Autodesk Navisworks Manage 2011

Getting Started Guide

Autodesk

Contents

Getting Started

Welcome to Autodesk Navisworks Manage 2011! We hope that you enjoy learning and using this industry changing solution for whole 3D project review. Autodesk Navisworks is designed to bring together geometry and data created by multi-disciplinary teams, on the largest projects, into a single model. This virtual building can then be visualized, simulated, and analyzed in real-time by all involved, to validate the design and provide insight and predictability for construction and operation.

In this short tutorial, you learn the essential knowledge required to use Autodesk Navisworks effectively.

You will learn how to create search sets based on the inherent property information, and see how these can be used in conjunction with various key features; create punch/snag lists from your review sessions; how to create photorealistic visualizations; define interference detection tests; techniques for quick 4D planning; and dynamic simulations.

To complete all exercises in this Getting Started guide you will need the Autodesk Navisworks Manage 2011 product.

Introduction

Installation

Before beginning the exercises, install the software and register it as either demo or subscription. Demo mode serves as a 30-day product trial.

By default, example files are installed to `C:\Program Files\Autodesk\Autodesk Navisworks Manage 2011\Examples\Getting Started`.

Exploring the User Interface

When the Autodesk Navisworks window is displayed, take a minute to view the different sections.
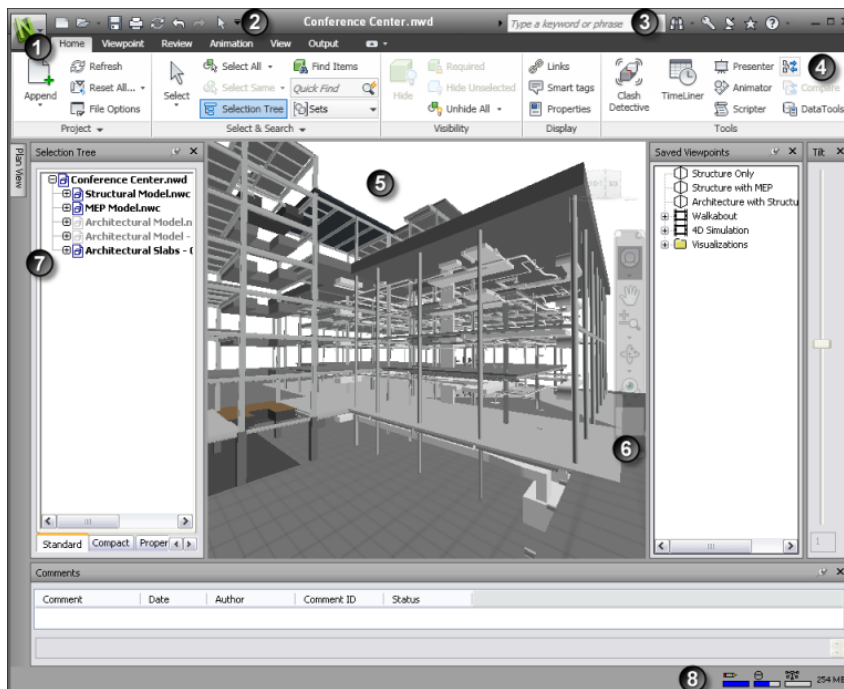
1	Application button and menu	**5**	Scene View
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Application Button and Menu

Click the application button to display the application menu. The application menu provides you with access to common tools. Double-clicking the application button exits Autodesk Navisworks.

Quick Access Toolbar and Ribbon

At the top of the application window, the Quick Access toolbar provides access to frequently used tools.

The Quick Access toolbar

Below the Quick Access toolbar is the ribbon pallet. The ribbon is grouped in task-based tabs and panels.
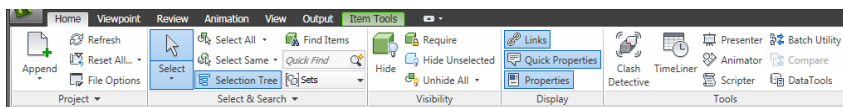
The ribbon

Scene Area

The main scene area is used to interact with the 3D model. The scene area may be split into multiple views enabling you to simultaneously view different areas of the model, or objects from different angles, and so on. (Click View tab ➤ Scene View panel ➤ Split View drop-down ➤ Split Horizontal or Split Vertical.)

Navigation Bar

The navigation bar provides access to various navigation tools which allow you to move around and experience your virtual project before it has been built. (Click View tab ➤ Navigation Aids panel ➤ Navigation Bar.)

Navigation is easiest controlled with a mouse - generally holding down the left-mouse button while moving the mouse. The Autodesk standard navigation SteeringWheels may also be accessed from here.
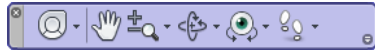
The navigation bar

Dockable Windows

Most Autodesk Navisworks features are accessible from the windows docked around the interface. An Auto Hide feature is enabled for many windows by default to maximize the scene area, though you may dock the windows with Auto Hide disabled should you prefer. (Click View tab ➤ Workspace panel ➤ Windows drop-down and select the desired window.)

Selection Tree

The Selection Tree window is where you will find the model hierarchy of the files you have opened and appended into the current Autodesk Navisworks scene. This hierarchy reflects the structure created in the original design application. (Click View tab ➤ Workspace panel ➤ Windows drop-down ➤ Selection Tree.)

Properties

When selecting an object in either the Selection Tree or directly within the scene area, the information associated with that object is displayed in the Properties window. This information is organized into relevant tabs dependant on the information brought through from the original design application, or extended data linked to with Autodesk Navisworks. (Click View tab ➤ Workspace panel ➤ Windows drop-down ➤ Properties.)

TIP You can also click Home tab ➤ Display panel ➤ Properties.

Status Bar

The status bar appears at the bottom of the Autodesk Navisworks window. In the right-hand corner, there are four performance indicators that give constant feedback as to how Autodesk Navisworks is performing on your computer.

The pencil progress bar indicates how much of the current scene is drawn. When the progress bar is closer to 0%, this indicates more of the scene is being dropped-out. 100% indicates there is no drop-out.

NOTE The Autodesk Navisworks engine intelligently prioritizes all objects in the scene. If your computer is unable to process (draw) all geometry while navigating, it elects to drop-out the finer detail, allowing you to continue navigating in real-time. Once navigation ceases all of the detail is filled in. Some degree of drop-out is normal; however, users of larger, complex models and lower spec computers are more likely to experience increased drop-out while navigating.

The disk progress bar indicates how much of the current model has been loaded into memory. The Autodesk Navisworks engine manages your memory usage, only loading in the required data. When the progress bar is at 100% this indicates that all of the models objects and property information has been loaded.

The web server progress bar ▨▭ indicates how much of a model has been downloaded from a web server (when using the Open URL command). As the Autodesk Navisworks engine can identify which data is required (within an NWD file), it can prioritize this data and download it first (acting like a buffer) allowing you to commence navigation of the model while Autodesk Navisworks continues to stream the remaining data from the web server.

The memory bar indicates how much memory is being used currently Autodesk Navisworks. This is reported in megabytes (MB).

Workspaces

The Autodesk Navisworks user interface can be referred to as a workspace, and has been designed to be intuitive and easy to use. Workspaces retain information about which windows are open, their positions, and the size of the application window. Workspaces do not retain changes made to the ribbon or the Quick Access toolbar.

Autodesk Navisworks comes with a number of pre-defined workspaces which can be used as-is, or you can customize and save these as your own task-oriented working environments. (Click View tab ➤ Workspace panel ➤ Load Workspace drop-down and select the desired workspace.)

Combine and Manage Your Projects

Autodesk Navisworks has three main file extensions: NWD, NWF, and NWC.

NWC files are cache files containing conversion data only (that is, they contain the relevant data necessary to convert the CAD file into the Autodesk Navisworks format). NWC files can be exported directly out of supported CAD applications, including Autodesk AutoCAD, Revit and 3ds Max; Bentley MicroStation and Graphisoft ArchiCAD.

By default NWC files are also created automatically whenever you read a CAD file into Autodesk Navisworks - this will actually speed up the process when next opening that CAD file (provided that it hasn't been modified), as the cache file can be used. This is especially noticeable when you are opening a project containing tens or even hundreds of CAD files.

This brings us to NWF files, which are reference files and contain no geometry. They contain pointers back to the original files that you open and append together plus anything you do with the model in Autodesk Navisworks. It is recommended to save a master NWF file for your project once you've appended all of your CAD files. Subsequent opening of the NWF will then re-open each file. Actually, it's a little more intelligent than this. It will check to see if there is a corresponding NWC file and checks whether the CAD file has been modified since last converted. If it has, the CAD file will be re-read and re-cached. If it hasn't, the cache file will be used, speeding up the loading process.

