



AECbytes Product Review (June 21, 2011)

Revit Architecture 2012

Product Summary

Revit Architecture 2012 is the latest release of Autodesk's BIM application for architectural design, featuring improvements across several different areas of the application. It is available as a stand-alone application or as part of Autodesk's Premium and Ultimate Building Design suites.

Pros: Ability to import point clouds with snapping capabilities that allow building models to be created more accurately in reference to them for renovation and retrofit projects; the Revit Server and the Conceptual Energy Analysis capability released for subscription customers last fall are now part of the general 2012 release; ability to divide a building element into parts reflecting how that element will be constructed; ability to group elements into assemblies and create sheets of the different assembly views; improved worksharing display that uses color-coding to provide greater visibility into element ownership and status; several visualization improvements, including semi-transparent element selection and the ability to "paint" a different material on the surface of an element; increased multithreading for performance enhancements; several additional improvements to the user interface, DWG export, and dimensions capability.

Cons: Files sizes in Revit are still very large; multi-processing is not fully supported across all areas of the application; conceptual modeling environment lacks the intuitiveness of other popular conceptual design tools; Help documentation has been replaced by an online Wiki system that has some benefits but is more difficult to use as a resource compared to comprehensive documentation accompanying the application.

Price: Suggested retail price is \$5,495 for the stand-alone version of Revit Architecture 2012 (without subscription), \$6,495 for the Autodesk Building Design Suite Premium Edition, and \$11,495 for the Autodesk Building Design Suite Ultimate Edition.

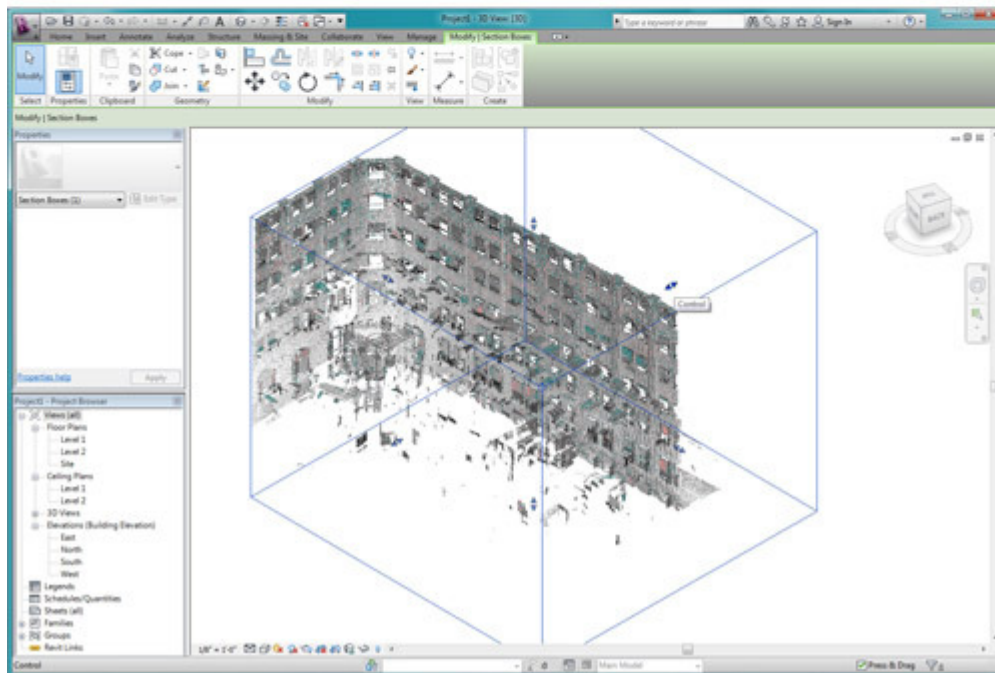
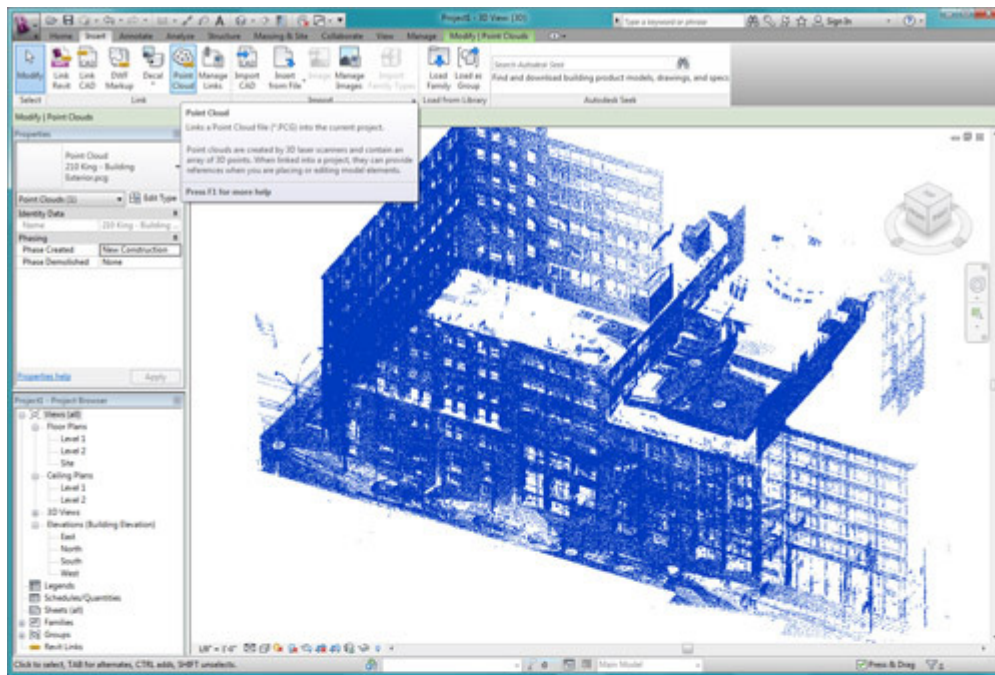
In mid-April, we looked at the highlights of [Autodesk's 2012 product portfolio launch webcast](#), which provided the rationale for the new design suites Autodesk was introducing for different industries, as well as a sampling of the main enhancements in the 2012 versions of key applications such as AutoCAD and Revit. Subsequently, we also looked in more detail at the updated functionality in the 2012 versions of Autodesk's AEC applications, which was presented at [Autodesk's 2nd annual AEC Technology Day](#). While these served to highlight some of the key new features in Revit Architecture 2012, let's take a more detailed look at the application to see how much progress it has made since the last two releases, [2010](#) and [2011](#), both of which have been reviewed in AECbytes. (A more comprehensive evaluation of Revit Architecture can be found in the paid research report, [BIM Evaluation Study Report](#).)

Key Enhancements to the Revit Platform

As discussed in the earlier two articles on Autodesk's 2012 product release, individual applications have been packaged into "suites" for different industries which are available for installation on a single Flash disk. Thus, Revit Architecture 2012 is available both as a stand-alone application as well as part of the Premium and Ultimate Building Design suites. I installed it as part of the Premium Building Design Suite, which also included the 2012 versions of the other two disciplinary BIM applications, Revit Structure and Revit MEP, as well as 3ds Max Design, AutoCAD, AutoCAD Architecture, AutoCAD MEP, AutoCAD Structural Detailing, Autodesk Showcase, and Autodesk SketchBook Designer. I was indeed able to install all of these applications from a single USB key—it took several hours because of the number of applications, but it was very convenient not having to install by cycling through multiple CDs/DVDs, as I have to do with large applications in the past.

