

room separation line A line that you draw in a view to define areas that are used for different purposes, when a wall between the rooms is not desired. Room separation lines are visible in plan views, 3D views, and perspective views.

For example, the following floor plan uses room separation lines to distinguish the entry from the kitchen and dining areas. For more information, see [Room Separation Lines](#) on page 982.



room-bounding elements A model element that defines a boundary of a room. For example, walls, partitions, floors, ceilings, and roofs are room-bounding elements.

Revit Architecture uses room-bounding elements when calculating the area or volume of a room. You can designate an element as room-bounding by changing the Room Bounding parameter of its element properties. For example, you can define columns as room-bounding to omit their mass from room volume calculations.

For more information, see [Room-Bounding Elements](#) on page 981.

rough opening The framed hole (opening) in a wall into which a manufactured window or door is installed.

In Revit Architecture, you can specify the height and width of the rough opening for a window type or door type.

RPC Rich Photorealistic Content. The file type for ArchVision realpeople and other objects, which can be loaded into Revit Architecture as an entourage family, for use in rendered images. See [Plants and Entourage](#) on page 1203.

RSS feed

Information published by a website to which you subscribe. Usually allows users to receive notifications when new content (articles) are posted. RSS stands for Rich Site Summary (or Really Simple Syndication).

RTE The file type for a Revit project template. See [Creating a Custom Project Template](#) on page 445.

rule-based filter A filter with user-defined rules that determine the visibility/graphics settings for model elements in a particular view. For example, you can create a rule-based filter that displays all fire-rated walls as solid red in a plan view to distinguish them from non-fire-rated walls in the building.

See [Controlling Visibility and Graphic Display of Elements Using Filters](#) on page 204.

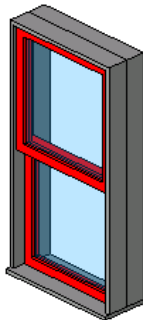
run A set of stairs or a ramp of a defined length. In Revit Architecture, you can sketch a run to create a ramp or set of stairs. See [Stairs](#) on page 728 and [Ramps](#) on page 742.

RVG The file format for a Revit group prior to Revit Architecture 2008.

In Revit Architecture 2008 and later, you can still load Revit groups (RVG files) into a project or a family. However, new groups can be saved as RVT or RFA files, not RVG files. See [Loading Groups](#) on page 358.

RVT The file format for a Revit project.

sash The part of a window that holds the glass panes in place. The sash can be movable or fixed in place. It usually consists of horizontal and vertical pieces.



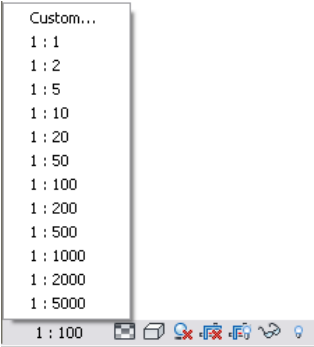
SAT Standard ACIS Text. The file format for [ACIS](#), a solid modeling technology that is supported by many CAD applications.

Revit Architecture can import and export SAT files. See [Importing ACIS Objects](#) on page 1391 and [Exporting to SAT](#) on page 1345.

scale The proportional system used to represent objects in a drawing.

In Revit Architecture, you can assign a different scale to each view. See [View Scale](#) on page 243.

Metric view scale



schedule A tabular display of information.

In Revit Architecture, a schedule is extracted from the properties of elements in a project. It is displayed in a schedule view. Using Revit Architecture, you can create many types of schedules, including quantities, material takeoffs, annotation schedules, revision schedules, view lists, and drawing lists.

See [Schedule Views](#) on page 172.

Building Window Schedule					
Type Mark	Count	Height	Width	Level	Comments
A	9	1830	3734		
B	2	1830	3048	Level 3	
C	1	1830	2438	Level 3	
D	2	1830	1626	Level 1	
E	4	2438	3048		
F	1	1830	2438	Level 2	
G	3	2438	1626	Level 1	
H	11	2438	3734		

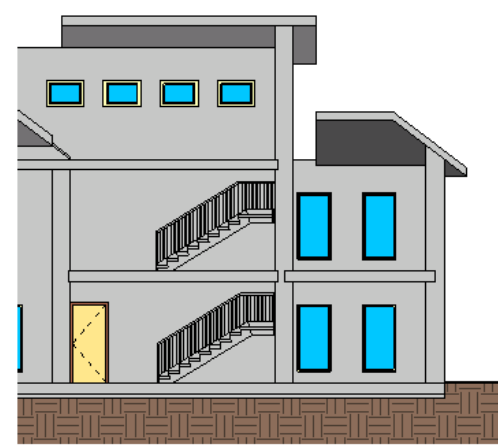
scope box A user interface mechanism that controls the visibility of datum planes (levels, reference lines, and grids) in views.

When you add grids, levels, and reference lines to a project, they may display in more views than desired. For example, when you add grid lines to a plan view, the grid lines display in all plan views of the model. To limit the appearance of datum planes to certain views, use a scope box.

See [Controlling Visibility of Datums Using Scope Boxes](#) on page 1112.

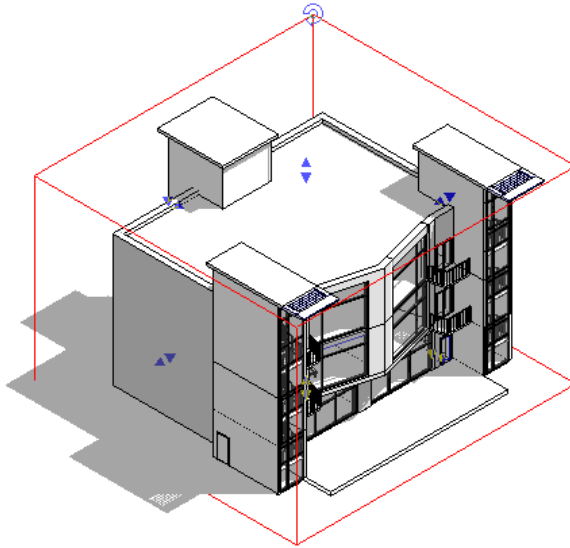
section A representation of a building model as if the model is cut vertically to show interior detail.

See [Section Views](#) on page 137.



section box A user interface mechanism that crops the model in a 3D view. Elements in the building model that are outside the section box do not display in the view or in an exported view.

See [Using a Section Box in a 3D View](#) on page 159.



section view See [section](#) on page 1532.

select To choose an object in the drawing area.

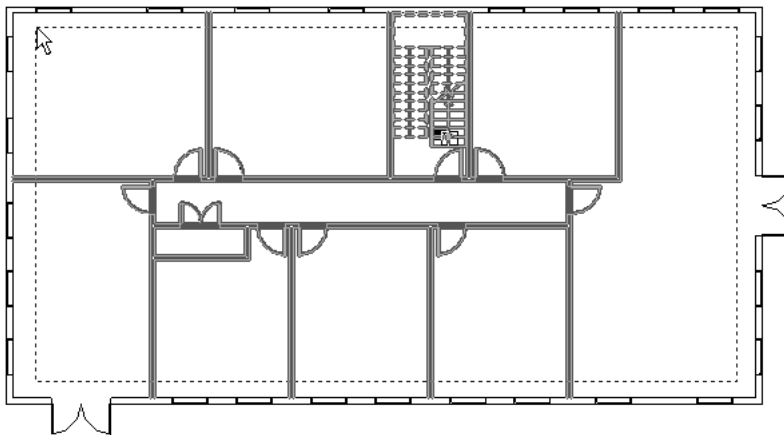
Many of the controls and tools that you use to modify an element in the drawing area are available only when an element is selected. In Revit Architecture, a selected element displays in the selection color, and controls or handles indicate how the element can be manipulated or modified.

See [Selecting Elements](#) on page 339.

selection box A user interface mechanism that you use to select elements within a defined area by dragging the cursor around them.

To create a selection box, place the cursor near the elements to select, click and hold the left mouse button, and drag the cursor diagonally across the screen to draw a rectangle around the desired elements. Dragging from right to left includes elements completely enclosed by the selection box. Dragging from left to right includes any element that the selection box encloses or touches.

See [Selecting Multiple Elements](#) on page 340.



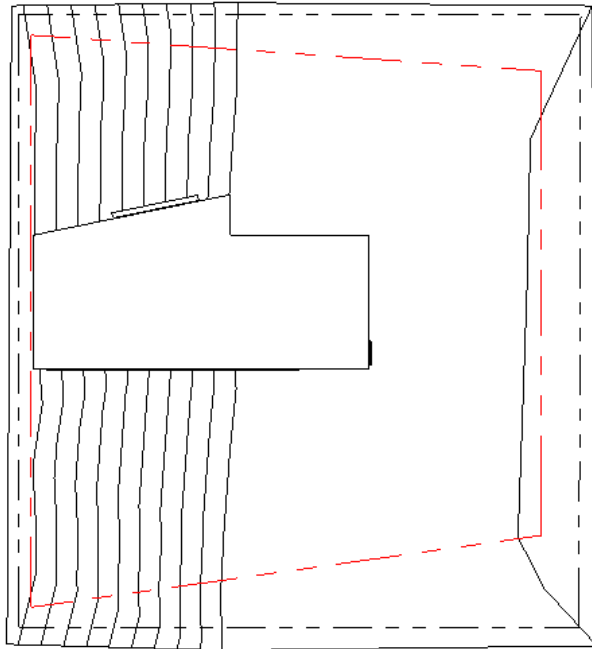
selection filter A mechanism for determining which elements are selected (for modification or manipulation) based on their family types or element parameters.