Finally we have the NWD file format. This is a complete data set, containing all of the geometry and anything you do with the model in Autodesk Navisworks. It is highly compressed, and can be secured with password protection. The NWD file is the recommended format for sharing the entire project with all stakeholders, enabling individual disciplines to see how their design fits within the overall project. NWD files can be reviewed in the free viewer, Autodesk Navisworks Freedom 2011, or if you need to add markup and carry out full analysis of the project, then a full Autodesk Navisworks product may be used.

So let's take a look at these file formats in practice. We're going to start with three NWC files exported from Revit Architecture, Revit Structure, and Revit MEP. These could, however, be any combination of supported file formats/applications.

NOTE For the latest list of supported formats and applications, see our website: *http://www.autodesk.com/navisworks*

1 Click the application button ➤ Open 📂 .

2 Browse to the `C:\Program Files\Autodesk\Autodesk Navisworks Manage 2011\Examples\Getting Started` directory, select *Structure.nwc* and click Open.
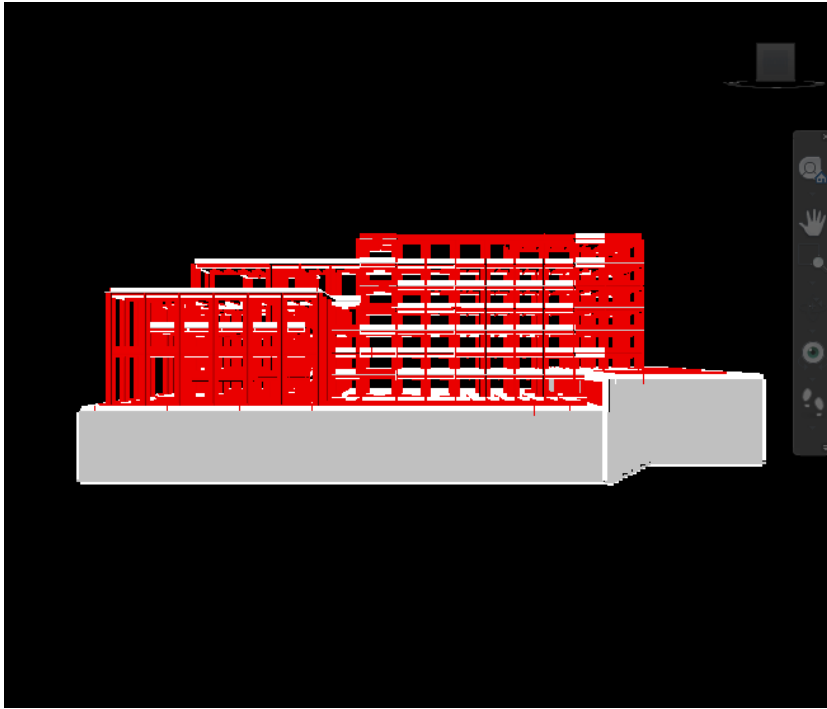
3 Append the *MEP.nwc* file. (Click Home tab ➤ Project panel ➤ Append ⬦ .)
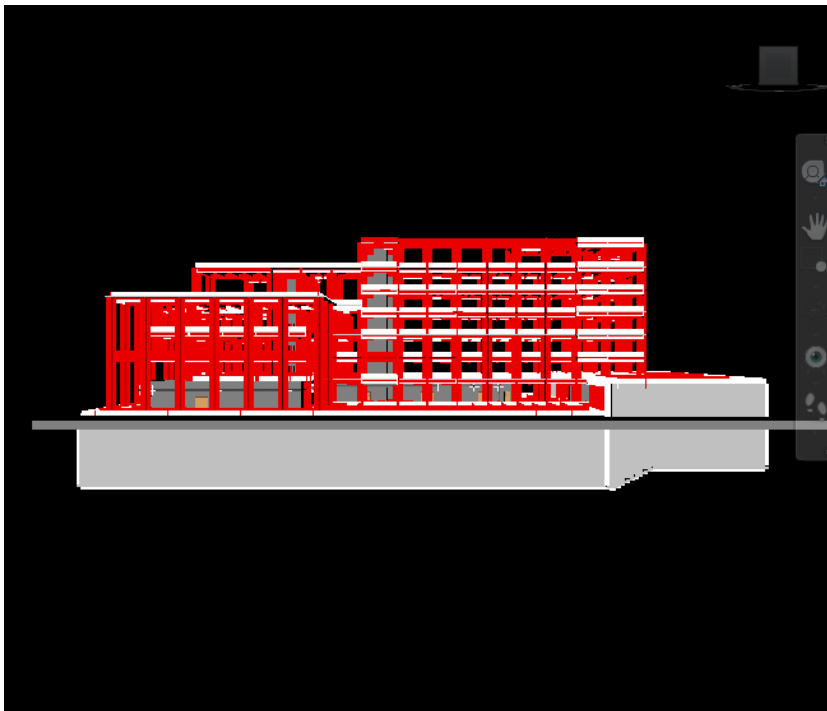
4 Append the file, *Architecture.nwc*.
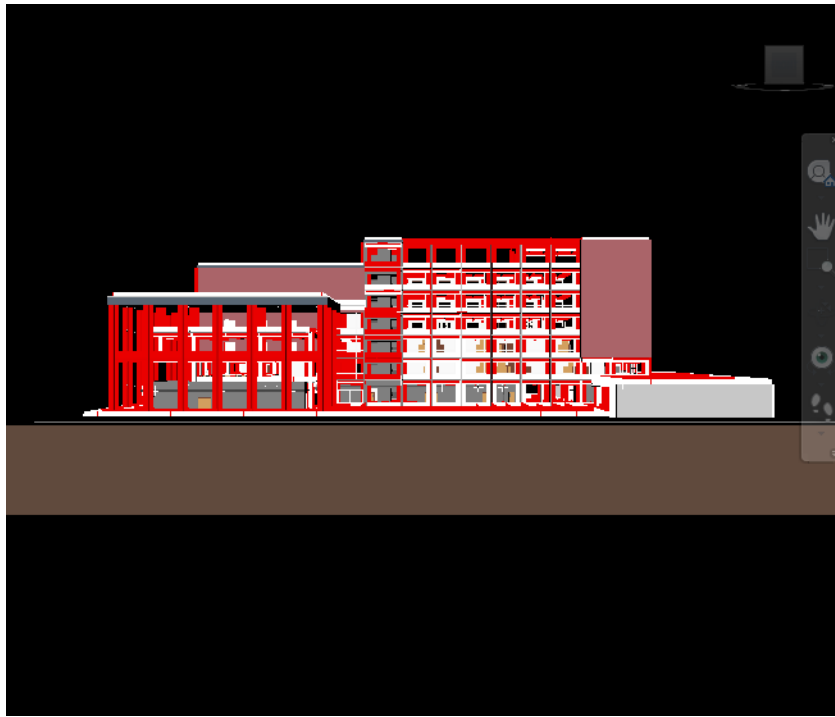
5 Now we have the complete project appended into a single scene, we can save this as an NWF. Click the application button ➤ Save As ![disk icon], and save as *Conference Center.nwf*.

This is our master NWF project file which, in this example, references the latest NWC files exported from Revit.

Effective Navigation

Autodesk Navisworks provides a selection of navigation tools to allow you to navigate around your 3D model. These can be accessed from the Navigation Bar. As well as basic navigation tools such as Pan, Orbit , Zoom, the navigation bar also offers access to tools that allow you to Walk, Fly or Look Around your model.

The navigation bar also allows you to turn on/off the ViewCube navigation tool, which provides visual feedback of the current orientation of a model, and the SteeringWheels, which are tracking menus that follow your cursor, allowing you to access the different 3D navigation tools from within a single tool. Due to the interactive nature of Autodesk Navisworks, you will likely find the Full Navigation Wheel of most use.

The navigation tools are selected by moving the cursor over the relevant wedge and holding down the left mouse button.

Panning, Zooming, and Orbiting with the Navigation Bar

Pan ![pan icon], Zoom ![zoom icon] and Orbit ![orbit icon] are fundamental 3D navigation tools that allow you to orient your view of the 3D model. Pan, Zoom and Orbit are all accessible from the navigation bar.

You start navigation tools by clicking one of the buttons on the navigation bar or selecting one of the tools from a list that is displayed when you click the smaller portion of a split button.