Let us start by looking at the main enhancements to the core Revit platform, which are available in all the three Revit disciplinary BIM applications including Revit Architecture. Revit can now import point clouds, with snapping capabilities that allow Revit elements to be accurately modeled in reference to imported laser scans, which is very helpful for renovation and retrofit projects. Prior to the 2012 release, Revit users had to rely on AutoCAD for point cloud support, which had been introduced in [AutoCAD 2011](#) released last year. Revit now supports point clouds natively, using the same point cloud engine as AutoCAD (see Figure 1). There is a new Point Cloud tool in the Insert tab, which can be used to import raw point cloud data in eight different formats, covering all the popular laser scanning devices. Once a point cloud in any of these raw formats is imported, it gets converted to a proprietary Autodesk file format for point clouds, the ".pcg" format. While the conversion takes some time, the resulting .pcg file opens up much faster because it is indexed. However, this additional data and faster processing does come at a price—the resulting .pcg file is much larger in size than the original raw point cloud data file.

While importing the point cloud into Revit, you can choose from different positioning options to place it where required. Once it is imported, all of the regular display and navigation options can be applied to it. You can see plan and elevation views, generate section views using the Section tool, view it in 3D from any desired angle by using the View Cube, and apply clipping planes to see different parts of it, as shown in Figure 1. You can zoom in and out, and the display automatically adjusts to the zoom level—showing more points when you zoom in and fewer points when you zoom out—so that the display system is not overloaded, and is faster and more responsive. The Visibility/Graphic dialog for views now includes an additional option for point clouds, allowing you to display or hide them as required.

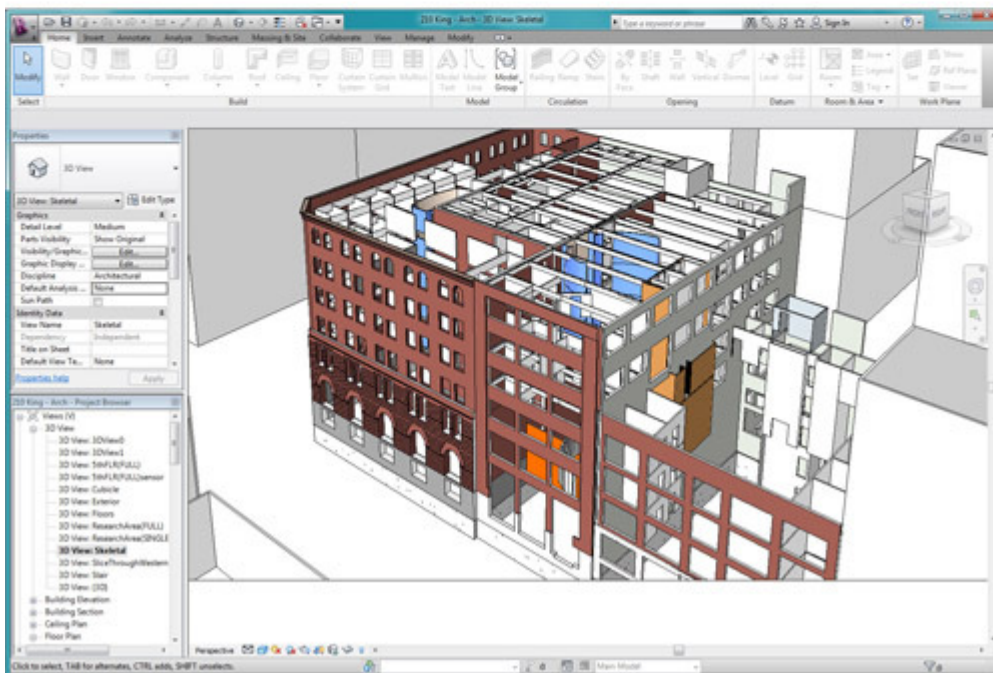
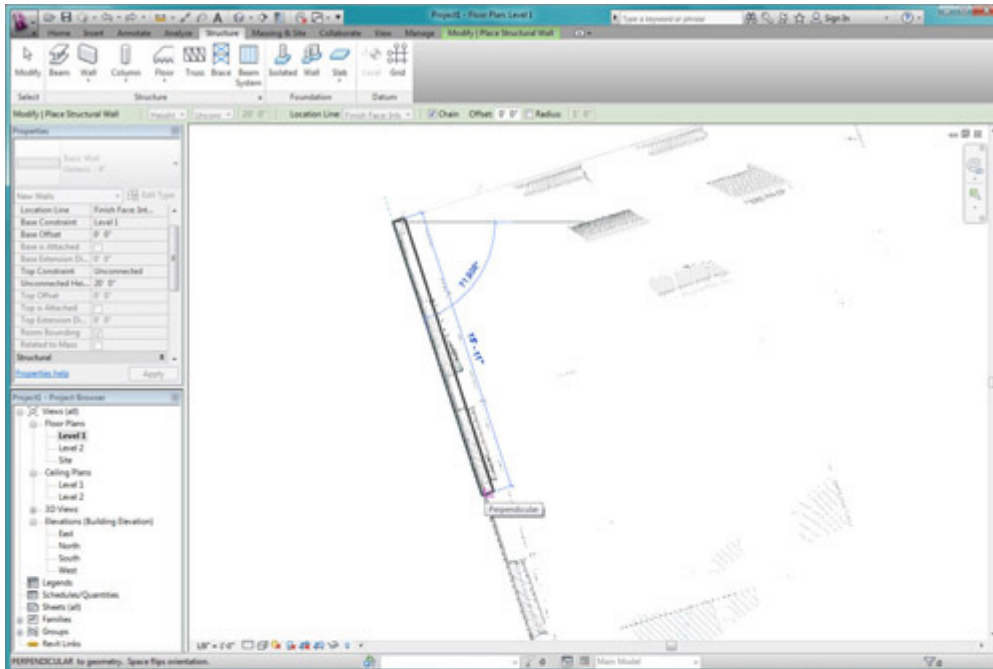


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Figure 1. Using a clipping plane to explore a point cloud captured by a laser scan and imported into Revit Architecture. The top image shows the unclipped point cloud.

While there is no feature recognition yet, let alone automatic conversion of the point cloud to a 3D or BIM model—which is undoubtedly the holy grail of laser scanning for AEC—Revit does have the capability to snap to implicit planar surfaces that are dynamically detected in the point cloud, making it easier to create building geometry in reference to it (see Figure 2). Thus, you essentially have to remodel the whole building in Revit, except that you can do it in reference to the point cloud and thereby attempt to ensure that the model more accurately captures as-built conditions. In the future, there are plans for automatic plane recognition, which would enhance