See [Selecting Elements Using a Filter](#) on page 341.

separation line See [room separation line](#) on page 1530.

setback (1) The distance that a wall sweep or wall reveal is offset from intersecting wall inserts. The setback value allows you to place sweeps or reveals properly near window or door trims. You can define a default setback for wall sweeps and wall reveals in their type properties.

setback (2) The legally required distance between the property line and buildings. For example, in the following site plan, a red dashed line indicates the zoning setback.

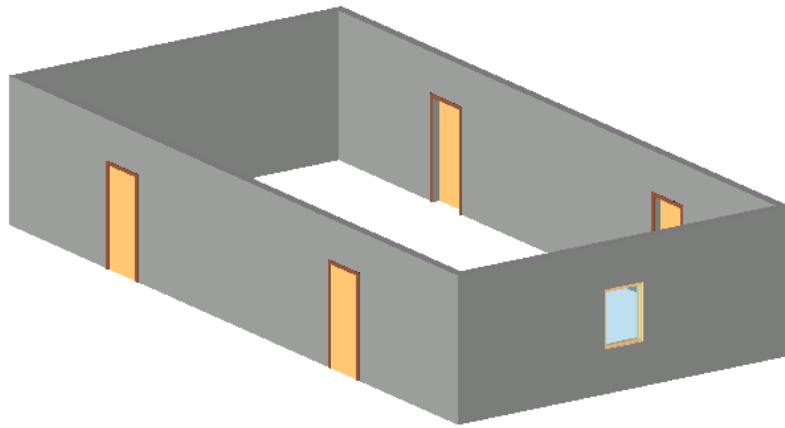


setback (3) The distance from the connection point of a primary beam in a join to its edge. This is measured linearly with a connecting beam's center.

For more information, see [Cutback](#) on page 865.

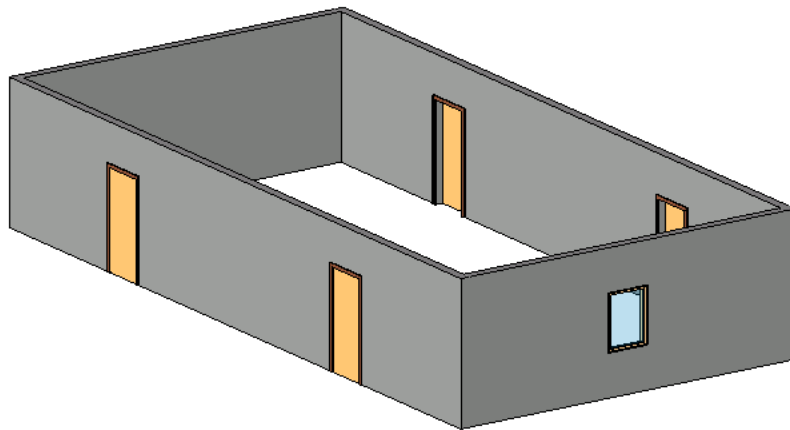
shading A model graphics style in which Revit Architecture shows the image with all surfaces shaded according to their material color settings and project light locations. A default light source provides illumination for the shaded elements.

See [Shading Model Graphics Style](#) on page 252.



shading with edges A model graphics style in which Revit Architecture shows the image with all surfaces shaded according to their material color settings and project light locations, and with all non-occluded edges drawn. A default light source provides illumination for the shaded elements.

See [Shading with Edges Model Graphics Style](#) on page 253.



shadow study See [solar study](#) on page 1539.

shaft An opening that extends the entire height (or through specified levels) of a building, cutting through floors, ceilings, and roofs, as appropriate.

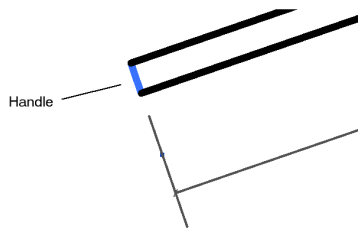
For example, the stairwell and elevator shaft in the following section view were created as shafts.

See [Cutting Shaft Openings](#) on page 728.



shape handle A user interface mechanism that you drag to change the shape of an element in the building model. A shape handle appears in the selection color.

For more information, see [Shape Handles](#) on page 352.



shared coordinates Project coordinates that are used for remembering the mutual positions of multiple interlinked files. Those interlinked files can be all RVT files, or a combination of RVT, DWG, and DXF files. See [Shared Positioning](#) on page 1296.

shared family A family of model elements that can be used to create subcomponents of a [nested family](#). When you use shared families to create a nested family, you can select, tag, and schedule the individual subcomponents in a project. (If subcomponents are not from shared families, Revit Architecture treats an instance of the nested family as a single item for selecting, tagging, and scheduling.)

See also [nested family](#) on page 1510. For more information, see [The Families Guide](#) on page 418.

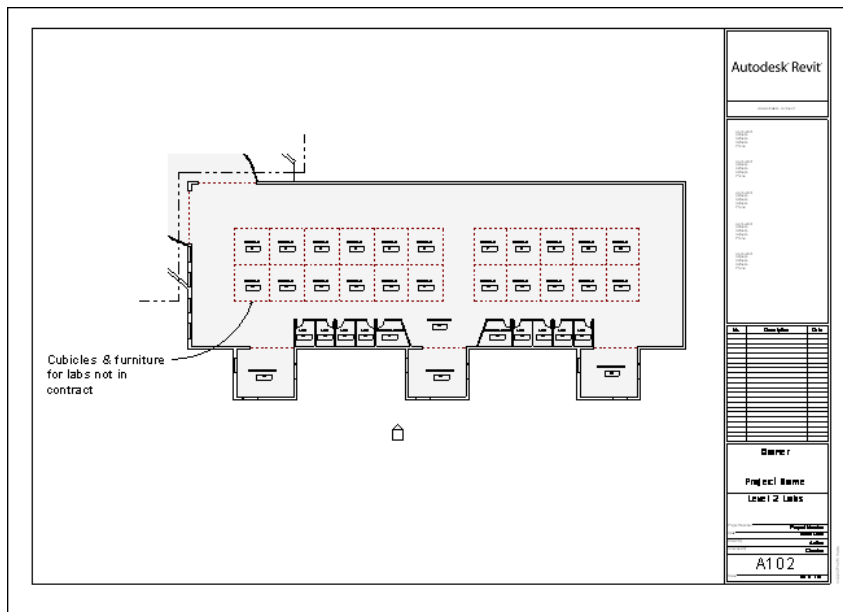
shared parameters User-defined fields that you add to families or projects and then share with other families and projects. They are stored in a file independently of a family file or Revit project; this allows you to access the file from different families or projects. In addition, shared parameters can be used in tags for model elements, and they can display in schedules.

Compare with [project parameters](#) on page 1521. For more information, see [Shared Parameters](#) on page 451.

shear wall A wall composed of braced panels to counter the effects of lateral loads (such as wind and earthquakes) acting on a structure. See [Structural Walls](#) on page 906.

sheet A construction document. Also referred to as a drawing sheet.

In Revit Architecture, you place project views on sheets to create a construction document set. For more information, see [Sheets](#) on page 1030.



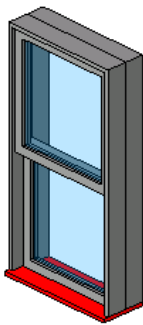
shortcut menu A menu of context-sensitive options. A shortcut menu displays when you right-click an element or view.

silhouette edges The edges of a building design when the model graphics style is Shading with Edges or Hidden Line.

You can change the line style used for silhouette edges in these modes. See [Applying or Removing a Line Style for a Silhouette Edge](#) on page 254.

sill The horizontal member at the bottom of a door or window frame.

In Revit Architecture, you can specify a default sill height for a window type, or a specific sill height for a window instance or door instance. The sill height is the measurement from the floor up to the sill.

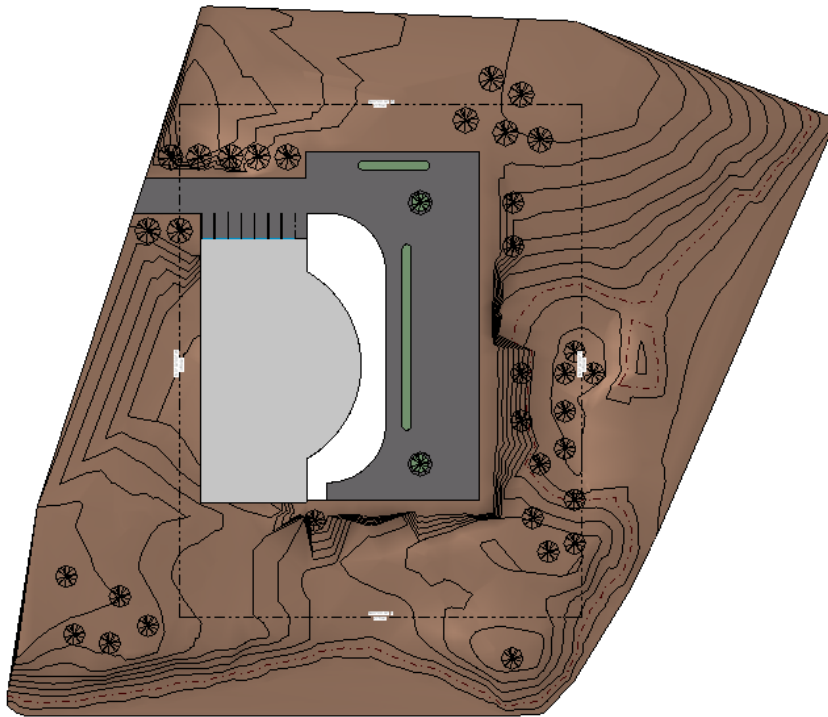


site The location or defined plot of ground for a building project.