1 To move the view of the model parallel to the screen, select Pan ![pan icon] on the navigation bar. In the Scene View, click and hold the left mouse button and drag to pan the model.
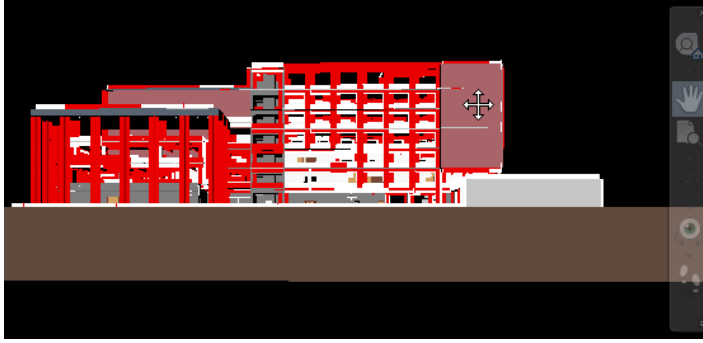
2 To increase or decrease the maginification of the current view of the model, select one of the Zoom tools from the navigation bar.

- Selecting Zoom Window ![zoom window icon] , and then click-dragging in the Scene View lets you define the rectangle that you want to zoom to. Releasing the mouse button fills the view with the contents of the rectangle.
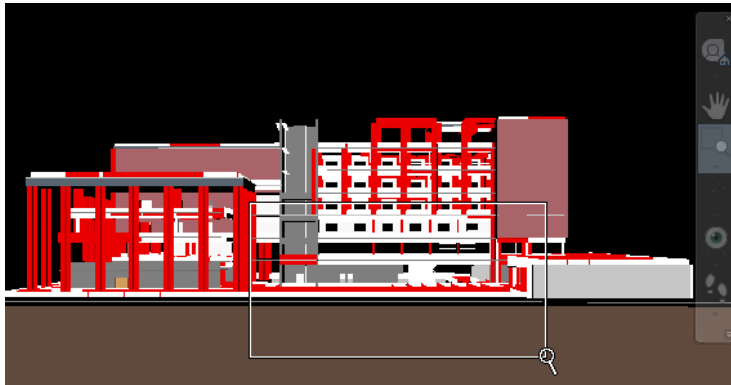
- Selecting Zoom ![zoom icon] , and then click-dragging in the Scene View zooms in and out to a fixed point (beneath the mouse cursor). Dragging forwards zooms in; dragging backwards zooms out.

- Selecting Zoom Selected ![zoom selected icon] instanly zooms to the extents of the items you have selected in the Scene View.
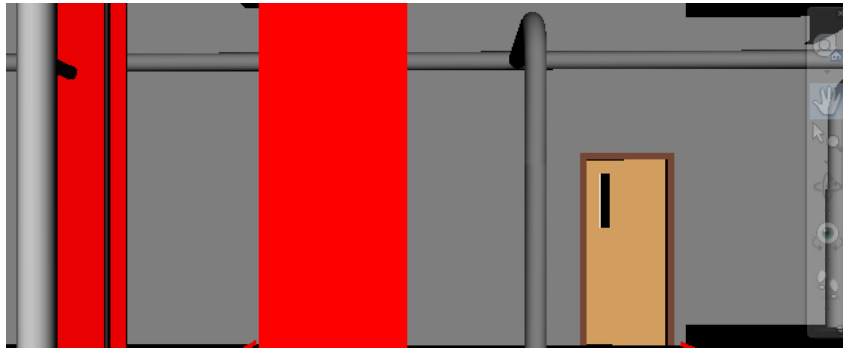
■ Selecting Zoom All ⌕ instantly zooms to the extents of the whole model.

3 To rotate the model, around a pivot point, select one of the Orbit tools from the navigation bar. Click-dragging with the left mouse button in the Scene View rotates the model.

■ Selecting Orbit ⟳ rotates the model with the up direction maintained, and does not allow the camera to roll over from side to side.
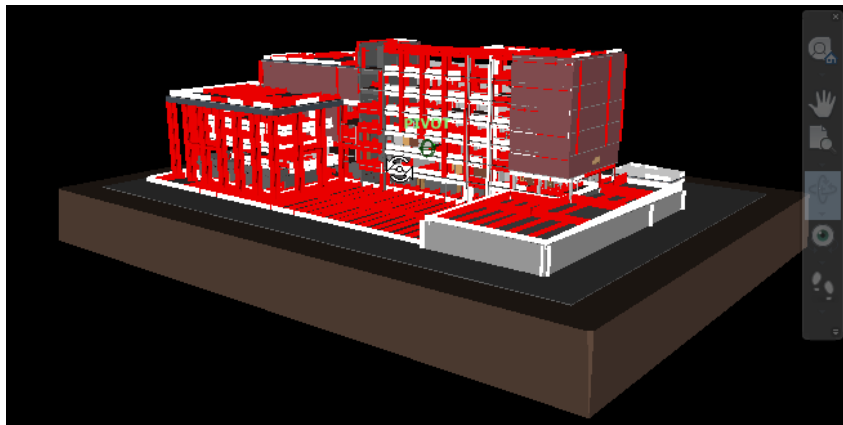
■ Selecting Constrained Orbit ⟳ spins the model around a fixed horizontal plane as thought it is sitting on a turntable.
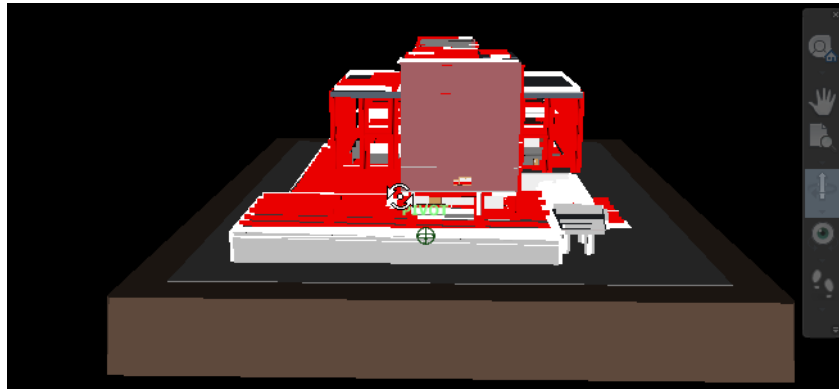
■ Selecting Free Orbit ⊘ freely rotates the model around the focal point in any direction.
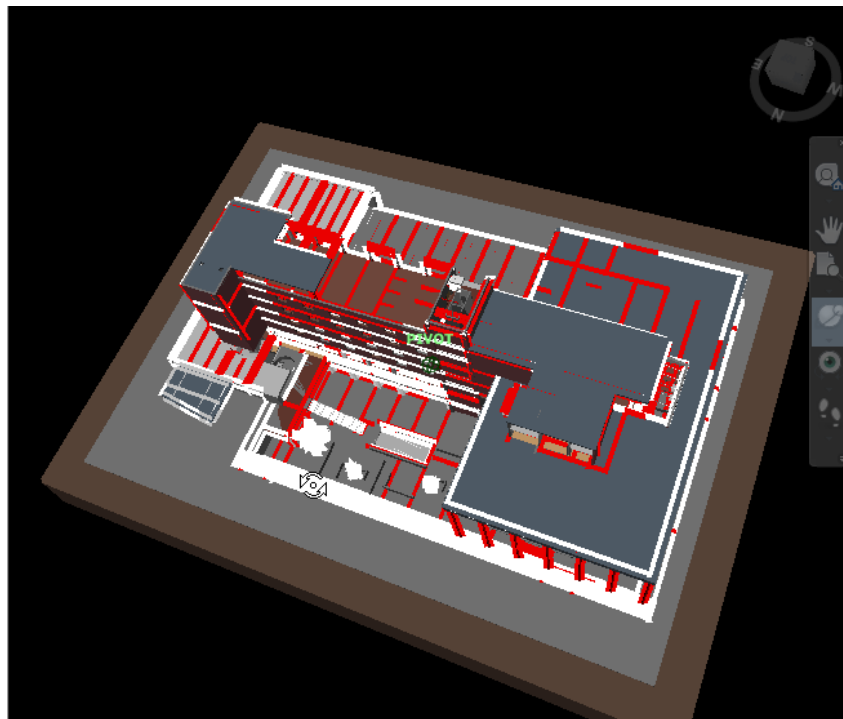
Panning, Zooming, and Orbiting with the Mouse Wheel/Middle Mouse Button

Autodesk Navisworks also allows you to perform basic navigation with the mouse wheel and middle mouse button. This is effective when you need to orient the model while doing other tasks such as measuring, sectioning or selecting items, as it does not require you to explicitly select a navigation tool from the navigation bar, but instead gives you quick 'shortcut' access via the middle button.

1 To pan, press and hold the middle mouse button, and then move the mouse.

2 To zoom the model, rool the mouse wheel. Rolling forwards zooms in, rolling backwards zooms out.

3 To orbit the model, press and hold the SHIFT key and hold down the middle mouse button. Moving the mouse rotates the model about the currently defined pivot point.

Walking and Looking Around a Model

One of the most effective way to navigate large projects is to use the Walk 👣 tool on the navigation bar.