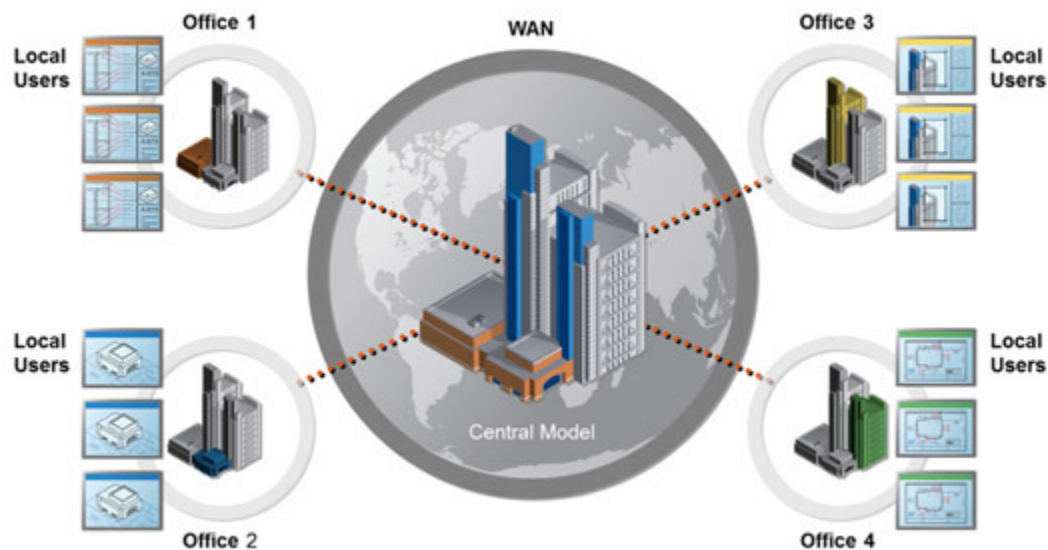
the ease with which you can model “on top of” an existing point cloud in Revit. But of course, the ultimate goal is automatic conversion of the point cloud to a BIM model, which could be a long way off. In the meantime, Autodesk has opened up the APIs for point cloud development in Revit, allowing third party vendors to develop plug-ins providing additional point cloud functionality. A good example of this is the “Scan to BIM” application developed by IMAGINiT, an Autodesk reseller, which was exhibited at [Autodesk University 2010](#). While it essentially provides the same functionality as what Revit now offers, we can look forward to additional innovations in the area of laser scanning for BIM both from Autodesk as well as third-party vendors like IMAGINiT who are using the Revit point cloud APIs.



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Figure 2. The top image shows a wall being modeled in reference to the point cloud by using Revit's implicit snapping capability, while the lower image shows the architectural model of the entire building that was imported as a point cloud in Figure 1.

In addition to the point cloud support, other key enhancements to the Revit platform include the Revit Server and the Conceptual Energy Analysis capability, which were released for subscription customers last September and have now been included in the general 2012 Revit release. These were described in detail in a [dedicated article](#) following their release. The Revit Server is designed to help project teams in different locations to more easily collaborate on shared Revit models across a wide-area network (WAN). It comprises a central server in one location where the central Revit models of projects are stored, and local servers at each of the office locations, which maintain local copies of the models that users in that office are working with (see Figure 3). Team members work on a local copy of the central model, accessing it through a LAN (local area network), and thereby avoiding the slow speed and latency problems that existed earlier when accessing the central model across the WAN. Additionally, the central server and the multiple local servers are being constantly synchronized to ensure that changes made to the local models are updated in the central model, which are then, in turn, updated in all the local servers in different locations. (For an interesting comparison between the Revit Server and Revit cloud computing, please see the recent article, [STRATUS: A Private Cloud Server Technology for Revit.](#))

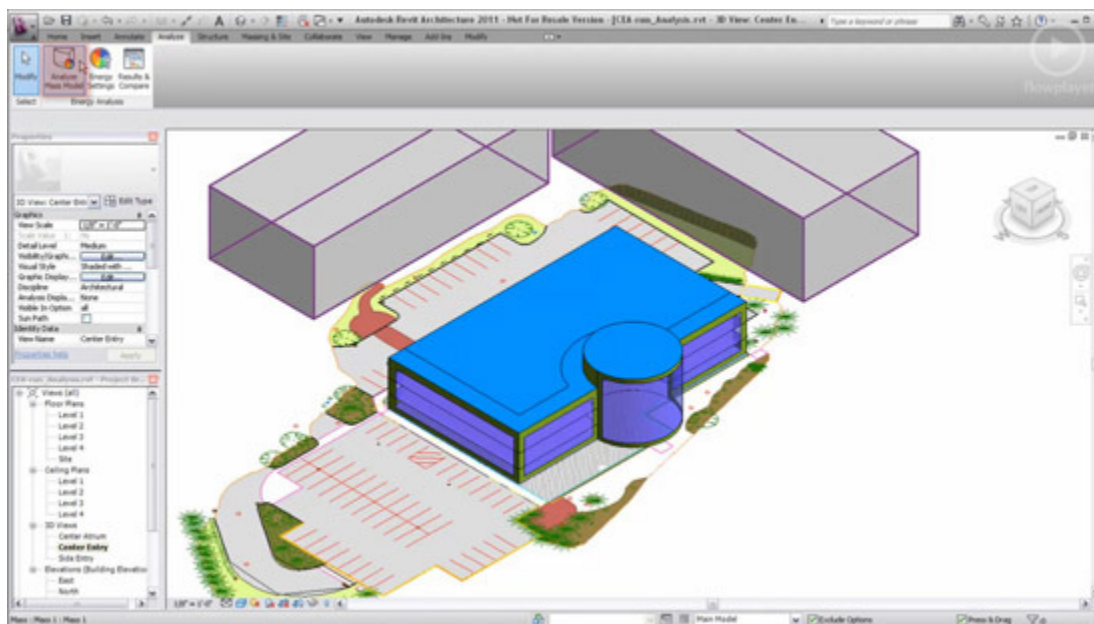


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Figure 3. An illustration of how the Revit Server works.

The Conceptual Energy Analysis capability, which is now available in the regular release of Revit Architecture 2012, allows energy analysis to be performed on conceptual massing models (see Figure 4). This capability was also described in detail in the article from last September, [Revit's New Server and Conceptual Energy Analysis Capabilities](#). The analysis works on a massing model that has been divided into levels; it automatically uses this to create an analytical energy model by rationalizing the form into thermal zones and building surfaces, based on parameters such as site location, construction type, percentage of glazing, and several additional attributes that come from the main project settings or are defined specifically for the energy analysis. For the glazing, you can also actually draw it on the building's surfaces instead of just going with a uniform distribution of the glazing percentage. The actual analysis uses cloud-based tools and provides an estimate of the energy consumption and lifecycle costs of the proposed design. You can also compare the analysis results of multiple alternatives by modeling them in Revit as different

design options. You can view the results within Revit itself, enabling sustainability to be taken into consideration earlier on in the design process.