See [Site Design](#) on page 953.

site plan The design for the site on which a building is located, including building pads, parking lots, sidewalks, and landscaping.

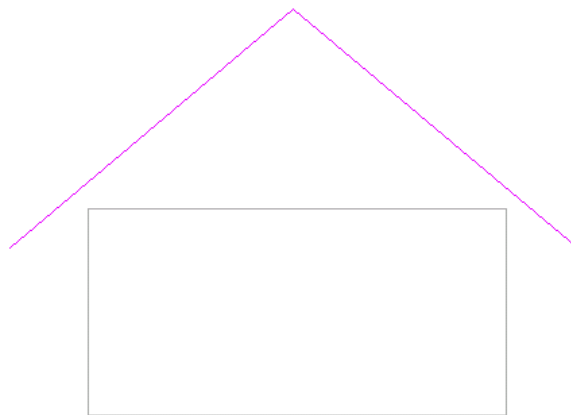
See [Site Design](#) on page 953.



site utility A component family that either has connectors or has the capability of hosting connectors that become functional when linked in a civil engineering application, such as AutoCAD® Civil 3D®. See [Creating Site Utilities for Export](#) on page 1378.

sketch (1) To draw a line or shape. Revit Architecture provides several tools and techniques for sketching. See [Sketching](#) on page 303.

sketch (2) A drawing of a 2D shape. The following sketch contains an open loop (the roof) and a closed loop (the walls, floor, and ceiling).



SKP The file format for projects created using Google® SketchUp, a general purpose modeling and visualization tool.

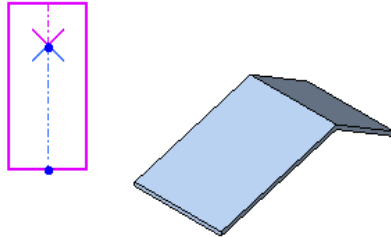
You can import SKP files into a Revit project. See [Importing SKP Files](#) on page 1390.

slope An angled surface (such as a roof or ramp), or the angle at which the surface rises.

See [Roof Slope](#) on page 684, [Sloped Ceilings](#) on page 720, and [Ramps](#) on page 742.

slope arrow A user interface mechanism that defines the slope of a roof, floor, or ceiling plane, using a line in the direction of the slope.

Use a slope arrow when you know the height at the top and bottom of the object's plane rather than the slope. For example, slope arrows can be used to adjust a flat roof to satisfy a particular height at a drainage point. See [Slope Arrow](#) on page 685.



snap (1) To jump to a line or reference point in a drawing.

snap (2) A line or reference point to which Revit Architecture will jump when you are placing a component or sketching a line.

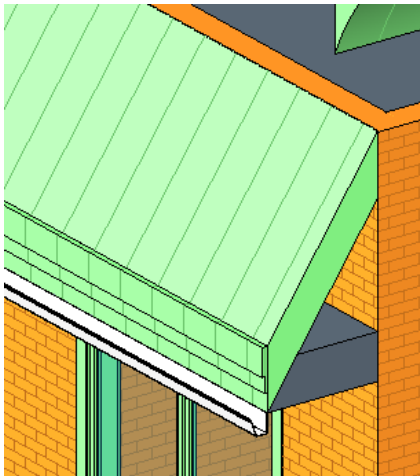
When you place a model element or sketch a line in a drawing, Revit Architecture displays snap points and snap lines to assist in aligning elements or lines with existing geometry. Snap points display in the drawing area as triangles, squares, and diamonds, depending on the snap type. Snap lines display as dashed lines in the drawing area.

For example, when you move the cursor over an existing wall to draw a new wall, Revit Architecture displays a snap line (a dashed line at the center line of the wall) and a snap point (purple triangle at the midpoint of the wall). Click a snap point or snap line to start drawing the new wall from that location. For more information, see [Snaps](#) on page 503.



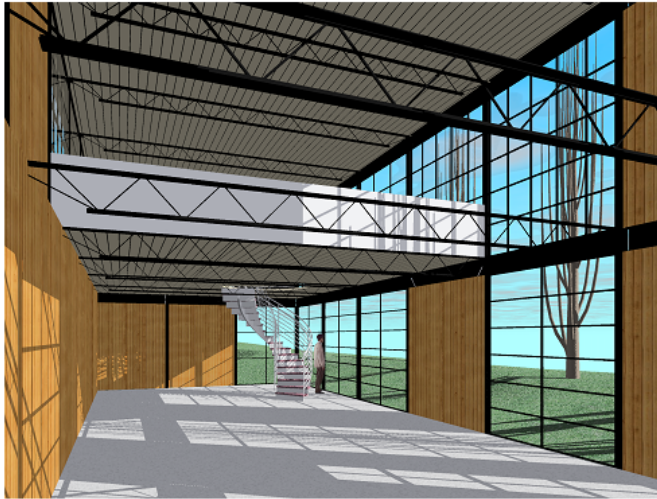
soffit The exposed underside of an architectural element.

On a roof, the soffit is the underside of an overhanging roof eave. See [Roof Soffits](#) on page 694.



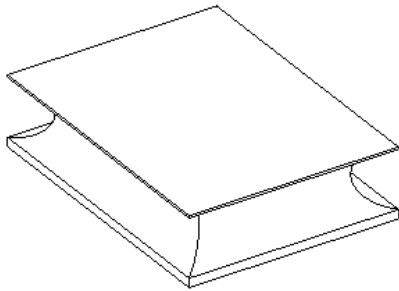
solar study A photorealistic image of a building model used to evaluate the impact of natural light and shadows on the buildings and site.

For more information, see [Solar Studies](#) on page 1241.



solid geometry A 3-dimensional shape used in a building model.

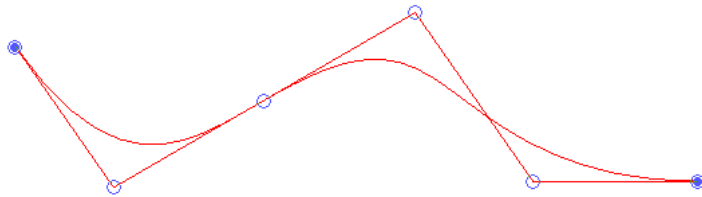
You can use the Family Editor to create solid geometry shapes to build families of model elements. See [Creating Solid and Void Geometry](#) on page 320.



span direction The orientation of a structural floor.

When you place a structural floor in the plan view, Revit Architecture creates a span direction component. Rotate the span direction component to change the orientation of the structural floor. For more information, see [Span Direction](#) on page 932.

spline A curved line drawn by specifying and positioning a number of points. Revit Architecture uses a mathematical polynomial function to smoothly join the segments at these points, creating the curved line. See [Best Practices for Sketching a Spline](#) on page 314 and [Modifying a Spline](#) on page 808.



split To divide a single object into multiple objects or sections.

In a Revit project, you can split walls, lines, faces, toposurfaces, layers in vertically compound walls, and schedules using various split tools.

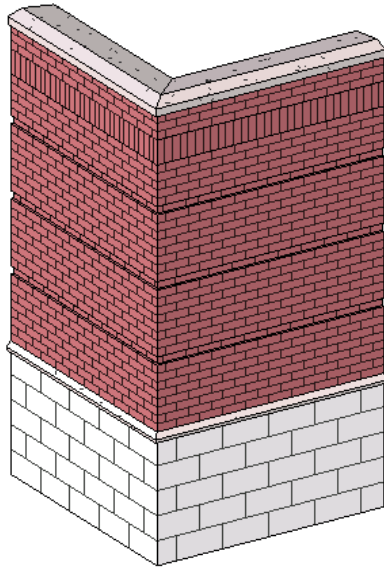
spot coordinate The North/South and East/West coordinates of an individual point with respect to the shared coordinate system for a group of linked Revit projects.

See [Spot Coordinates](#) on page 280.

spot elevation dimension The elevation of a selected point. Use spot elevation dimensions to determine a point of elevation for ramps, roads, toposurfaces, and stair landings.

For more information, see [Spot Dimensions](#) on page 277.