1 Click on the Walk ⧉ tool on the navigation bar. Now, in the Scene View, hold the left mouse button down and push forwards to walk forwards; push backwards to walk backwards; and move the mouse left and right to turn left and right, respectively.

2 The further you move the mouse forwards, the quicker you will walk.

3 To increase the realism of your navigation experience, there are a number of tools that can be employed, including detection of collisions (which stops you walking through walls) and gravity (which brings you down to earth). Use them when you want, for example, walk up and down stairs. You can access these

realism settings from the ribbon pallete (Viewpoint tab ➤ Motion Settings ➤ Realism drop-down 🚶) or from the navigation bar (under the Walk/Fly drop-down).
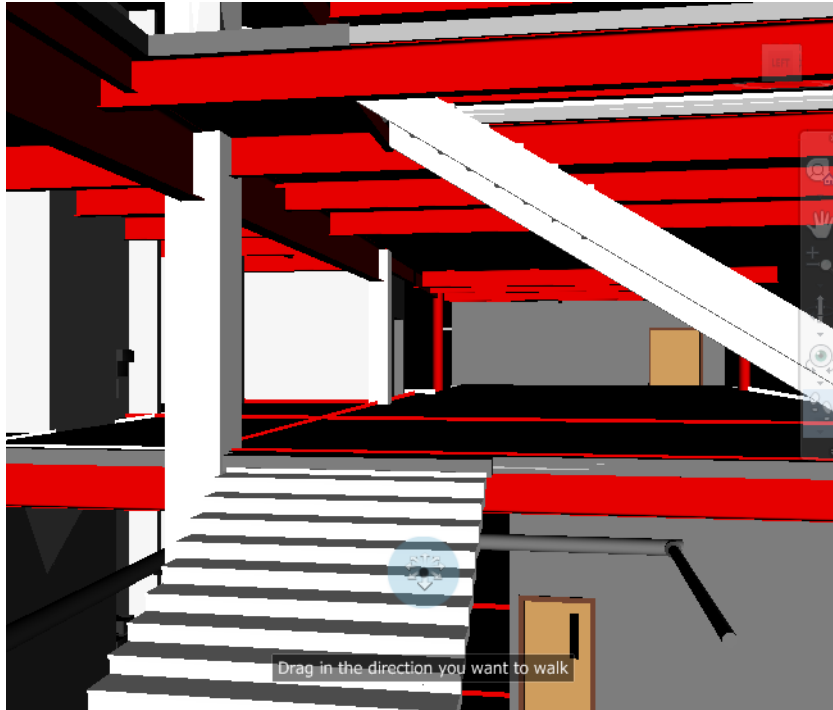
4 To look around the model, select the Look Around 👁 tool from the navigation bar. Now, in the Scene View, hold the left mouse button and drag the mouse around to look around. The Look Around tool keeps you in the same spot but moves the camera around smoothly with the mouse.

Autodesk Navisworks also displays the ViewCube in the top-right corner of the Scene View. This provides quick access to a number of preset views around the current model (or currently selected objects), including a Home view (which you may customize).

Create Intelligent Groups of Objects

Building Information Modeling (BIM) is a term that has become synonymous with applications, such as Revit. However, BIM doesn't stop there. This information can be used throughout the full lifecycle of the building. Autodesk Navisworks enables you to interrogate and utilize this information throughout the project design, build and operation stages without the need for the design application.

One of the first processes you can do with your single project model is to create "intelligent" groups of like objects. This makes it easier to review and analyze your project at each stage. The recommended way to achieve this is to use the Find Items tool to search for items having a common property or combination of properties.

1 Navigate to the glass-faced end of the building.

2 Using the Select tool ▷ on the Quick Access toolbar, click one of the sections of glass in the view.
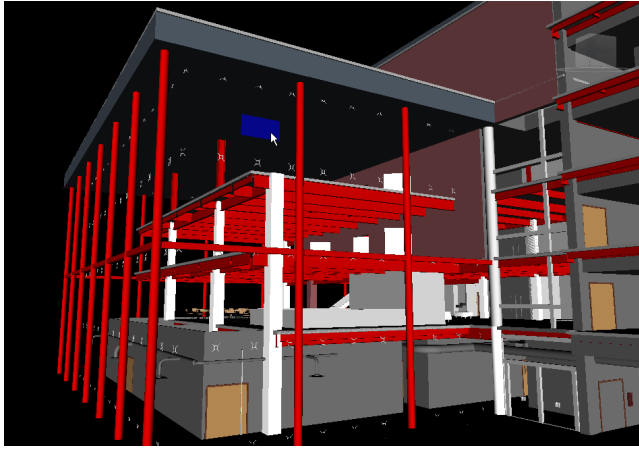
Mouse over the Properties window on the right. Under the Item tab you will see the Item Name is *Glazed*. Let's use this property to define a search condition to find all glazing.

3 Mouse over the Find Items window (at the bottom of the interface) and pin it open.

4 From the Category drop-down, select Item (this being the name of the tab in the Properties window).

5 From the Property drop-down, select Name (identifying that we wish to look at the name of each item).

6 From the Conditions drop-down, select Contains (we are not only looking for an exact match, in which case we would have selected =, but also any name containing *Glazed*).

7 In the Value field, type *Glazed*, then press Enter (Glazed being the search term we're looking for).

8 As we aren't sure whether all item names will be spelled with a capital *G*, we can search for the term ignoring case sensitivity. Uncheck the Match Case option to do this.

9 Click Find All to perform the search.
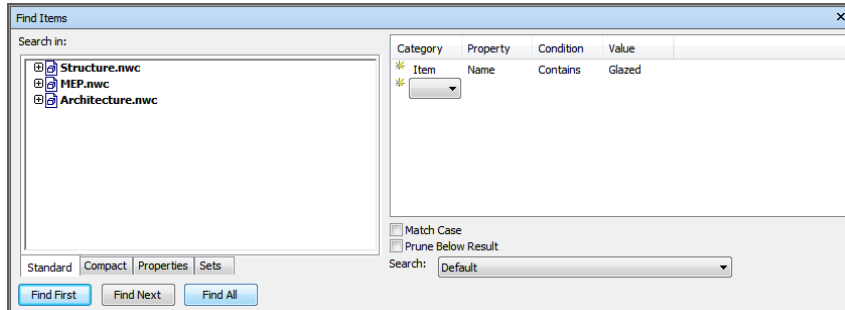
In the scene area, all of the items satisfying this search condition will be selected and highlighted in blue. The Properties window will show you the number of items currently selected, such as the number of items having the word Glazed in their name (mouse over the Properties window to view it).

10 Look around the building to check that all glass has been selected with this search condition.

You will notice that the glass in some of the windows has not been selected. Therefore, they have not met our search condition. We're going to need to build a more complex find condition to include these windows.

11 Select one of the windows that was not previously selected, and then, on the navigation bar, click Zoom Selected .
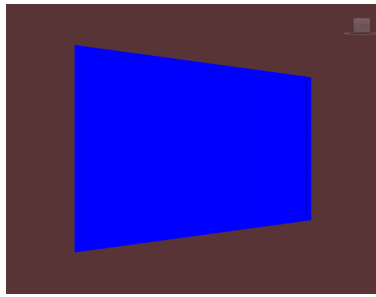
12 In the Selection Tree, the window is highlighted, 78 x 54. Click the + to the left of this to expand the window.
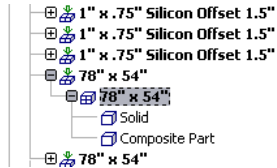
13 The windows have both a Solid component (the glass) and a Composite Part (the frame). Click Solid to select the window glass.

Look in the Properties window, and you will see that the Item does not have a Name property, which is what we were searching for earlier. We can, however, see that the item has a Material property value of *Glass*. We can, therefore, use this condition to find all of these window panes.

14 Our previous search condition will still be in the Find Items window.

15 Click under Item in the Category column and select Item from the drop-down.

16 From the Property drop-down, select Material.

17 From the Condition drop-down, select =.

18 In the Value field, type *Glass*, then press Enter.

If we leave this as is, the two conditions would be ANDed together, meaning both conditions would need to be true for an item in order for it to be selected. We don't want this. We require one condition OR the other to result in an item being selected.

19 Right-click the second item and select Or Condition from the shortcut menu.
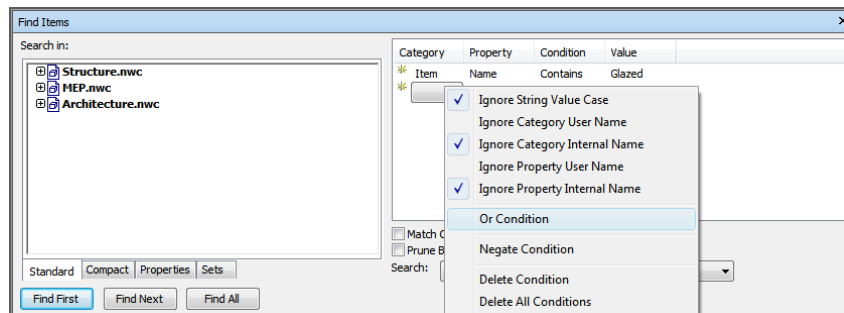
20 Click Find All.