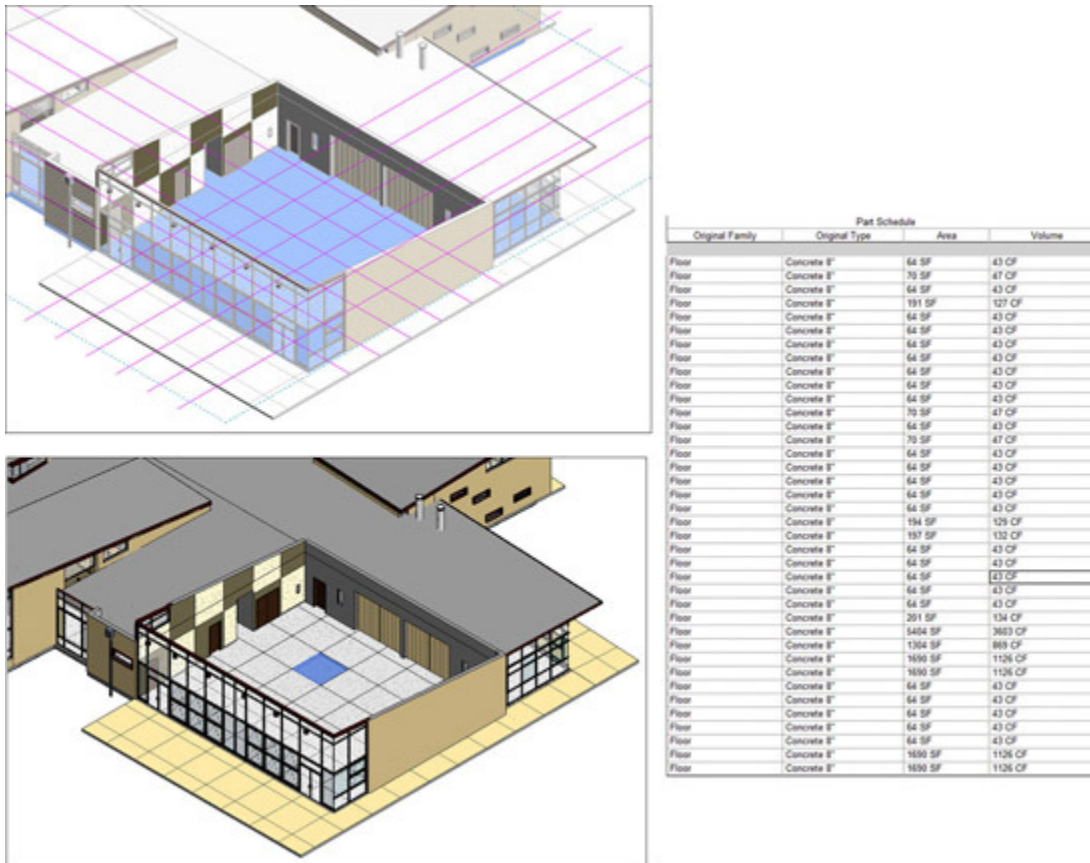
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Figure 4. Running energy analysis on a conceptual massing model that has been divided into levels. This capability was first available in the subscription update to Revit Architecture 2011 last September.

In addition to the enhancements described above, all the Revit applications are now Citrix XenApp6 ready, supporting users working from remote locations using a single server. This can help to enhance collaborative workflows, especially when used in conjunction with the Revit Server to share Revit models across a WAN.

Going Beyond Architecture: Construction Modeling and Shop Drawings

Another key development in Revit is the introduction of new tools for construction modeling, which allows contractors, or even architects, to add constructability to design models. It allows construction methods to be added to building components; for example, breaking up a wall into its individual layers or breaking up a single slab into separate parts based on the sequence in which it will be poured on site. Selecting a construction element activates a new Create category in the Modify ribbon, from which you can choose the Create Parts option. For a construction element made up of multiple layers of materials, you can simply select the Enter key to break up the element into parts based on its layers. You can now select and manipulate the layers individually by setting the new Parts Visibility option in the Properties dialog of the view to Show Parts, and by activating the Shape Handles option for the part. If an element has to be subdivided into smaller parts, you can select the Divide Parts option, which allows you to subdivide the element in different ways: by drawing on it using different drawing tools or by using intersecting references such as level lines and grid lines (see Figure 5). If the parent element is modified, the corresponding changes are also made to the parts. Additionally, you can create a workplane that coincides with any plane surface and use the Workplane Viewer option to see that surface head-on, making it easier to draw on an element to subdivide it more precisely.



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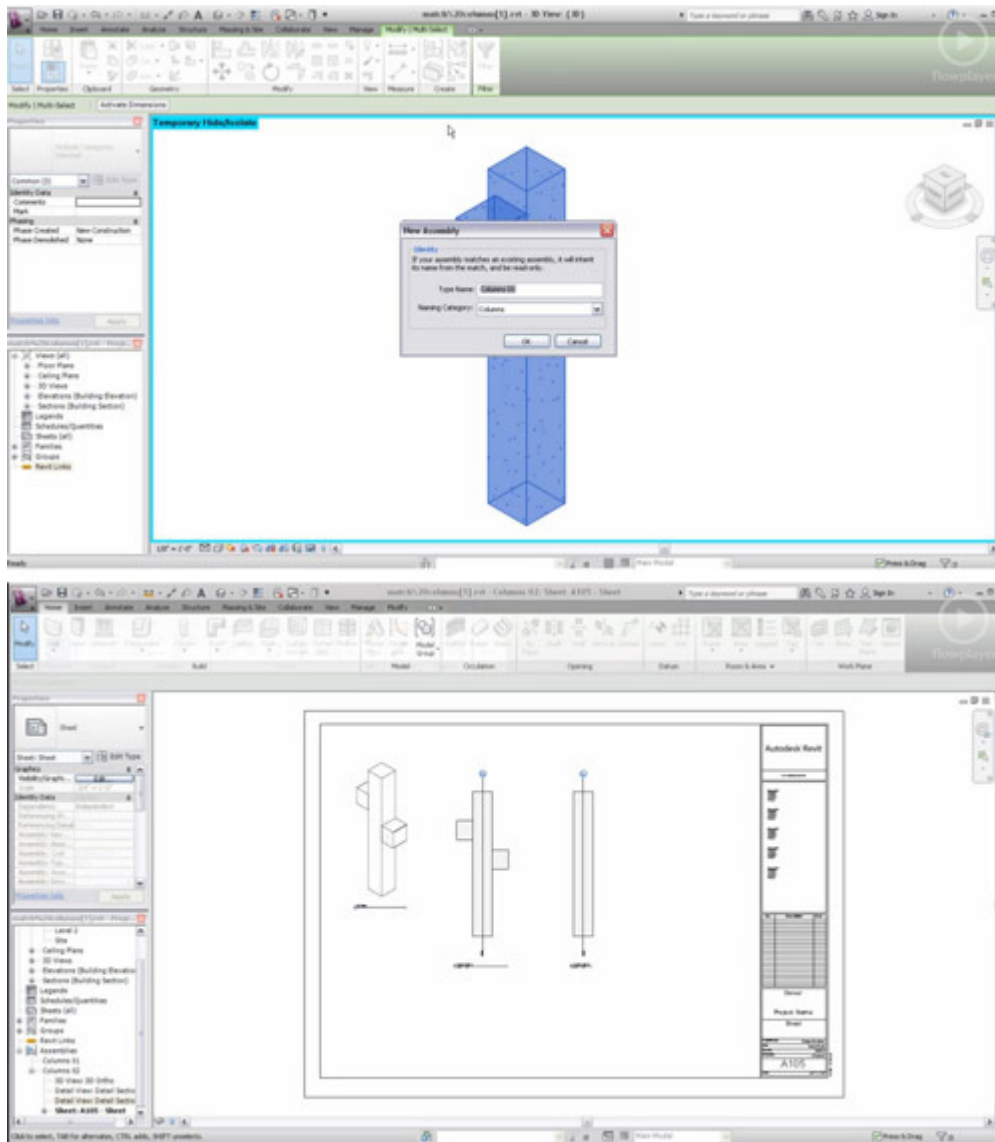
Figure 5. Using a grid as intersecting references to divide up a single floor slab into multiple parts. The part schedule for the subdivided slab is also shown.