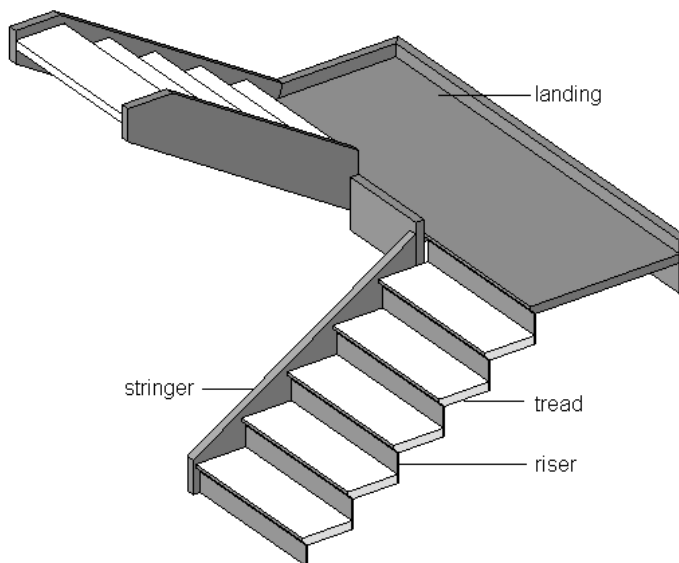
stacked wall A wall that has 2 or more horizontal layers, each consisting of different materials and surfaces. See [Vertically Stacked Walls](#) on page 647.



stair calculator A Revit tool that automates the creation of stairs based on a specified minimum tread depth and maximum riser height.

For more information, see [Stair Calculator](#) on page 734.

stairs A series of steps that allow you to go from one level to another. Also referred to as a staircase.



start point The beginning of a sketched line. See [Sketching](#) on page 303.

status bar Part of the Revit interface that displays information about what is highlighted or selected, or hints on what to do next. The status bar is located in the lower left corner of the Revit window.

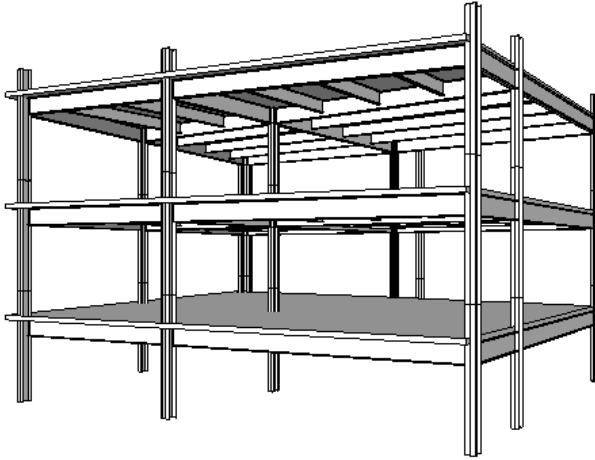
See [Using the Revit Interface](#) on page 85 and [Status Bar](#) on page 99.

stringer The diagonal support for the treads and risers in a staircase. See [stairs](#) on page 1541.

structural column A column that supports a vertical load in addition to its own weight.

Compare with [architectural column](#) on page 1453.

For more information, see [Structural Columns](#) on page 820.



structural floor A section of solid concrete pavement, roof, or floor. Structural floors can be used as a combined floor and foundation system. See [Structural Floor](#) on page 929.

subcategory For a subcomponent of a family, a property that defines its display (the line weight, line color, and line pattern). For example, you can assign one subcategory to the wood trim of a window and another subcategory to the glass.

For information about creating a subcategory, see [The Families Guide](#) on page 418.

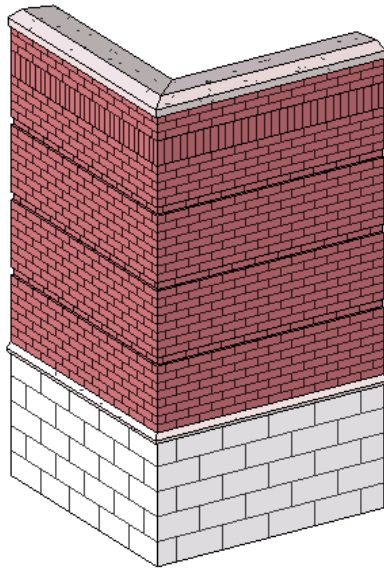
subscription Purchased support for Revit Architecture. A subscription provides access to web-based resources, such as e-learning lessons, extension announcements, and subscription program news.

Subscription Center

Provides access to information about subscription services such as product enhancements, web support from Autodesk technical experts, and self-paced e-Learning.

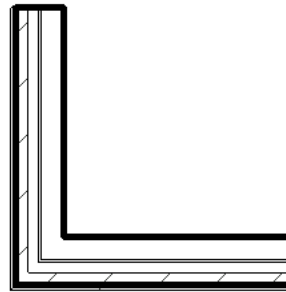
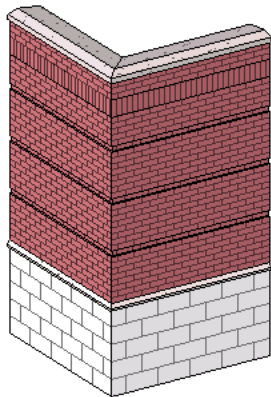
substrate Material (such as plywood or gypsum board) that acts as a foundation for another material.

subwall A component wall in a stacked wall. See [Vertically Stacked Walls](#) on page 647.



surface pattern The graphic design (fill pattern) used to represent a surface when shown in projection. See [Fill Patterns](#) on page 459.

Surface patterns (left) and cut patterns (right) for a wall



survey Topographical information about a building site, including its location, boundaries, and elevation. See [Property Lines](#) on page 962.

survey point The survey point represents a known point in the physical world, such as a geodetic survey marker. The survey point is used to correctly orient a building's geometry in another coordinate system, such as the coordinate system used in a civil engineering application.

[Project Base Points and Survey Points](#) on page 1302.

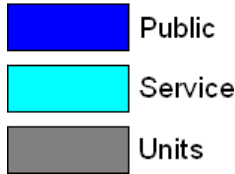
sustainable design The art of planning physical objects so they can be created and maintained in a way that supports the longevity of natural ecosystems and reserves. It ranges from designing small objects for everyday use to designing buildings, cities, and the physical surface of the earth.

Revit Architecture provides predefined families of model elements that promote sustainable design, including water tanks, solar panels, and wind-powered generators. For information about loading predefined families into a project, see [Loading Families](#) on page 427.

swatch A sample patch of a color or pattern.

When you apply a color scheme to rooms, the floor plan can display a color scheme legend, which indicates the colors and what they represent. The color scheme legend includes color swatches.

Room Type

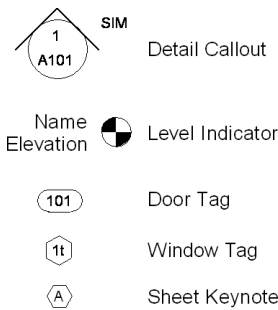


sweep See [wall sweep](#) on page 1552.

symbol A graphic representation of an annotation element or other object. Symbols are sometimes referred to as tags.

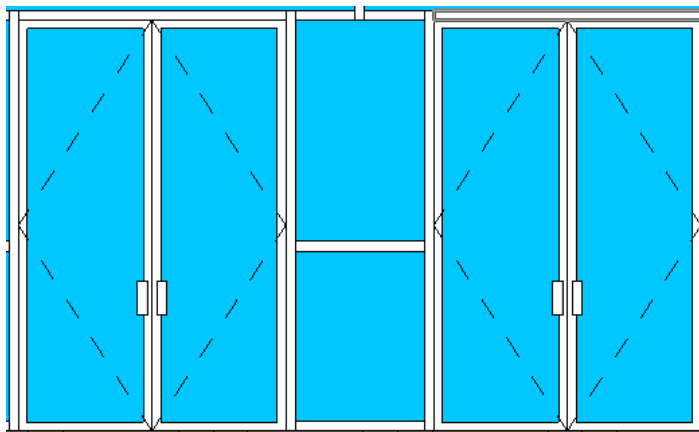
Revit Architecture uses symbols for annotations, moment frames, cantilever connections, and other elements. For more information, see [Symbols](#) on page 1130.

Annotation symbols used in a set of construction documents



symbolic line A line that provides information but is not intended to represent actual geometry in an element. For example, when creating a door family, you might sketch symbolic lines in an elevation view to represent a door swing. Symbolic lines are visible parallel to the view in which you sketch them.

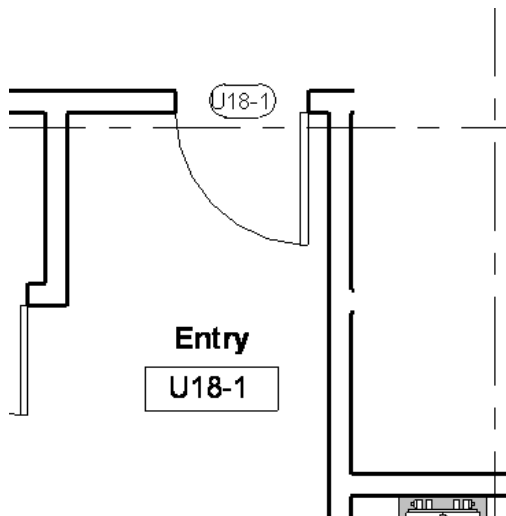
You can control the visibility of symbolic lines on cut instances. You can also control the visibility of symbolic lines based on the detail level of the view.



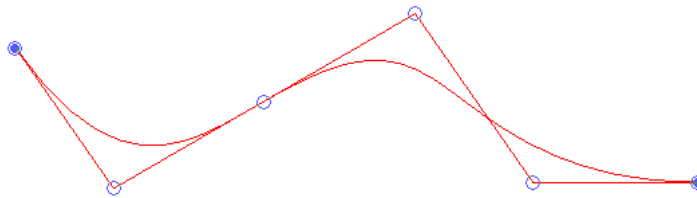
system family A Revit family that can be used as a building block for creating families. Revit Architecture provides system families for floors, walls, ceilings, roofs, drawing sheets, viewports, and other elements. You cannot delete system families.

tag An annotation used to identify elements in a drawing. Tags provide a way to automate the display of attributes for an element or type. Revit Architecture provides default tags for some types of elements, such as windows, doors, and rooms. You can change the information displayed in tags, and you can create labels to add information to tags. You can also control the visibility of tags in each view. For more information, see [Tags](#) on page 1123.