21 Zoom out and you will see that all of the glass has now been selected. Auto Hide 🔲 the Find Items window.

Once we have defined a search and found the items we wish to group together, we can then save the selected items as a selection set (a static group of items), or a search set (a dynamic group of items). Search sets are much more powerful and WILL save you time, especially if your project files are continuing to be updated and revised.

22 With your search defined and the resulting items selected, mouse over the Sets window and pin 📌 it open.

23 Right-click in the Sets window and select Add Current Search.

24 With the search set created, rename this as *Window Glass*.

Whenever you select this search set, the search will be performed on the current model and select all items that meet the conditions, including any additional window glass that has subsequently been added to the project, hence why we refer to search sets as dynamic.

NOTE A further benefit of using search sets is that they can be exported and used on other projects. If you have a number of generic searches then, having defined them once, they can be saved and re-used time and time again.

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25 Click the application button ➤ Import ➤ Search Sets XML.

26 In the `Getting Started` directory, select *Conference Center - Search Sets.xml* and click Open.

   The pre-defined search sets for this project can now be found in the Sets window.

27 As these search sets will be of use to all who review the project, save these into the master NWF file, *Conference Center.nwf*.

Using Saved Viewpoints

Saved Viewpoints not only contain a camera position, they can also contain color and transparency overrides, hidden items, section planes, navigation speeds and modes, and collision detection settings.

These options can be set on a per-view basis, or they can be set as a global option. Click the application button ➤ Options. In the Options Editor dialog box, in the left pane, expand Interface and select Viewpoint Defaults.

Let's look at the two options, Save Hide/Required Attributes and Override Material. Without these options being set, a saved viewpoint will not store any details of the material overrides (color and transparency) or items hidden at the time of saving the viewpoint. When you select such a viewpoint, the camera position will change, however, you will see the model in its current state, regardless of whether any overrides have been made since the viewpoint was saved. When you have these saved attribute options enabled, then you guarantee that when someone reviews your viewpoints, they will see the model exactly as you intended.

Let's look at an example:

1 Open the file, *Conference Center.nwf*.

2 Mouse over the Saved Viewpoints window and pin it open. Right-click in the Saved Viewpoints window and save a viewpoint named *Camera Only*.

3 Right-click the saved viewpoint and select Edit. Notice that the Saved Attributes are disabled. Close the Edit Viewpoint dialog box.

4 In the Sets window, select *Exterior Brickwork*.

5 Right-click the highlighted brickwork in the scene area and select Override Item ➤ Override Color. Select pale yellow and click OK. Press the escape (Esc) key to unselect everything.

6 Click the application button ➤ Options. In the Options Editor dialog box, in the left pane, expand Interface and select Viewpoint Defaults. Check both the Save Hide/Required Attributes and Override Material options. Click OK to accept the changes.
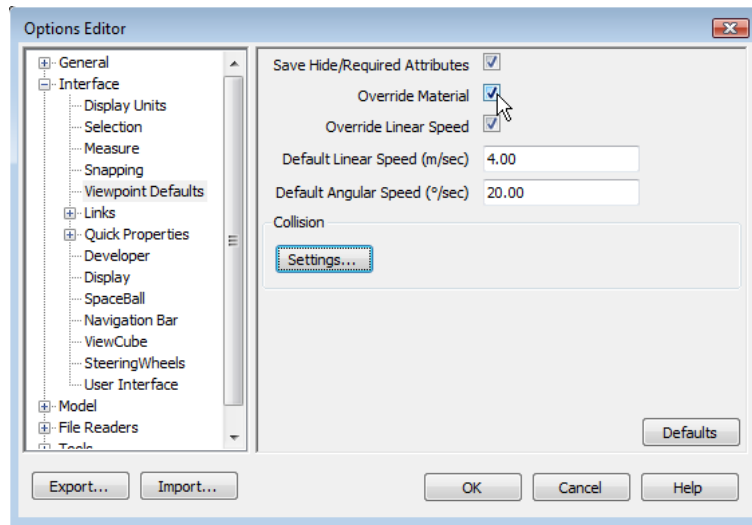
7 Navigate to another position and save a viewpoint named *Yellow Brickwork*.

8 Select the *Exterior Brickwork* search set again, and change the color to pale blue. Auto Hide 🔲 the Sets window.

9 Save another viewpoint this time named *Blue Brickwork*.

10 Mouse over the Selection Tree window and pin 🔲 it open. On the Standard tab, select the *Architecture.nwc* file, and then right-click and select Hide. Auto Hide 🔲 the Selection Tree window.

11 Save a final viewpoint named *Architecture Hidden*.

12 When you click the viewpoints (*Yellow Brickwork*, *Blue Brickwork*, or *Architecture Hidden)*, the model is displayed exactly as you had saved it, because we saved these attributes with the viewpoint.

13 Now click the viewpoint, *Camera Only*. You will notice that the camera position changes, however, it does not show the model in its original colors (as it was when we saved this viewpoint), but with the overrides of the previous viewpoint. Click one of the other saved viewpoints and then back to this one. Again you will see the camera position change with the previous viewpoint overrides applied.

14 Save the file as a separate NWF file, *Color Options.nwf*.

Understanding how these options work means that you can fully utilize viewpoints to communicate your design intent.

Creating Animations

There are two methods by which to create animations in Autodesk Navisworks. Firstly you can record your navigation through the model, and secondly you can create key frames and allow Autodesk Navisworks to interpolate between them.

Each method has its own place. If you are animating an action that can be performed easily with one of the navigation tools, for example spinning the model, or require sweeping curves, then interactive recording is the right option. If, however, your camera can follow a linear path, then you can quickly and easily use viewpoints as key frames. Let's look at both in turn.

1 Open the file, *Conference Center.nwf*.

2 Click the Home button on the ViewCube.
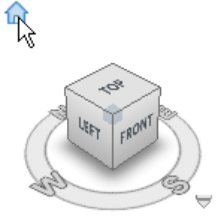
3 On the navigation bar, select the Constrained Orbit tool.

4 Click Animation tab ➤ Create panel ➤ Record . To the far right of the Animation tab, notice that the Recording panel displays.

5 Hold down the left mouse button and, while moving the mouse slowly to the left, release the mouse button. This will spin the model slowly.

6 Once the model has rotated through 360 degrees, on the Recording panel, click Stop .

7 The animation is saved automatically in the Saved Viewpoints window.

8 On the Playback panel, click Play to re-run the animation.

Now we'll create a series of viewpoints which will be our key frames and allow Autodesk Navisworks to do the rest for us.

9 Navigate towards the left-hand corner of the surrounding ground, looking back at the building.
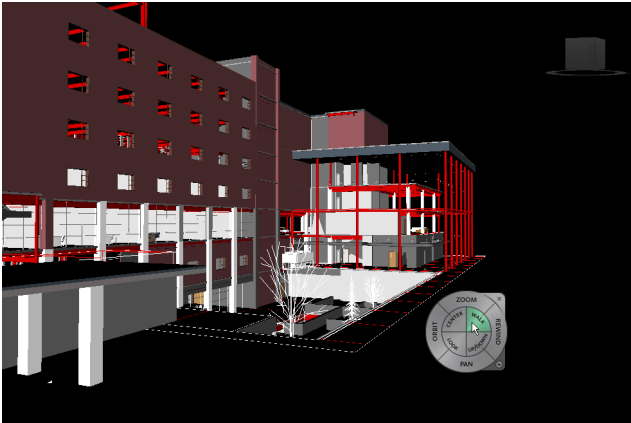
10 Right-click the Saved Viewpoints window and select Save Viewpoint.

11 Walk approximately one third of the way along the surround, looking in a similar direction to the first viewpoint, and then save your second viewpoint.

12 Walk further along and tilt your head up to frame the glass section of the building, and then save your third viewpoint.

13 Walk past the end of the surrounding ground and then look back towards the building. Save your fourth viewpoint.

14 Use the mouse wheel as a button to dolly the camera up until you are just above the building then tilt the camera down to look down on the building. Save your final viewpoint.

15 Right-click the Saved Viewpoints window and select Add Animation.

16 Drag your five viewpoints (in order) into the empty animation, each now being a key frame.

17 Right-click the animation and select Edit. Set the duration to *10* seconds and click OK.

18 Playback ▷ the animation to see the results. Autodesk Navisworks will automatically transition the camera between each key frame.