The different parts can be made up of different materials from their parent element, if required. For example, you can have one slab with different floor finishes on different parts of it. For this, you would first break the slab into different parts based on its layers—assuming you have chosen a composite structure for the slab when it was created—and then subdivide the top layer of it, representing the finish layer, into multiple parts representing different finishes. Once the shape handles for the parts are turned on, you can graphically manipulate them independently of other parts.

The different parts that an element is subdivided into can be scheduled independently, as shown in Figure 5. Just as with elements, schedules of parts are also interactive, so any modification made to a part graphically will automatically update the schedule. The part information can be passed on to applications like Autodesk QTO for quantity takeoff and to Navisworks for construction scheduling and other construction related tasks. It should be noted that while these different parts can be scheduled differently for 4D construction sequencing, thereby enabling a more accurate construction schedule, they still belong to the same building element from a design standpoint.

Another new but related functionality is the ability to combine multiple elements into an assembly. The tool for this, Create Assembly, is also in the Create category of the Modify ribbon. In a way, it is the reverse of the Create Parts tool, where you are subdividing an element into parts. With the Create Assembly tool, you are grouping related elements into a larger assembly, typically for construction purposes. Examples include a complex column made up of multiple smaller elements (see Figure 6), a column with its associated rebar, etc. You can create an assembly by selecting multiple elements and providing the assembly with a name. You can then replicate the

assembly wherever required. If you select the same set of elements and try to create another assembly, you cannot, as Revit detects that you have already created an identical assembly. Needless to say, you can also add and remove elements from assemblies if required. You can use this new functionality to create assembly views that are different from detail views, and create separate sheets for assemblies with plans, sections, 3D views, and so on, as shown in Figure 6. The primary use case of this capability is to create shop drawings for construction, although many architects are also using it to show millwork assembly and so on. It should be noted that unlike Revit families that are accessible from all projects, assemblies are specific to the project in which they are created and are only available within it. Also, assembly views are separate and do not interfere with the main model views.



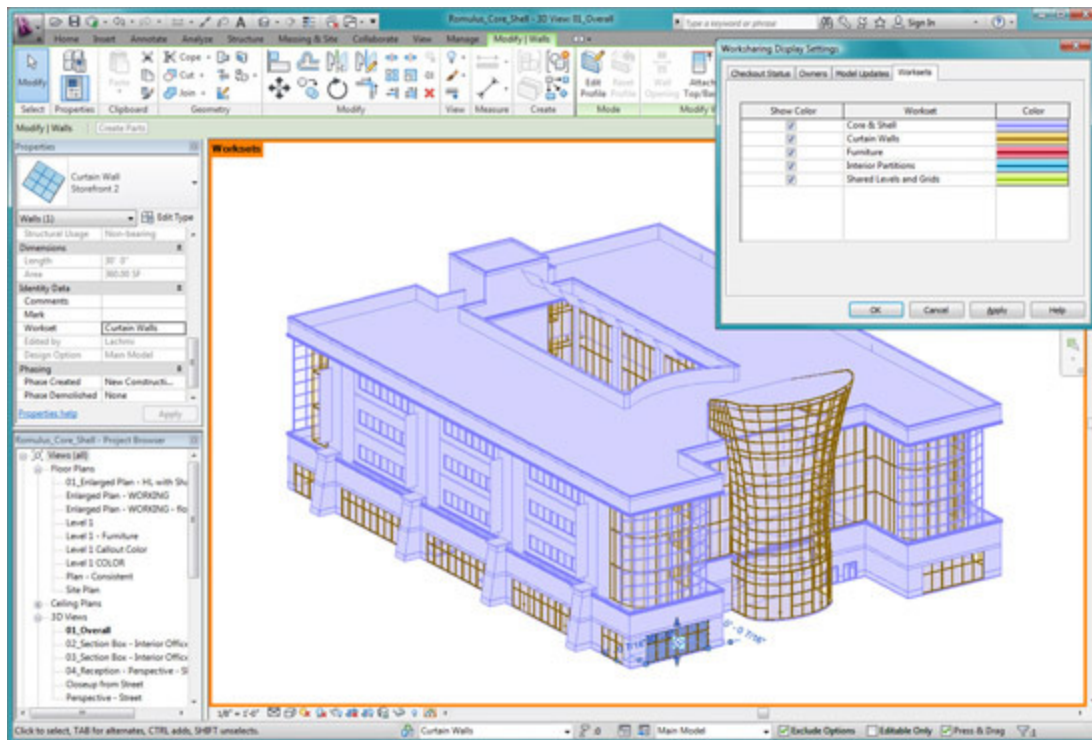
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Figure 6. Combining a set of multiple elements making up a column into an assembly and composing a sheet showing all the different assembly views.

Both these new capabilities for creating parts and assemblies are available in Revit Architecture 2012 as well as Revit Structure 2012, enabling design models to be used more easily by contractors instead of having to start over and create a construction model from scratch.

Collaboration Improvements: Worksharing and Vault Integration

Revit Architecture 2012 finally includes some major improvements to its worksharing module, the limitations of which were brought into sharper focus by the revamped Teamwork module that had been introduced in [ArchiCAD 13](#) close to two years ago with a color-coded workspace and a flexible element reservation system. Revit has also introduced color-coding to provide greater visibility into element ownership and status to better manage team workflows. When worksharing is enabled on a project, a new Worksharing Display Settings dialog is available, which allows different color settings for four different aspects of worksets, as shown in Figure 7: checkout status of elements, the specific owners of elements, elements that are out of date with the central model or have been deleted in the central model, and which elements are assigned to particular worksets. For example, activating the last Worksets option enables you to ensure that elements are brought created in the right workset, as they will be displayed in the colors assigned to the different worksets. Other worksharing improvements include balloon notifications that are displayed when editing requests are placed, granted, and denied—they also show the elements involved, enabling team communication to be faster and more efficient. There is a new option in the general Options dialog where you can specify the frequency of updates between the local copy and the central model. There is also the option to disable worksharing and detach the project from the central file, which could not be done directly in previous versions of Revit.



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Figure 7. One of the worksharing display enhancements in Revit 2012 allows you to see which elements belong to what workset. Here, the curtain walls are in a different workset and are therefore displayed in a different color from the other elements that are part of another workset.