For example, the following floor plan shows a door tag and a room tag.



tangent A line that passes through the same point as a curve, in the same direction as the curve.



tape measure A long, flexible ruler (often made of cloth, plastic, or metal) used for measuring.

In Revit Architecture, you can use the Measure tool to measure between points in a drawing or to measure the length of an element. See [Measuring Elements](#) on page 405.

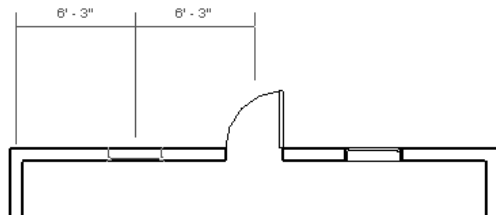
target point The point in the distance at which a camera is aimed or directed. See [camera](#) on page 1460.

template A collection of settings that you can use as a starting point for projects, families, views, and more. See [Creating a Custom Project Template](#) on page 445 and [View Templates](#) on page 507. For information about family templates, see [The Families Guide](#) on page 418.

temporary dimension A dimension that Revit Architecture displays as you draw or place elements in a view. Temporary dimensions can help you to position an element in the desired location, or to draw a line to the desired length or angle. When you finish drawing or placing an element, temporary dimensions no longer display.

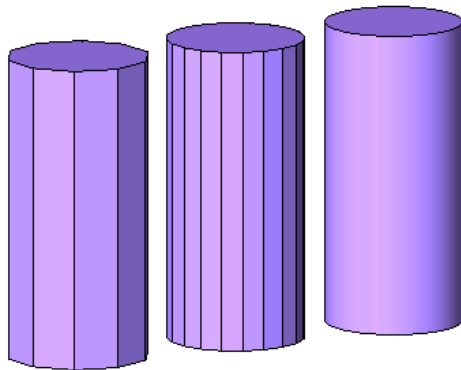
Compare with [permanent dimension](#) on page 1516. See also [listening dimensions](#) on page 1500. For more information, see [Temporary Dimensions](#) on page 263.

The following image shows temporary dimensions that display as you place a window in a wall.



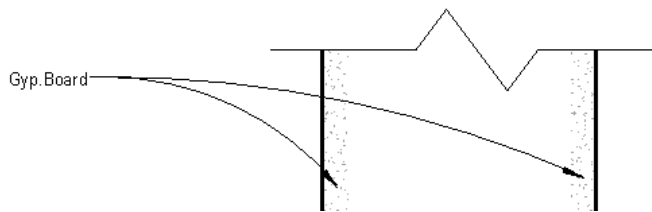
tessellation A technique used to manage datasets of polygons and divide them into suitable structures for rendering. Data is often tessellated into triangles, which is sometimes referred to as triangulation.

When CAD or design software applications export 3D geometry to a file for use in Revit Architecture, they may use tessellation to approximate a curved surface.



text note An annotation that consists of text and may include a leader line and arrow. You can add text notes to a detail view, drafting view, or a sheet.

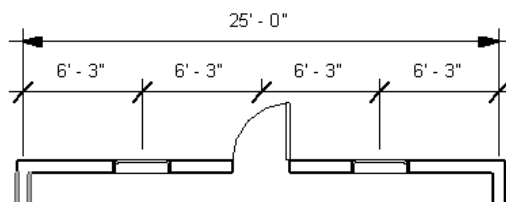
For more information, see [Text Notes](#) on page 1087.



tick mark The graphic shape used to represent the end of a dimension, such as an arrow or a slash.

See [Changing the Dimension Line Tick Mark](#) on page 287.

A floor plan that uses 2 types of tick marks



title block A template for a sheet. A title block generally includes information about the company, address, date of the project, and revisions.

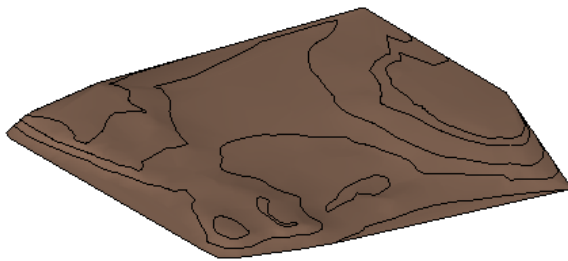
For more information, see [Title Blocks](#) on page 1046.



topographical surface See [toposurface](#).

toposurface Topographical surface. A graphic representation of the terrain of a building site or plot. The toposurface may include contour lines to represent elevations.

For more information, see [Toposurfaces](#) on page 955.



tread The horizontal surface of a step in a set of [stairs](#).

triangulation The process of dividing a shape into triangles to determine its area (as for a room) or to approximate a curved surface (as for a 3D shape). See also [tessellation](#) on page 1546.

For more information, see [Creating Room/Area Reports](#) on page 1366 and [Toposurfaces](#) on page 955.

trim To shorten selected elements to meet a specified boundary. See [Trimming and Extending Elements](#) on page 390.

True North The direction toward the North Pole.

Drafting conventions dictate that Project North is the top of the view. You may want to orient a view to True North when producing solar studies (to create accurate sunlight and shadow patterns for the project) or rendered images. See [Rotating a View to True North](#) on page 449.

type A subdivision within a family of elements.

For example, the family of Concrete Round Columns is further divided into types such as Concrete Round 18", Concrete Round 24", and Concrete Round 30".

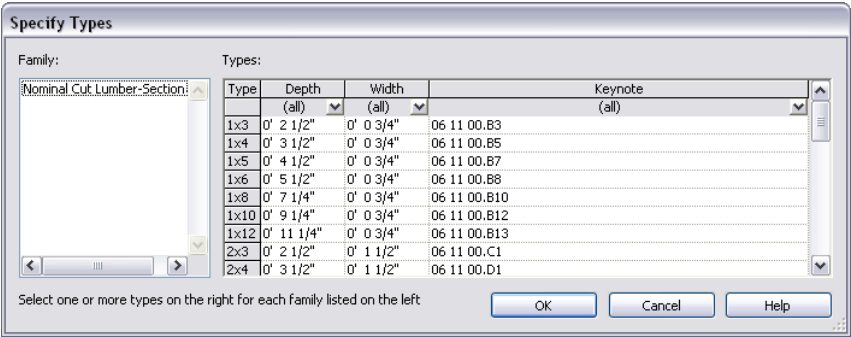
See [category](#) on page 1461 for examples of the hierarchy of categories, families, and types of model elements and annotation elements. For more information, see [Building with Elements](#) on page 119 and [Revit Families](#) on page 415.

type catalog A list of model elements that belong to a particular family type but that differ in size or other characteristics. Using type catalogs, you can load only the size you need, rather than loading the entire family type.

For example, suppose that you want to load detail components for wood framing to use in detail views. Rather than load the entire Nominal Cut Lumber-Section family, which includes 32 sizes of cut lumber, you can select the specific sizes that you need.

By using the type catalog to load selected items from a family type, you can reduce project size and limit the number of items listed in the Type Selector for that family, which, in turn, improves productivity. For information about creating a type catalog, see [The Families Guide](#) on page 418.

Type catalog for a lumber family



type parameters Settings that control the appearance or behavior of all elements of a particular family type. Type parameters are also called type properties.

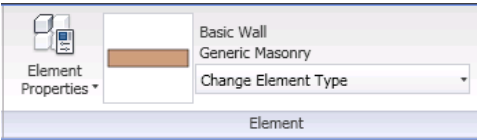
The instance parameters and type parameters of an element combine to establish its element properties. For more information, see [Modifying Type Properties](#) on page 121.

type properties See [type parameters](#).

Type Selector A drop-down list on the ribbon from which you can select a family type for the element being added or modified.

For more information, see [Type Selector](#) on page 99.

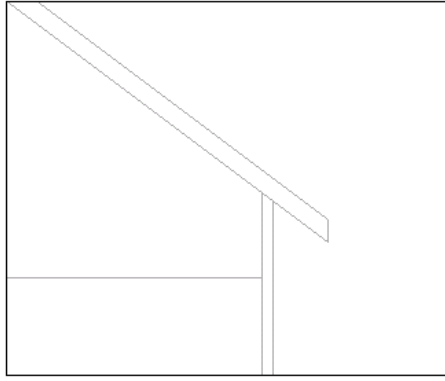
Type Selector when adding a wall



underlay A project view or imported file that you use to help position elements in the current view.

For example, when you use a section view as an underlay to a detail view, model elements in the detail view display in halftone or a different line weight and line pattern. This allows you to see the difference between the model geometry (from the section view) and added detail components.

To use a view as the underlay for the current view, set the Underlay parameter in its view properties. See [View Properties](#) on page 259 and [Halftone/Underlay](#) on page 497.



Uniformalt assembly code A standard classification of building elements and related site work.

During the design phase of a building project, Uniformalt assembly codes can be used to define performance specifications and technical requirements, and to generate cost estimates for the project.

For more information, see [Uniformalt Assembly Codes](#) on page 818.

unit The basic quantity or amount used as a standard for measuring.