19 Save the file as *Animation.nwf*.

> **TIP** A good tip for creating animations is to first create a storyboard. Record each section of the storyboard using the most appropriate method (interactive recording or key frames) and then join them together by dragging one onto another. To avoid any transition between sections, try inserting a cut (right-click at the relevant point in the animation and select Add Cut). If you do want sections to join together smoothly, try using the last frame of one section as the first frame of the next section.

Rendered Images

Autodesk Navisworks enables you to quickly add materials, lighting, backgrounds and rich photorealistic content (RPC) to your models, whether to enhance the interactive experience, or to create photorealistic output. The beauty of Autodesk Navisworks is that you continue to use the same combined data set that you're familiar with and it's easy to use without requiring any specialist CAD or rendering skills, though an eye for knowing what looks good always helps!

We saw earlier how to create generic search sets for groups of similar items, and we can use these search sets here. We can create a generic palette of materials that match the materials of our search sets. In doing so, we can then use Rules to instantly apply the materials to a significant amount, if not all, of the items in the model.

Light studios are a pre-defined collection of lights that work well together. With a simple drag and drop you can change the entire look and feel of the model. Various light studios are available out of the box enabling a range of instant effects from sun studies to the most realistic environment lighting.

A range of backgrounds and effects can be applied. Similar to lighting, the most realistic are environment backgrounds. Let's look at these in combination:

1 Open the file, *Conference Center.nwf*, and select one of the saved external viewpoints. Auto Hide 🔲 the Saved Viewpoints window.
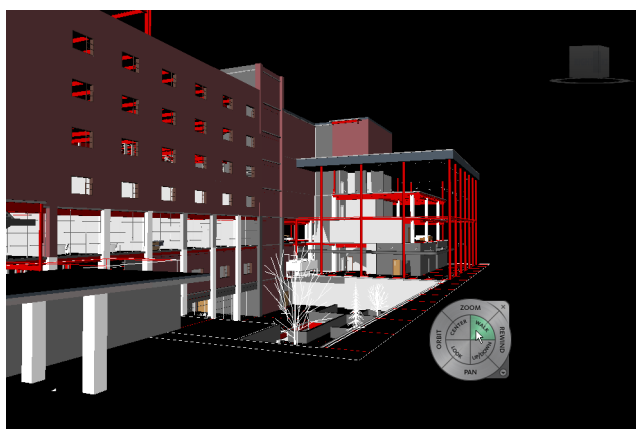
2 To turn off lines, click Viewpoint tab ➤ Render Style panel ➤ Lines ╱ .

3 Mouse over the Presenter window and pin 📌 it open.

4 In the Materials tab, right-click and Load the pre-defined *Conference Center.nwp* palette file.
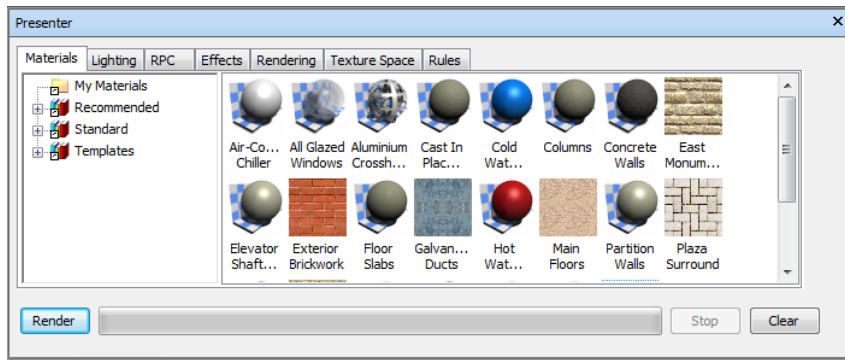
This saves us from having to drag each material from the archives. Each material has also been named the same as its corresponding search set. Go to the Rules tab. Select the Map Presenter Materials to Selection Sets by Name option. Uncheck the Apply to Current Selection Only option and click Apply.

The materials will be automatically applied to the items in each corresponding search set.

5   Go to the Effects tab. Under *Recommended*, expand *Background*. Drag the *Environment* background shader into the palette on the right.

6   Under *Recommended*, expand *Environments* then *Panorama*. Drag *Sky* into the palette on the right.
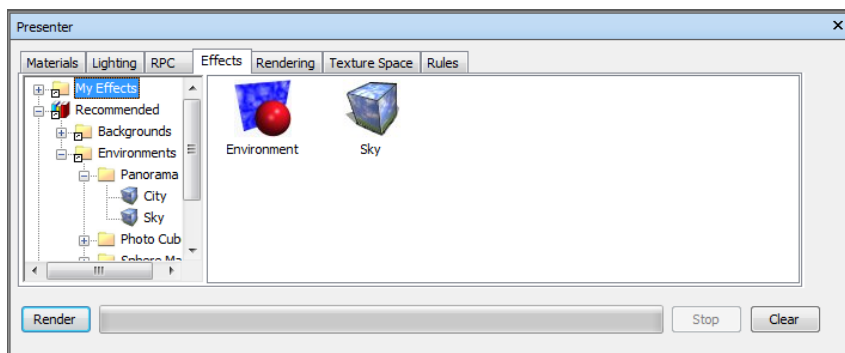
You will see the background is now a bright blue sky over a desert. If you navigate now, you will also notice that the background is interactive and moves with the model (provided that your graphics card is capable of this).

7   Go to the Lighting tab. Expand the *Recommended* archive and drag the *Environment* light studio into the palette on the right. Double-click the *Environment* light and change the Intensity value to *2* (making the light brighter). Save the file as *Presenter.nwf*.

Believe it or not, that's it! These are some of the basic steps required to produce great rendered images from your models.

8   Click Render to see the final effect.

Notice that there's much more depth to the shadowing as the light is being cast and bounced from every direction, much like the real world. Also the background and objects in the scene area are all reflected in any reflective materials, like the glass windows, again further adding to the realism.

To take your renderings further, you may wish to consider adding in a few RPC people and trees to add some life to the scene.

9 Auto Hide the Presenter window once you're finished.

Create Punch/Snag Lists

Although Autodesk Navisworks can produce a single, compressed and secure NWD file for distribution to all stakeholders, allowing each of them to review the project individually, many customers will hold regular review sessions with all major stakeholders in the same room. By collaborating in this way, they are able to review the project together and identify potential issues, which they can discuss and agree on a course of action, there and then.

Autodesk Navisworks makes this significantly easier by presenting the entire project in a single 3D scene which everyone involved can relate to. The real time navigation enables the review team to explore every inch of the project, with immediate access to the inherent building information.

Being able to select a group of search sets and hide everything else at the click of a button, quickly isolates a specific part of the project for detailed review. Similarly using the sectioning tools enables you to isolate a specific region of the project for review. You can then use this section window to systematically traverse the entire model effectively breaking a large project into more manageable sections.

During such a review session you need a way to record your findings along with any discussions and resolutions reached, and then be able to communicate these to a wider audience, including the CAD engineers for example, if design changes be required. The Autodesk Navisworks Tag tool enables this communication, and we'll look at this now.

1 Open the file, *Conference Center.nwf*.

2 Click Review tab ➤ Tags panel ➤ Add Tag.

3 To add a tag, left-click the item you wish to tag and then make a second click away from the item, (preferably where the background is less busy). The tag will be drawn on screen and will be identified as number 1. The Add Comment dialog box opens automatically, allowing you to type details of why you've added this tag, or instructions to team members and so on. (Simultaneously a new viewpoint will be created named *Tag View 1*.)
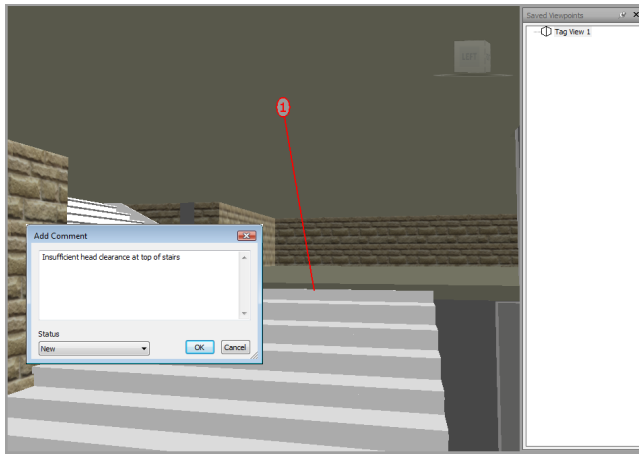
4   Try hiding certain search sets (groups of objects) while navigating around the model and add a few more redline tags. Each new tag ID will be automatically incremented to maintain uniqueness.