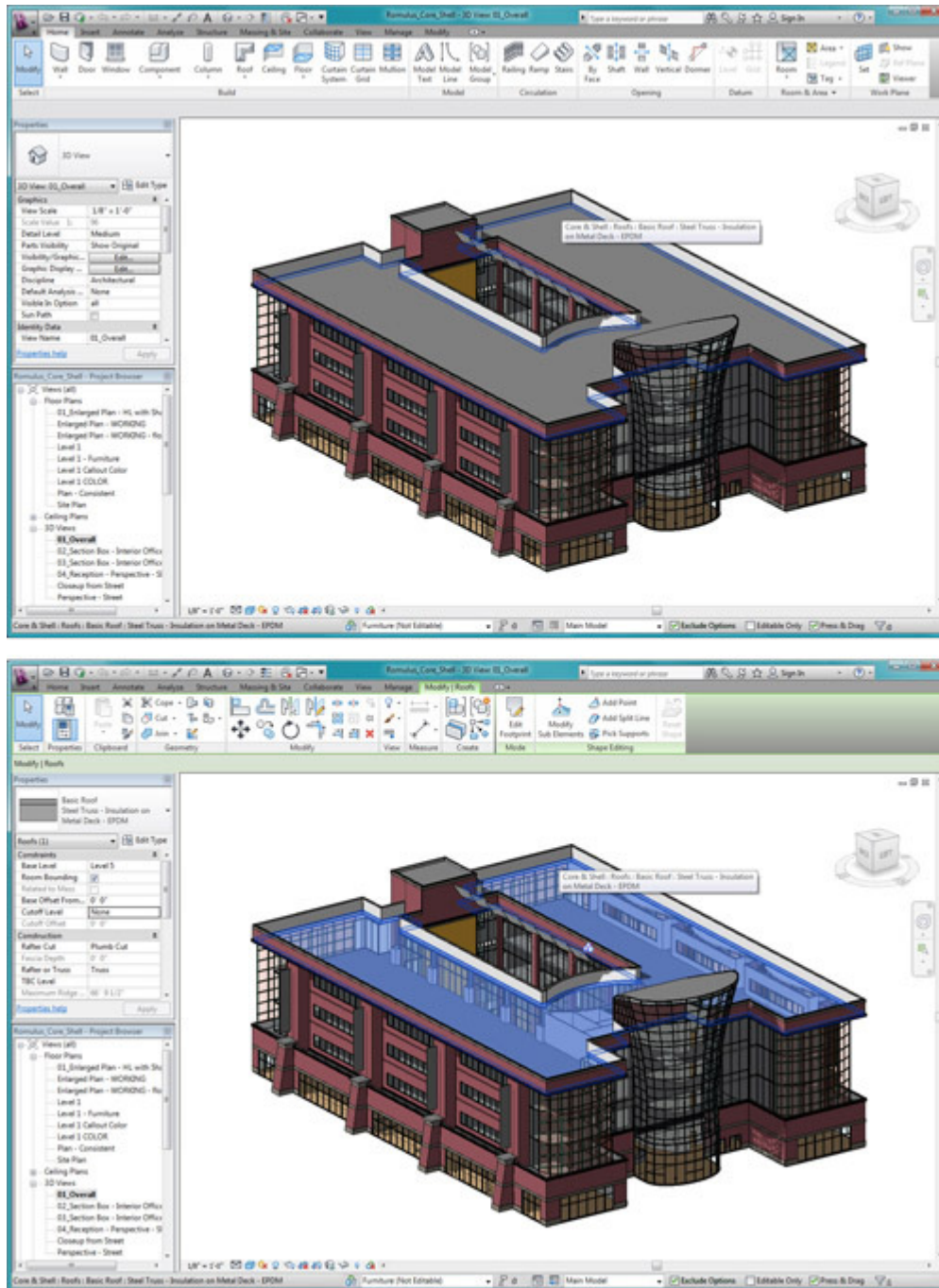
As mentioned in the article on [Autodesk's 2nd annual AEC Technology Day](#), Autodesk has also re-engineered its Vault application, traditionally used in MCAD, for AEC. It is part of a broader Autodesk initiative called BIM 360 to support collaboration and data management in AEC. The AEC-specific version of Vault integrates with popular Autodesk applications including Revit, Navisworks, AutoCAD, Civil 3D, as well as Buzzsaw, Autodesk's online project management and collaboration solution, allowing users and firms to better manage the large volume of data that is

generated on projects. The integration with Revit, for instance, allows Vault to manage all the linked models in a Revit project, providing functionality such as version control and project history. It can be used to manage Revit family files in addition to project files. If a Vault account has been set up, files can be checked in and out of Vault directly from Revit.

With the introduction of Revit Server and Vault, there are now three options for collaboration and project management in Revit. The first is file-based worksharing, which has been the only option available until six months ago and is still the most compelling option for small firms. The Revit Server option, where the central server sits in one location and local servers sit in other firm locations, will be attractive to medium and large firms. And finally, large firms can get additional benefits from the Vault offering, which can work with the Revit Server so that the files between them stay synchronized.

Visualization and Rendering Improvements

There are several visualization enhancements in Revit Architecture 2012 which can improve its on-screen display capabilities as well as the rendered images that can be created with the application. There is a new semi-transparent option for selection, which can be set in the Graphics tab of the Options dialog. It is a neat feature, as it helps to see the complete object that is being selected and also helps you to look through it at other parts of the model (see Figure 8). There are some new settings for the display of the entire model, which can be set in the Graphics Display Options dialog: the Realistic mode now includes the ability to show edges; the Consistent Colors mode includes the option to display shadows; and the Ghost Surfaces option, which displays all surfaces with a 30% transparency, is available for all the display styles. It is now possible to print displays that are set to the Ambient Occlusion mode.

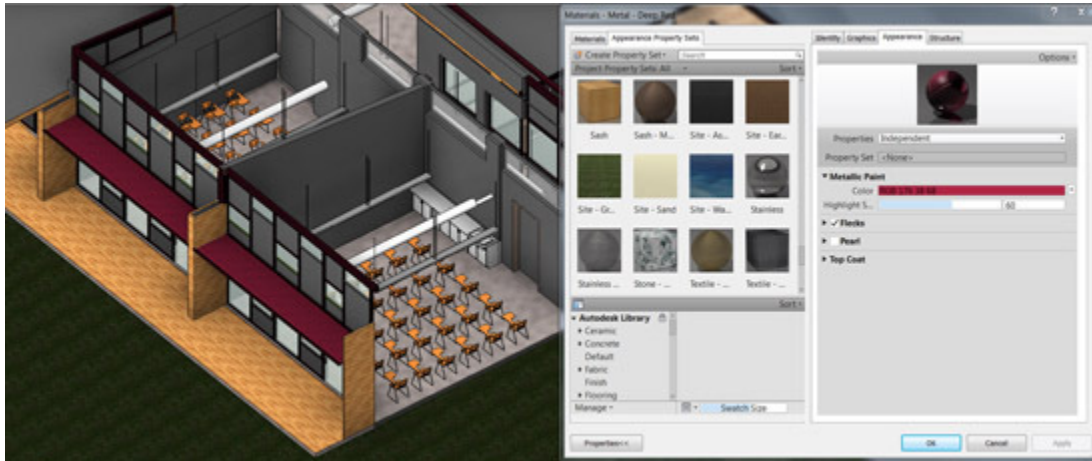


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Figure 8. Elements can now be displayed in a semi-transparent mode when selected, allowing users to see through them and have a better insight into the model.