When you install Revit Architecture, you specify whether you want to use imperial units (feet and inches) or metric units (meters and centimeters). You can also change the type of units used in a project. See [Project Units](#) on page 502 and [Creating Custom Dimension Units](#) on page 275.

UV grid Coordinate plotting grids for non-planar surfaces. Plotting locations in a 3D space is based on an XYZ coordinate system, while 2D Space is based on an XY system. Since surfaces are not necessarily planar, the UVW coordinate system is used to plot location. This maps a grid adjusting for the contours of a non-planar surface or form. UV Grids, as used in the conceptual design environment, are comparable to XY Grids. See [Understanding UV Grids](#) on page 569.

vertex (1) For a 2-dimensional polygon, an intersection of 2 sides.

vertex (2) For a 3-dimensional shape, an intersection of 3 sides. When you blend 2D shapes to create a 3D shape, you can use vertex connections to control the rate at which one shape is blended to another shape. See [Creating a Blend](#) on page 323.

view See [project view](#) on page 1522.

View Control Bar A panel of buttons providing quick access to functions that control the current view. Use the View Control Bar to change the scale, detail level, model graphics style, shadowing, crop views, and display of elements or categories in the view.

The View Control Bar is located at the bottom of the Revit drawing area. For more information, see [View Control Bar](#) on page 100.



view depth A horizontal plane that helps to define the view range in a floor plan or reflected ceiling plan.

By default, the view depth is the same as the bottom clip plane. However, you can specify the view depth to show elements (such as foundation footings) below the bottom clip plane.

You define the view depth in the view range properties, which are accessible from the view properties. See [View Range](#) on page 247.

view list A schedule (list) of all views in a project. The schedule includes the view parameters that you specify. You can use a view list to manage the views in a project.

For more information, see [Using View Lists](#) on page 258.

view properties Settings that control the appearance or behavior of a project view.

To see or change view properties, right-click a blank area of the view in the drawing area, and click View Properties. Or right-click a view name in the Project Browser, and click Properties. For more information, see [View Properties](#) on page 259.

view range A set of horizontal planes that control the visibility and display of objects in a view. The horizontal planes are Top Clip Plane, Cut Plane, Bottom Clip Plane, and View Depth. Elements outside the view range do not display in the view.

For more information, see [View Range](#) on page 247.

view reference A symbol indicating a dependent view to which the primary view is linked. See [Duplicate Dependent Views](#) on page 192 and [Navigating Primary and Dependent Views](#) on page 196.

view scale See [scale](#) on page 1531.

view template A collection of view properties (such as view scale, discipline, detail level, and visibility settings) that can be applied to a project view.

For example, you might create one view template for a structural floor plan, and another view template for an exit floor plan. You can then apply these templates to different floor plans to display information in each plan according to its purpose. See [View Templates](#) on page 507.

view-specific The characteristic of being visible in one project view only.

viewport A user interface mechanism that allows you to manipulate and activate a view that has been placed on a sheet. When you activate a view through a viewport, you can edit the model directly on the sheet.

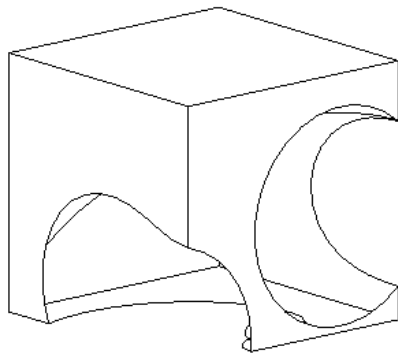
For more information, see [Sheets](#) on page 1030 and [Viewports](#) on page 1056.

VIZ An Autodesk product. VIZ is a 3D modeling, rendering, and presentation software application that provides state-of-the-art image creation technologies for communicating and sharing design intent.

Revit Architecture can export 3D models for use in VIZ. See [Exporting to 3ds Max](#) on page 1373.

void geometry A 3-dimensional shape that results from removing shapes from solid geometry.

See [Creating Solid and Void Geometry](#) on page 320.

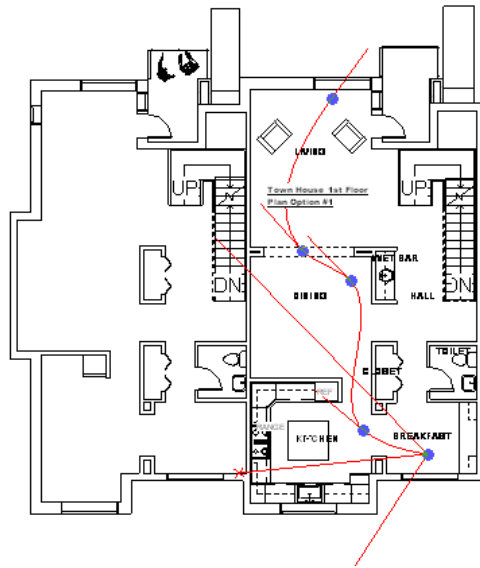


volumetric geometry A 3-dimensional shape that has measurable volume.

Non-volumetric geometry refers to a 2-dimensional shape.

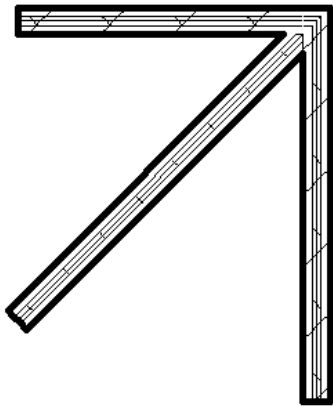
walkthrough A representation of a building model that simulates a person walking through the model along a defined path.

The following walkthrough view shows the walkthrough path in red. See [Walkthrough Views](#) on page 164.



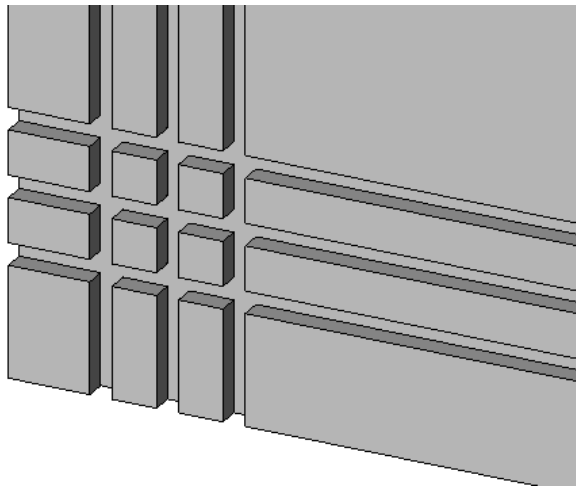
wall join An intersection of 2 or more walls.

In Revit Architecture, you can specify the type of join between walls. For more information, see [Wall Joins](#) on page 651.



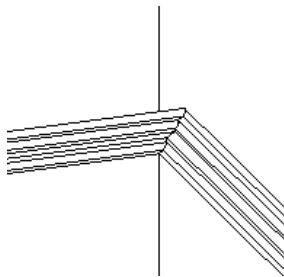
wall reveal A decorative cutout in a wall.

For more information, see [Wall Reveals](#) on page 669.



wall sweep A horizontal or vertical projection from a wall, often decorative in nature. Examples of wall sweeps include baseboards and crown molding.

For more information, see [Wall Sweeps](#) on page 664.

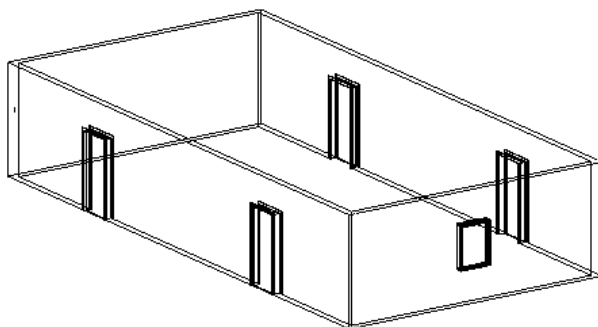


web library A collection of predefined project resources that are available on the Internet.

For example, you can access web libraries of templates, detail components, entourage, and families of model elements and annotation elements. See [Opening Files from the Web Library](#) on page 113.

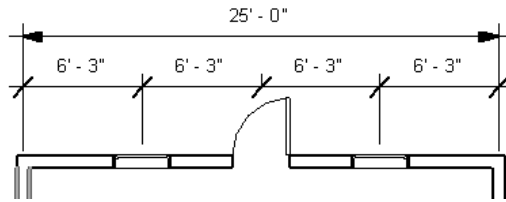
wireframe A model graphics style in which Revit Architecture displays the image of the model with all edges and lines drawn, but no surfaces.

See [Wireframe Model Graphics Style](#) on page 251.



witness line An annotation that indicates the distance between 2 points or elements in a building model.

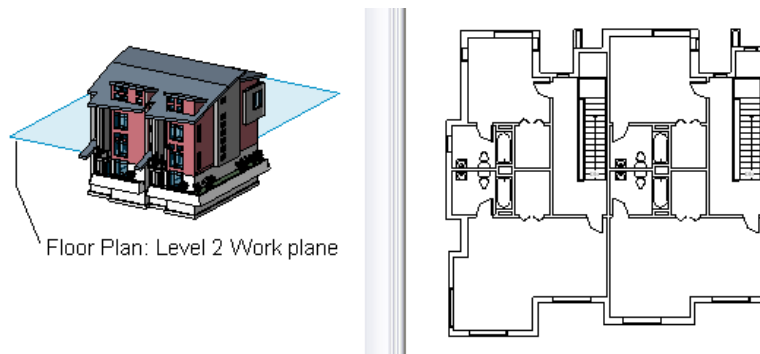
In Revit Architecture, you can change the points or elements that are used as references for a witness line. You can also control the gap between the witness line and the element being measured. See [Dimension Witness Lines](#) on page 284.



work plane A planar surface on which you can add sketch lines or other components.