5   Save the file as *Project review.nwf*.

We can then create a viewpoints folder (right-click the Saved Viewpoints window and select Add Folder), rename it with today's date (for example) and drag all of our review session tags into it, keeping a record of what we've found and discussed. We can then save this to go back to it later or distribute it to other extended team members.

We can also export the viewpoints as a HTML report (click Output tab ➤ Export Data panel). This can be distributed to an even wider audience as they require no additional software, yet they can see a screenshot of the tagged item and any comments associated with it.

As mentioned earlier, you could include instructions to team members. If you include an individual's or function's name in the comments, then those individuals/functions will be able to search for the tags associated to them, creating their own specific snag/punch list.

Merge and Manage your Projects

At each of the previous sections you may have noticed that we've saved up a series of NWF files, each based on the same original data set but the actions performed have been quite different. This is to demonstrate that once you have created your single model, it could be distributed to a varied audience, all of which may have differing objectives and reasons for using the model.

Autodesk Navisworks is an aid to collaboration and although people may be using the single model in different ways, we can unite their resultant files back into a single project file.

1   Open the file, *Conference Center.nwf*.

2   Earlier we used Append to combine additional model files. Here we want to use Merge to combine all of the session data together without duplicating the model geometry. Click Home tab ➤ Project panel ➤ Merge and select all of the other NWF files you've created.

3   We can now re-save this as *Conference Center.nwf*, our master project file.

Interference Detection

Everyone likes to believe what they've designed is perfect, yet why then are there so many change requests submitted once a project is under construction? One reason is that although individual component parts may be perfect and error free in isolation, when they come together in a collaborative environment, the issues are all too common.

Let's face it, buildings are complex! It's no wonder we have conflicts between disciplines.

Autodesk Navisworks enables you to combine the various disciplines, from disparate sources, into a single model environment. Clash Detective can then be used to identify any potential conflicts between the disciplines, giving

you the opportunity to resolve these while the project remains in the digital stage. The potential savings in time and money are obvious. (Click View tab ➤ Workspace panel ➤ Windows drop-down ➤ Clash Detective.)

The best advice for defining clash tests is to search for clashes where you would expect to find them. Let Clash Detective help you, not replace you. If you try searching the entire model for everything that touches something else, you will be inundated with false positives items that are meant to touch. If, however, you define clash tests based on your real-world experiences of where things go wrong, and don't fit on site, then Autodesk Navisworks can help you find and resolve these quickly.

1   Mouse over the Clash Detective window and pin 🖼 it open.

2   The Select tab is where we define our clash test. There is a Left and a Right side, both containing an identical copy of the Selection Tree.

3   Under the Left and a Right sides, you will see the tabs Standard, Compact, and so on. Scroll these to the right and select the Sets tab (for both Left and Right). Here you can see all of the search sets we imported earlier.

4   In the Left tree, select *Supply Air System*.

5   In the Right tree, select *Structural Framing Steel*.

6   Ensure Self Intersect is unchecked on both sides (as we do not wish to clash check each side against itself).

7   The Run Type should be set to Hard, looking for physical intersections between items on the left and items on the right.

8   The Tolerance (m) should be set to *0.001*; therefore, we will ignore any clashes found with interferences less than 1 mm.

9   In the Clash Detective window, click Start to perform the clash test.
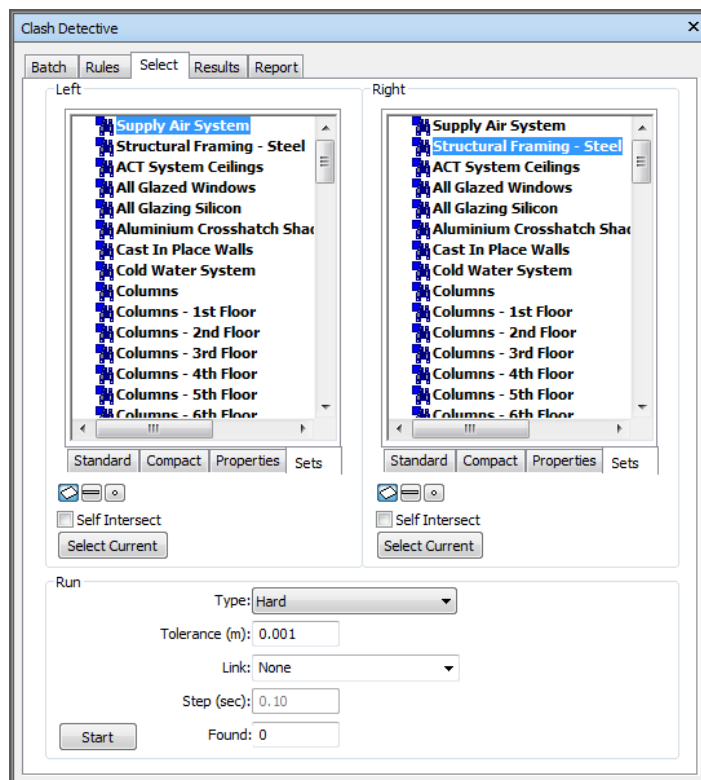

Five clashes should be found. Now let's review these results:

10   Go to the Results tab and click *Clash 3*.

11   You will be automatically zoomed into the clash area, however, you may not have a clear view or you may have objects (like the ceiling) obscuring your view. Use the Orbit tool to move around the clashing objects to find a preferred viewpoint. In the Display group, select the Dim Other option to gray out all other objects,

further highlighting the problem objects. Select the Transparent Dimming option, allowing you to see through the objects not involved in the clash.
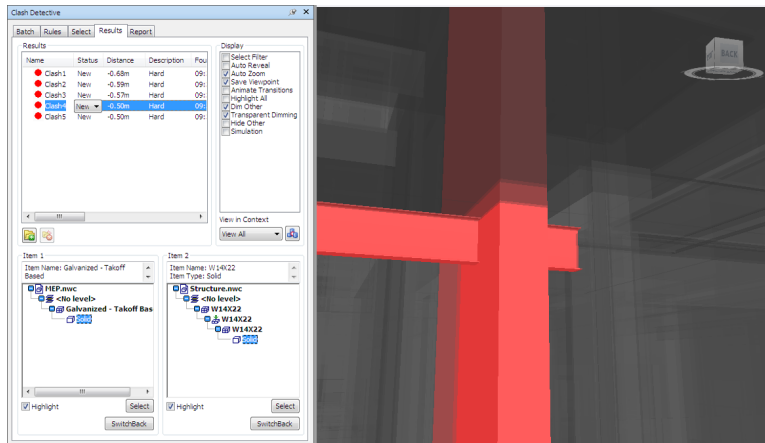
The clashing items are highlighted in red to signify that it is a newly found clash (there are other colors for clash management that we will not go into here).

The clash draws our attention to a section of the superstructure passing through a section of ducting. Details of the clashing items are shown at the bottom of the Results tab making it easier to identify them.

12 Auto Hide ◲ the Clash Detective window.

As part of the review process a decision has to be made whether to approve a clash, or whether action needs to be taken. Autodesk Navisworks provides tools to add comments and markup to clash results which can be recorded and kept as part of an audit trail, or passed back to the engineering teams advising to re-route the ducting, for example. Once any changes to the original CAD files have been made, the clash test can be re-run to determine whether the change has resolved the clash, and to also check that the change hasn't resulted in a clash with another item.

4D Construction Simulation

Autodesk Navisworks enables you to link your existing 3D model with an existing construction schedule to add new value. The ability to create a 4D simulation enables you to experience the construction process before it begins.

In this exercise we will use a basic schedule in the MPX exchange format. This enables us to read the schedule without the need for any scheduling software being installed.

1 Navigate to a clear view of the building.

2 Mouse-over the TimeLiner window and pin ◲ it open.

3 Go to the Links tab.

4 Under the Name column, right-click and select Add Link ➤ Microsoft Project MPX.

5 In the `Getting Started` directory, select *Conference Center.mpx* and click Open.

6 In the Field Selector dialog box, we map columns in TimeLiner with the corresponding columns in the schedule (MPX file). Set the External Field Name for the *Task Type Import* field to *text10*. For all other fields we will use the default. Click OK.

7 In the Name column, right-click the New Link and select Rebuild Task Hierarchy from Link.

8 Go to the Tasks tab. This now displays all of the data imported from the MPX file. You will notice that each task has a start and end date. You may also have noticed that the task names once again correspond to the generic search sets we added earlier.

9 Go to the Rules tab.

10 Check the Map TimeLiner Tasks from Column Name to Selection Sets with the Same Name, Matching Case option, and then click Apply. As this rule suggests, all items associated with a search set will be attached to the task of the same name.

So let's now see what we've created.