The other visualization enhancements in Revit Architecture 2012 are related to materials. Recall that the Materials Library available in Revit is the same one that has been implemented across all the Autodesk applications, enabling better compatibility between, say, Revit Architecture and 3ds Max. While the materials themselves cannot be changed, it is possible to customize materials by applying different “property sets” to them, which can also be shared across different rendering applications. A separate tab in the Materials dialog is available to manage these Appearance Property Sets, as shown in Figure 9, allowing you to modify a property set, load a

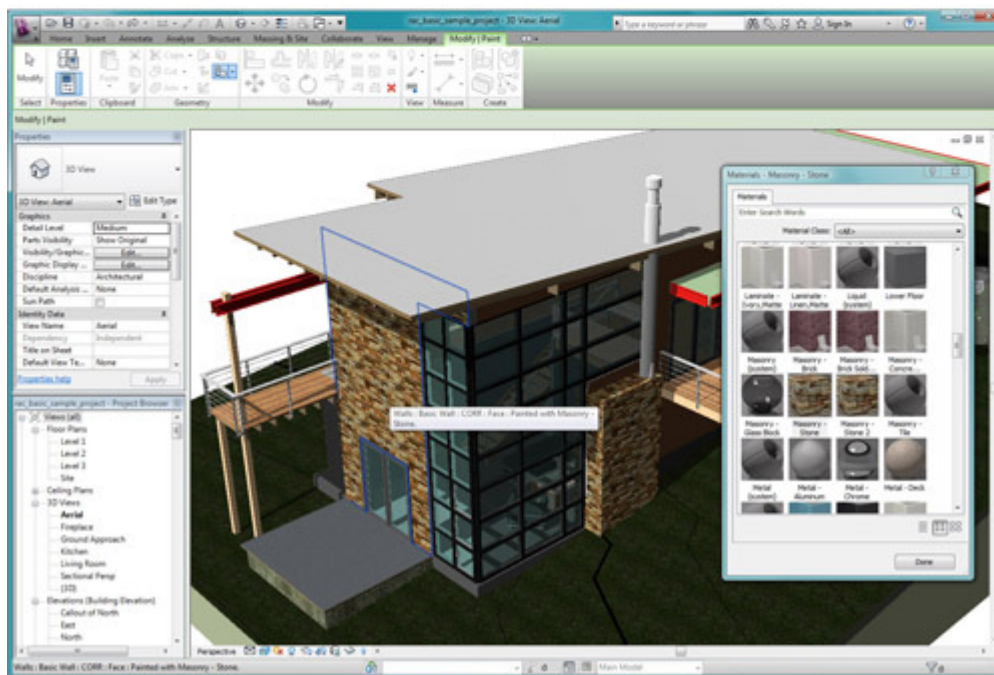
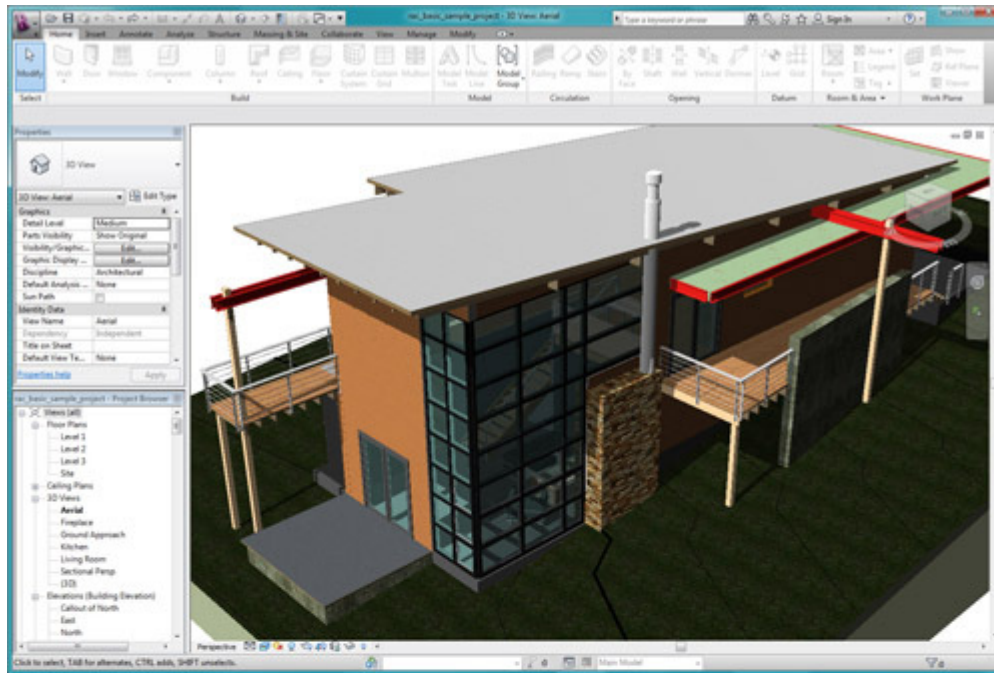
property set from a library, or delete all unused property sets and materials from a project.



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Figure 9. Managing the appearance of materials through property sets.

The Paint tool has also been enhanced. It now works in perspective view as well, which it did not do before. You can open the Materials Library and select a material from it to apply to a surface with the Paint tool; previously, you could only see the list of materials rather than the actual Materials Library, which made it difficult to choose materials unless you knew their exact name. There is now no need to select an edge first to use the Paint tool— you can apply it directly to a surface, as shown in Figure 10. It should be noted that there is a difference between applying the Paint tool to a surface and the underlying material of the element, which is part of the element type selected when it is created. The Paint tool simply applies a "coat" of another material on to a surface—it appears in the schedule as "paint" and is thus differentiated from the materials comprising building elements. There is also a new Remove Paint tool to remove a paint that is no longer needed.



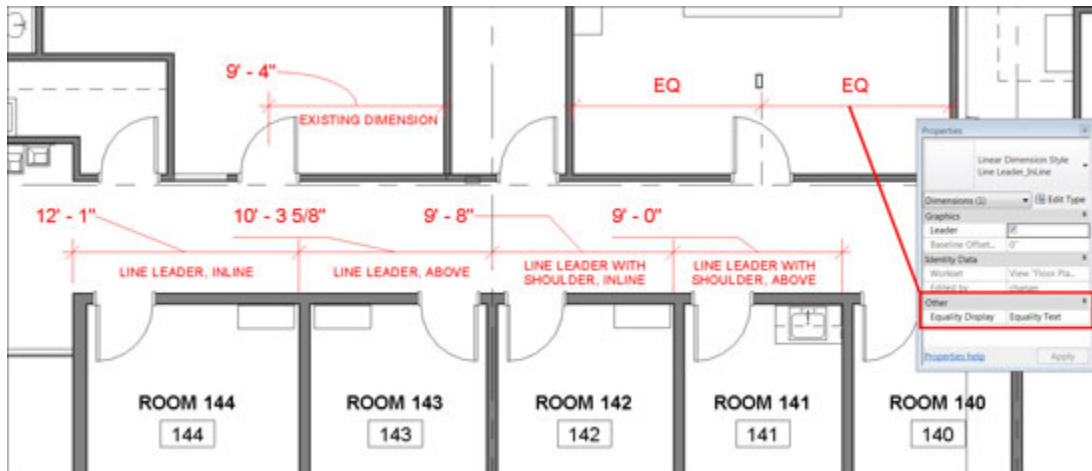
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Figure 10. Applying a masonry finish to a wall using the Paint tool. The original material is shown in the top image.

Other Enhancements

There are several additional enhancements in Revit Architecture 2012 in various aspects of the application, some of which have been made directly in response to customer requests. These include several enhancements to the Dimension tool that enable the appearance of leaders and text to be customized (see Figure 11). For example, when dimensions are pulled off of a

dimension line, the line leaders can be placed inline or above the text; they can also be displayed with a shoulder by specifying a shoulder length parameter. You can override the default EQ label for equal dimension segments and specify a custom global alternative as well as override an individual dimension segment value, which was previously not possible. These enhancements also better support the documentation needs of users around the world, as they may have different local standards they need to follow. Another enhancement that came from user requests is support for 3dconnexion's devices for 2D and 3D view navigation, enabling them to be used along with a traditional mouse simultaneously without interrupting the workflow.