Each view in Revit Architecture is associated with a work plane. In some views (such as plan, 3D, and drafting) and for views in the Family Editor, the work plane is automatically defined. In other views, such as elevation and section views, you need to define the plane. The work plane is necessary for sketching operations (such as creating an extruded roof) and for using tools in particular views (such as Rotate and Mirror in a 3D view).

For more information, see [Sketching and Work Planes](#) on page 317.



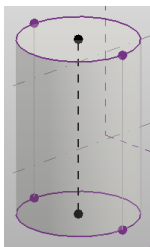
workset A collection of elements in a workshared project that can be worked on independently. A workset is typically a discrete functional area, such as interior, exterior, or site. When you enable worksharing, you can divide a project into worksets, with different team members responsible for each workset.

For more information, see [Setting Up Worksets](#) on page 1252.

worksharing A design method in which different team members are responsible for designing different functional areas of the same project file.

See [Working in a Team](#) on page 1249.

X-Ray Available in the conceptual design environment, X-Ray mode is a transparent view that displays the underlying geometric skeleton of a form.



xref See [external reference](#) on page 1478.

z-direction The direction of the third axis (the z-axis) in a 3-dimensional coordinate system.

zoning envelope A set of legal constraints on a building project that defines the volume within which the building must be contained. These constraints include the maximum height of the building, the percentage of the lot that the building can cover, and rear and side setbacks.

zoom To change the magnification of a view.

In a 3D context, zoom moves the camera in and out. In a 2D context, zoom moves up and down perpendicular to the view.

- To **zoom in** is to increase the magnification, making the building appear larger.
- To **zoom out** is to decrease the magnification, making the building appear smaller.

Zoom tools are available on the 2d and 3D SteeringWheels and the Navigation Bar. See [Zooming Project Views](#) on page 243.

Appendix A - gbXML Schema Support

27

Revit Architecture exports a gbXML file structure according to version 0.37 of the gbXML schema (<http://www.gbxml.org/schema/GreenBuildingXML.xsd>). It contains all of the elements required to validate to the schema. The following elements and attributes are supported by Revit Architecture:

gbXML Element

This element specifies the default attributes for the entire gbXML document.

Supported Attributes:

Attribute	Value	Description
temperature-Unit	F or C	Specifies the default temperature unit wherever the temperatureUnit simple type is used. The value is F when Feet and Fractional Inches is specified as the Project Units for Length and C when Meters specified as the Project Units for Length.
lengthUnit	Feet or Meters	Specifies the default unit for length. The value is Feet when Feet and Fractional Inches is specified as the Project Units for Length and Meters when Meters is specified as the Project Units for Length.
areaUnit	SquareFeet or Square-Meters	Specifies the default unit for area.
volumeUnit	CubicFeet or CubicMeters	Specifies the default unit for volume.
useSIUnitsFor-Results	false or true	Specifies if the results should be given in imperial or metric units-- false for imperial and true for metric.
xmlns	http://www.gbxml.org/xmlns/2002/06	Declares the default namespace.
version	"0.37"	Version number of the gbXML schema this file uses.

Supported Children

Element	Description
Campus	See Campus Element on page 1556.
DocumentHistory	See DocumentHistory Element on page 1557.

Sample:

```
- </gbXML>

temperatureUnit="F"

lengthUnit="Feet"

areaUnit="SquareFeet"

volumeUnit="CubicFeet"

useSIUnitsForResults="false"

xmlns="http://www.gbxml.org/schema">

version="0.37">>

+ <Campus id="cmps-1">

+ <Construction id="con-wl0">

+ <Layer id="lay-266">

+ <Material id="mat-266">

+ <Schedule id="schdl-Common_Office" >

+ <WeekSchedule id="wk-schdl-Common_Office"

+ <DaySchedule id="dy-schdl-Common_Office"

+ <Zone id="zone-A">

+ <DocumentHistory>

</gbXML>
```

Campus Element

The Campus element should be used as the base for all physical objects. On a campus, place one or more buildings.

Supported Attributes:

Attribute	Description
Id	Always icmps-1

Supported Children:

Element	Description
Location	See Location Element.

Element	Description
Building	See Building Element.
Surface	See Surface Element.

Sample:

```
<Campus id="cmps-1">
+ <Location>
+ <Building id="bldg-1" buildingType="Office">
+ <Surface id="su-1" surfaceType="ExteriorWall">
</Campus>
```

DocumentHistory Element

This element contains details about the people and programs that created and modified the gbXML file.

Supported Children:

Element	Description
ProgramInfo	The id attribute of this element will be adesk-rvt-1. This element contains the below described children with information about Revit MEP.
CompanyName	The value of this element will be Autodesk.
ProductName	This is the name of the product release that produces this file. If this file is produced by Revit MEP, the value of this element will be Revit MEP YYYY. The YYYY can vary depending on release.
Version	This is the number of the product release that produces this file. If this file is produced by Revit MEP, the value of this element will be YYYY. The release number YYYY, currently 2008, will vary depending on release.
Platform	This is the version of Microsoft Windows. The value can be Microsoft Windows [95/98/Me/NT/2000/XP/Server 2003].
PersonInfo	The id attribute of this element will be adesk-rvt-usr-1.
LastName	The value of this element is collected from the Username in Options.
CreatedBy	This element indicates the time and date when this file was created. This element will include an element CADModelId, which is the Global Unique ID for this Revit project.

Sample:

```
<DocumentHistory>
<ProgramInfo id="adesk-rvt-1">
<CompanyInfo>Autodesk</CompanyInfo>
<ProductName>Revit MEP 2008</ProductName>
<Version>2008</Version>
```

```

<Platform>Microsoft Windows XP</Platform>

</ProgramInfo>

<PersonInfo id="adesk-rvt-usr-1">

<LastName>user</LastName>

</PersonInfo>

<CreatedBy>

personId="adesk-rvt-usr-1"

programId="adesk-rvt-1"

date="2008-08-15T17:43:33"

<CADModelId>26c355ef-c939-4125-ad4f-f578e0c55b77"</CADModelId>

</CreatedBy>

</DocumentHistory>

```

Location Element

Supported Children:

Element	Description
Name	This is the value specified for City in the Manage Place and Locations dialog-- blank, if a location is specified by as latitude and longitude.
ZipcodeOrPostalCode	This is the value specified for Postal Code in the Project Information dialog.
Latitude	This is the value specified for Latitude in the Manage Place and Locations dialog.
Longitude	This is the value specified for Longitude in the Manage Place and Locations dialog. Longitude is given as an angular measurement ranging from 0× at the Prime Meridian (Greenwich) to +180× eastward and 180× westward.

Sample:

```

<Location>

<Name>Boston, MA, USA</Name>

<ZipcodeOrPostalCode>02001</ZipcodeOrPostalCode>

<City>London, United Kingdom</City>

<Latitude>42.358300</Latitude>

<Longitude>-71.060300</Longitude>

</Location>

```

Building Element

Supported Attributes:

Attribute	Description
id	Always bldg-1
buildingType	This is the value specified for Building Type in the Project Information dialog. The list of building types available is defined by the gbXML schema and is based on ASHRAE 90.1.

Supported Children:

Element	Description
Area	The building area, the total floor area is computed as the sum of areas for each Surface element of type InteriorFloor, UndergroundSlab, RaisedFloor, or SlabOnGrade.
BuildingStorey	Captures Building Storey Structure. A BuildingStorey element will be specified for each Level element in the project that has referenced Spaces. The Name element will be collected from the Level:Name property and the Level element in BuildingStorey will be collected from the elevation for the "Revit" Level element.
Space	See Space Element.

Sample:

```
- <Building id="bldg-1" buildingType="MultiFamily">
<Area>2972.114583</Area>
<InfiltrationFlow type="Average" />
- <BuildingStorey id="bldg-lvl-Level_1">
<Name>Level 1</Name>
<Level>0.000000</Level>
</BuildingStorey>
+ <Space id="sp-1">
</Building>
```

Space Element

Supported Attributes:

Attribute	Description
id	This attribute is a hyphen-separated string, consisting of a prefix sp , Room Number , and Room Name . For example, sp-1-Lounge. The id attribute must be unique within the file. A number can be added to the end to avoid duplicate values. The attribute is formatted as a XML string (XSD:IDREF). Unwanted characters are filtered out or replaced with an underbar (_). The following special characters are filtered out: Period (.); Apostrophe ('); Backslash (\); Semicolon (;); DollarSign (\$);
buildingStoreyIdRef	This specifies a unique "id" for a building storey that references this space (e.g. the Level for the Space).