11 Go to the Simulate tab.

12 There is a timeline from the start to the end of the project, allowing you to look at the project at any point in time. Alternatively, you can click Play ▷ to play back the entire simulation. Try this now.
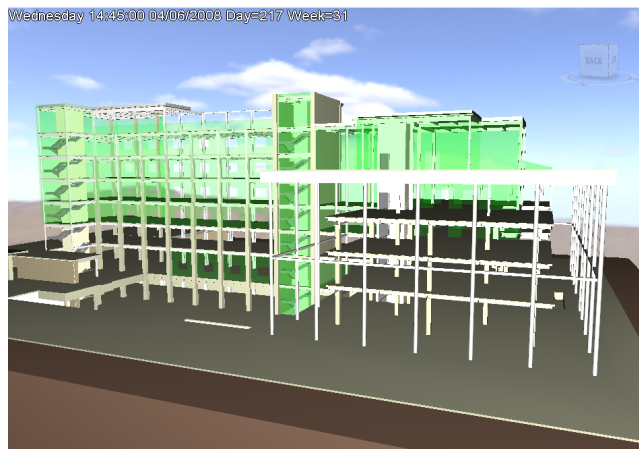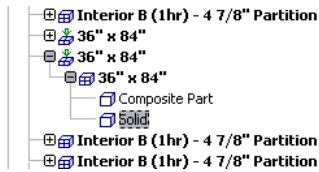

13 Click the Tasks tab and Auto Hide ▣ the TimeLiner window.

Object Animation

Autodesk Navisworks has the ability to animate objects within the combined model scene. The possibilities are endless, however, some examples could include the opening of doors; movement of vehicles or cranes around a construction site; animation of mechanical components/machinery or production lines in an industrial facility.

1 Click the Animator window.

2 Navigate to one of the internal 36 x 84 doors.

3 In the Animator window, click Add ⊕ , and select Add Scene.

4 Select ▷ the door. Notice that the door frame is also selected.

5 Open the Selection Tree window and pin ▣ it open. Expand the selection tree to see the door components. Select the door components, excluding the door frame.

Interior B (1hr) - 4 7/8" Partition
36" x 84"
36" x 84"
36" x 84"
Composite Part
Solid
Interior B (1hr) - 4 7/8" Partition
Interior B (1hr) - 4 7/8" Partition

Auto Hide [icon] the Selection Tree window.

6 Click Add [icon] again and select Add Animation Set ➤ From Current Selection. Rename the animation set, *Internal Door*.

7 Click Rotate [icon] . The gizmo will appear, positioned at the center of the door.

8 Move the cursor over the central yellow node on the gizmo. The cursor will change to a hand [icon] when you're in position to control the gizmo.

9 Hold down the Control key and then the left mouse button and move the gizmo, until the z-axis (blue) is aligned with the edge of the door (where the door hinge would be).
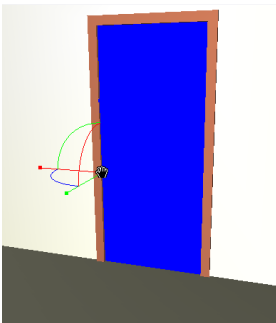
10 Click Capture Keyframe [icon] . The keyframe is represented by a black diamond on the timeline at the zero second position.

11 Drag the black timeline position bar to around 3 seconds.

12 On the gizmo, there is a blue arc between the x- and y-axis. Hover over the blue arc (again the cursor will change to a hand), hold down the left mouse button and drag the arc to swing the door open. Open the door to around 90 degrees.
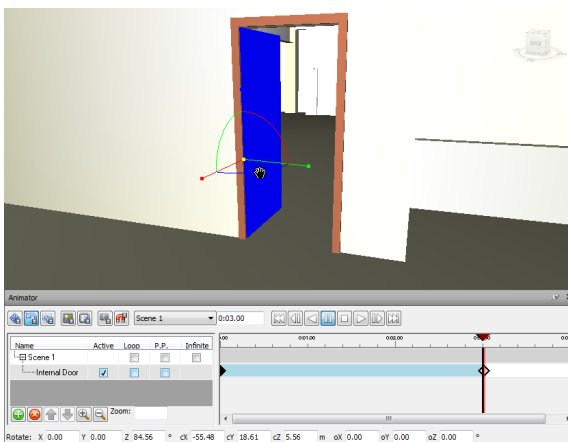
13 Click Capture Keyframe [icon] again. A second black diamond will be added to the timeline at the 3-second position. Click Rotate [icon] again to deactivate the gizmo.

14 That's it! Your animation is complete. Drag the timeline bar back and forth to open and close the door, or use the playback controls.

In the Animator window, there is an option called P.P., which stands for Ping-Pong. Selecting this option and then playing your animation will play the animation forwards and then when the end is reached, play it backwards. Simulating the door opening and then closing in this case. You could try copying the second keyframe a few seconds later, then using Ping-Pong the door will open, stay open for a few seconds and then close.

Selecting the Infinite and Loop options will infinitely loop the animation. With Ping-Pong selected also, the simple animation will continuously play backwards and forwards. This could for example, be used to simulate the repetitive process of a crane or other mechanical equipment.

Animation Interaction

Having created object animations, Autodesk Navisworks enables you to associate these with events that can be triggered by the user. For example, taking the simple animation of opening a door in the previous section, you can create a script that plays the animation when you approach the door. Let's see how this is achieved.

1 Stop the Animator playback and uncheck P.P, Infinite, and Loop options.

2 Click Animation tab ➤ Script panel ➤ Scripter.

3 Click Add New Script , renaming this, *Open Door*.

4 In the Events section, click On Hotspot .

5 In the Properties section, click Pick. This will change the cursor to a cross-hair . Click the center of the door.
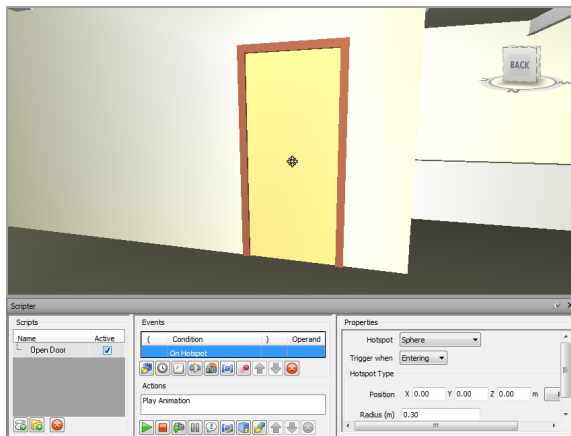

6 Change the Radius (m) value to *2*.

As a result, this hotspot is a sphere with a 2 meter radius, positioned at the center of the door. When you enter that sphere, the event will be triggered.

7 In the Actions section, click Play Animation .

8 In the Properties section, click the Animation drop-down, expand Scene 1 and select the Internal Door animation.

9 Change Starting At from Start to Current Position.
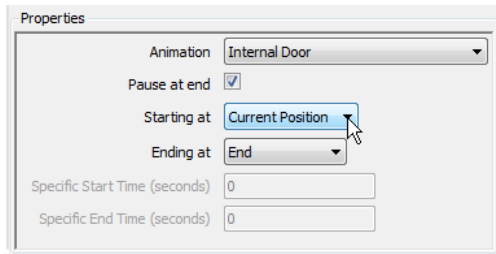
Before using this script, let's create a second script to close the door.

10 Click Add New Script renaming this, *Close Door*.

11 In the Events section, click On Hotspot .

12 In the Properties section, click Pick and click the center of the door.

13 Change the Radius (m) value to *2*.

14 Change Trigger When from Entering to Leaving.
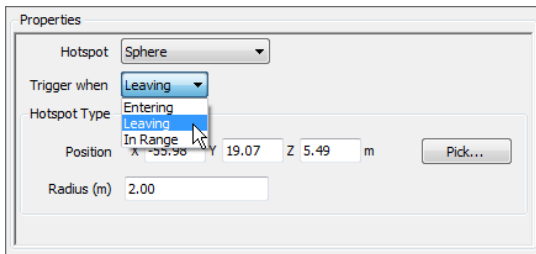
15 In the Actions section, click Play Animation .

16 In the Properties section, click the Animation drop-down, expand Scene 1 and select the Internal Door animation.

17 Change Starting At from Start to Current Position.

18 Change Ending At from End to Start.

You're now ready to try your scripts and interact with your animation.

19 Walk backwards away from the door (until you're more than 2 meters away).

20 Click Animation tab ➤ Script panel ➤ Enable Scripts , and then walk towards the door.

When you walk within 2 meters of the door, the event will be triggered and the door will open. If you then walk backwards (or through the door), when you are more than 2 meters away (leaving the hotspot sphere), the leaving event will be triggered, playing the animation in reverse, and the door will close.

NOTE When scripts are enabled, the Animator and Scripter windows will be disabled so that they cannot be modified while running. Once you are finished using the scripts, or if you need to edit/add animations or scripts, remember to click Enable Scripts again, turning them off.