Basic Supported Children:

Element	Description
Name	This is the value specified for Number in the Room Instance Properties dialog.
Area	This value is collected from the Space: Area parameter. This is the area computed at the Wall Finish.
Volume	This value is collected from the Space: Volume Parameter. This is the enclosed volume measured by interior bounding surfaces.
PlanarGeometry	The 2D boundary for the space measured by interior. This is a planar polygon that represents the perimeter of the space, and whose area is equal to the floor area of the space.
ShellGeometry	Polygons enclosing the volume measured by interior bounding surfaces. See ShellGeometry Element.
CADObjectId	ElementId for the associated Room element.
SpaceBoundary	Geometry data defining an analytical space volume where each polygon/face has a reference to a Surface. Through the Surface you can connect a source element with each polygon in a space. There will be a number of SpaceBoundary elements per Space. See SpaceBoundary Element.

Sample:

```
<Space id="sp-1-Room" buildingStoreyIdRef="bldg-lvl-Level_1">
  <Name>1 Space</Name>
  <Area>296.444444</Area>
  <Volume>2371.555556</Volume>
  + <ShellGeometry id="sg-sp-1-Room" unit="Feet">
  <CADObjectId>223542</CADObjectId>
  + <SpaceBoundary isSecondLevelBoundary="true" surfaceIdRef="su-1">
</Space>
```

ShellGeometry Element

Supported Attributes:

Attribute	Description
id	This attribute is a hyphen-separated string, consisting of a prefix This attribute is sg-sp and a sequential number. For example: sg-sp-1.
unit	This attribute specifies the length unit for the polygons in the ClosedShell geometry-- Feet for imperial or Meters for metric.

Supported Children:

Element	Description
ClosedShell	This element describes a collection of faces that make up a closed shell. It contains a series of polygons (PolyLoops) defining an enclosed volume. The volume is measured by the interior bounding surfaces for a space. It forms a solid body, which also defines the value of the volume specified for each space.

Sample:

```
<ShellGeometry id="sg-sp-1-Room" unit="Feet">  
+ <ClosedShell>  
  
</ShellGeometry>
```

SpaceBoundary Element

This element establishes the logical relation of a given part of the space geometry to the building constructions through its surfaceIdRef attribute. One Surface may be referenced by more space boundaries of one space.

Attributes:

Attribute	Description
surfaceRef	Every SpaceBoundary will have a corresponding Surface.

Children:

Element	Description
PlanarGeometry	
PolyLoop	A planar polygon describing the surface geometry as described in gbXML. The geometry is currently measured per analytical (center-line), the same way as the surfaces are measured.

Sample:

```
<SpaceBoundary isSecondLevelBoundary="true" surfaceIdRef="su-1">  
  
<PlanarGeometry>  
+ <PolyLoop>  
+ <PolyLoop>  
  
</PlanarGeometry>  
  
</SpaceBoundary>
```

Surface Element

Supported Attributes:

Attribute	Description
id	This attribute is a hyphen-separated string, consisting of a prefix, su and a sequential number. For example, su-1.

Attribute	Description
surfaceType	<p>The type of surface is figured out depending on the source element and the number of space adjacencies.</p> <p>If there is no associate source element and no space adjacencies, it will have a type of Shade.</p> <p>If there are any space adjacencies, it will have a type of Air.</p> <p>If the source element is a Wall or a Curtain Wall and have one space adjacency, it will have a type of ExteriorWall.</p> <p>If the source element is a Wall or a Curtain Wall and have two space adjacencies, it will have a type of InteriorWall.</p> <p>If the source element is a Wall or a Curtain Wall and the type Function parameter is set to Interior or CoreShaft, it will have a type of InteriorWall.</p> <p>If the source element is a Wall or a Curtain Wall and have one space adjacency and if it is below grade, it will have a type of UndergroundWall.</p> <hr/> <p>NOTE If the top elevation of a surface is equal to or below the elevation specified in Ground Plane, this surface is considered to be below grade.</p> <hr/> <p>If the source element is a Floor and have one space adjacency, it will have a type of SlabOn-Grade. If the source element is above grade, it will have a type of RaisedFloor. If the source element is below grade, it will have a type of UndergroundSlab.</p> <p>If the source element is a Floor and have two space adjacencies, it will have a type of InteriorFloor.</p> <p>If the source element is a Floor and the Function parameter is set to Interior, it will have a type of InteriorFloor.</p> <p>If the source element is a Roof or a Ceiling and have one space adjacency, it will have a type of Roof.</p>
Supported Children:	
Element	Description
Name	<p>Surface and Opening elements get an Name element assigned according to the below described schema:</p> <p>(Orientation)-(Space#)[- (Other space#)]-(Exposure)-(Type)-(sequence number) [Opening Type+#]</p> <p>Sample:</p> <p>N-101-102-E-W-D-84</p> <p>N = Orientation [N/NE/E/SE/S/SW/W/NW/N/T/B/X]</p> <p>(every surface within the sector of 22.5 degrees from the north vector gets the letter N etc) (horizontal surfaces facing upwards get the letter T for top, downwards B for bottom) (shading surfaces get the letter X for differentiation)</p> <p>101 = Space number</p> <p>102 = Other space number</p> <p>E = Exposure - exterior/interior/underground [E/I/U]</p> <p>W = Type [W/C/R/F] (Wall, Roof, Ceiling, Floor, Shade) (every surface type has it's letter W-Wall R-Roof C-Ceiling F-Floor S-Shade)</p> <p>O = Opening Type [W/D/O] (Window, Door, Opening) (every opening type has it's letter W-Window D-Door O-Opening)</p> <p>77 = sequence number</p> <p>Sample surface names:</p> <p>N-101-E-W-84 North facing Exterior Wall #84 in space 101</p> <p>N-101-E-W-84-D-1 Door #1 in North facing Exterior Wall #84 in space 101</p> <p>E-101-102-I-W-92 Vertical Interior Wall #92 between space 101 and 102</p> <p>T-101-E-R-141 Top facing Exterior Roof #141 in space 101</p> <p>B-101-201-I-F-88 Bottom facing Interior Floor #88 between space 101 and 201</p> <p>X-73 Shade #73</p>

Element	Description
AdjacentSpaceId	This is the Id for a space that is bounded by this surface.
RectangularGeometry	See Opening Element
PlanarGeometry	See Opening Element
CADObjectId	Surface and Opening elements get an CADObjectId element assigned according to the below described schema, based on associative room bounding. (Family Name): (Family Type)(Element Id) Sample: Basic Wall: Cast Concrete Wall 12" [49749]

Sample:

```
- <Surface id="su-1" surfaceType="ExteriorWall">
<Name>S-101-E-W-1</Name>
<AdjacentSpaceId spaceIdRef="sp-1-Room" />
+ <RectangularGeometry>
+ <PlanarGeometry>
+ <Opening id="su-1-op-1" openingType="NonSlidingDoor" constructionIdRef="con-sample-3">
<CADObjectId>223528</CADObjectId>
</Surface>
```

Opening Element

Supported Attributes:

Attribute	Description
id	This attribute is a hyphen-separated string, consisting of a prefix, op and a sequential number. For example, op-1.
Name	Surface and Opening elements get an Name element assigned according to the below described schema: (Orientation)-(Space#)[- (Other space#)]-(Exposure)-(Type)-(sequence number) [Opening Type+#] Sample: N-101-102-E-W-D-84 N = Orientation [N/NE/E/SE/S/SW/W/NW/N/T/B/X] (every surface within the sector of 22.5 degrees from the north vector gets the letter N etc) (horizontal surfaces facing upwards get the letter T for top, downwards B for bottom) (shading surfaces get the letter X for differentiation) 101 = Space number 102 = Other space number E = Exposure - exterior/interior/underground [E/I/U] W = Type [W/C/R/F] (Wall, Roof, Ceiling, Floor, Shade) (every surface type has it's letter W-Wall R-Roof C-Ceiling F-Floor S-Shade) O = Opening Type [W/D/O] (Window, Door, Opening) (every opening type has it's letter W-Window D-Door O-Opening) 77 = sequence number Sample surface names:

Attribute	Description
	N-101-E-W-84 North facing Exterior Wall #84 in space 101 N-101-E-W-84-D-1 Door #1 in North facing Exterior Wall #84 in space 101 E-101-102-I-W-92 Vertical Interior Wall #92 between space 101 and 102 T-101-E-R-141 Top facing Exterior Roof #141 in space 101 B-101-201-I-F-88 Bottom facing Interior Floor #88 between space 101 and 201 X-73 Shade #73

openingType	<p>The value for this attribute is based on the family category for the opening and the element in which it is contained:</p> <p>For a Window, the type is OperableWindow.</p> <p>For a Door, the type is NonSlidingDoor.</p> <p>For an opening contained in a Roof, the type is OperableSkylight.</p> <p>For a Curtain Wall Panel, the type will default to type FixedWindow. A Curtain Wall panel having a material and the material is not transparent (less than 3% transparency), the type is solid panel. Otherwise it is treated as a FixedWindow. For a Curtain Wall Panel having no material, the type is FixedWindow.</p> <p>For an opening of the category Openings, the type is Air.</p>
-------------	---

Supported Children:

Element	Description
RectangularGeometry	As described in gbXML. The azimuth and tilt are always 0. The optional Polyloop is not specified.
PlanarGeometry	As described in gbXML
CADObjectId	This is the element Id for the associated element.

Sample:

```

<Opening id="su-1-op-1" openingType="NonSlidingDoor">
  <Name>S-101-E-W-1-D-1</Name>
  + <RectangularGeometry>
  + <PlanarGeometry>
  <CADObjectId>172339</CADObjectId>
</Opening>

```

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