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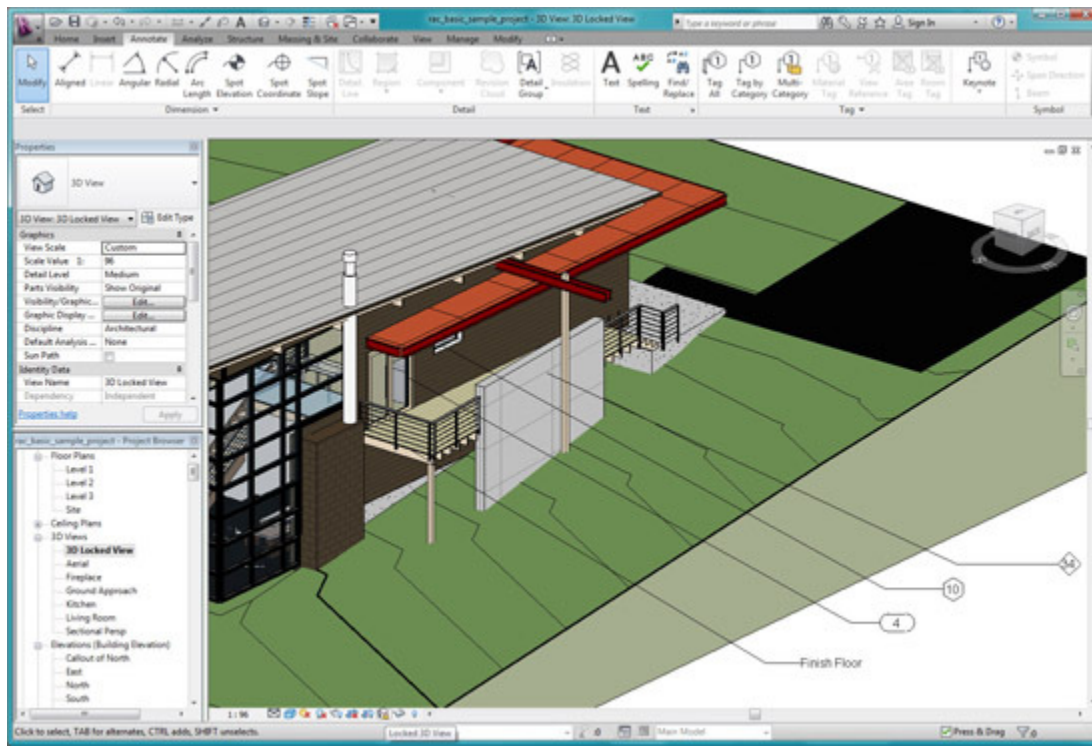
Figure 11. The different dimension enhancements made in Revit Architecture 2012.

The DWG export options from Revit have been significantly expanded. The Export dialog has eight different tabs, and it now supports different layer standards. You no longer have to go with the Revit defaults but can customize how the DWG file is exported. There are new options for mapping Revit categories and subcategories to layers in DWG files, providing more control over layer naming. In addition, you can also map Revit lines, patterns, and fonts to their DWG equivalents.

While Revit does not yet support full multi-processing like ArchiCAD, it is implementing multi-processing on a case-by-case basis, and every new release has additional operations that use multi-threading. In the 2012 release, loading elements into memory is now multithreaded, thereby helping to reduce view open times when elements are displayed for the first time in the session. Multithreading is also enabled for computation in perspective 3D views to make them faster, and for parallel silhouette computation that calculates in parallel the exterior outline of multiple objects seen from a particular viewpoint. Additional performance enhancements include more granular regenerations to avoid updating elements unaffected by editing changes, which helps reduce time significantly, and the ability to purge unused categories and object styles.

Some enhancements made to the user interface include the ability to lock a 3D view, which is helpful when you would like to annotate and tag elements in the view and retain it for better communication of design intent, as shown in Figure 12. When a view is locked, the View Cube is deactivated and the Orbit tool cannot be used. But you can still zoom in and out of the view. Many such locked views can be created, if required. The Type Selector has been improved to make access easier, enabling it to be used to change the type of an element even in Sketch mode, and being able to add it to the Modify ribbon. The Keyboard Shortcuts dialog has been enhanced to provide a faster and easier way to assign shortcuts to tools, including single key entry, warning on duplicate shortcut creation, and the ability to export all commands rather than just those to which shortcuts have been assigned. You can now open a file in the view that was last saved by simply specifying this option for the Starting View setting in the Options dialog. The Rotate tool has been revamped so that you can now redefine the rotate point rather than

navigating the view to find the default rotate point. For working with large files, Revit has improved the tagging capability across linked files that was introduced in the [2011 version](#). You can now tag many more elements including rooms, spaces, areas, keynotes, beams, and beam systems.



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Figure 12. Locking and annotating a 3D view.

And finally, the Help system has been completely overhauled in the new release with the introduction of the online Autodesk Wiki Help site, which contains help topics, videos, and tips. The Help button in the application directly takes you to this site by default if you are connected to the Internet; if you are not, it opens up a local Help file, ensuring that you still have access to product documentation. The advantage of the online Wiki Help is that it is not static but dynamic and can be constantly updated. Being a wiki—the best example of which is Wikipedia—it is open to contributions by users, which can lead to a richer learning resource, provided Autodesk monitors it carefully to make sure that the content posted by users is accurate and really adds value.

Analysis and Conclusions

Revit Architecture 2012 features a solid set of enhancements that will continue to strengthen its leading position as an architectural BIM application in the AEC industry. Unlike some of its past releases, the improvements this time are not focused on one or two main themes. (This is also the approach that has been adopted in the new release of ArchiCAD, as we will see in its upcoming review.) Instead, the improvements in Revit Architecture 2012 have been made across several aspects of the application, ensuring that most users will find at least something that will improve their efficiency and productivity. Autodesk does not score very high on originality here—Bentley has had the point cloud support for some years now, and its ProjectWise application that provides capabilities similar to Autodesk's new Vault offering also has been around for many years. Even the worksharing display enhancements in Revit shown in Figure 7 are similar to those ArchiCAD had implemented all the way back in its 2009 release. But from the Revit user's

perspective, it is great to finally have these capabilities in their application of choice—it probably does not matter that another BIM application had them first.

I do hope, though, that Autodesk can at least lead in the area of laser scanning for BIM, by developing automatic feature recognition of point clouds and eventually automatic conversion of the data captured by laser scanning devices into BIM models. This would be a huge time-saver to all those working on renovation and retrofit projects, which are, by Autodesk's own admission, becoming increasingly more common in the AEC industry. The ability to import point clouds in Revit and use them as a reference for modeling is a good start, but let's hope it leads to bigger and better things from the Revit development team.

One major development in Revit 2012 where Autodesk has shown itself to be a true leader is construction modeling. The ability to break up a construction element into parts in different ways as well as being able to bring together multiple parts in one assembly seems to be a capability that would be very helpful to contractors, enabling them to reuse the Revit models created by the architects rather than starting over to create construction models. I was impressed by how well this capability had been implemented in Revit and how easy it was to use. It remains to be seen how contractors take to it and whether they start using it to create virtual mockups and fabrication models, as described in the recent articles on the [AGC BIMForum event](#).

Revit continues to have the problem of large file sizes with the concomitant performance issues, and Autodesk seems to be relying more on computing developments such as 64-bit processors, multi-core processing, virtual computing, WAN acceleration, and so on to address it rather than undertaking any fundamental retooling of the application. I haven't heard many users complain of this issue lately, so perhaps it seems that firms have just become reconciled to it and are finding different ways of dealing with it. (For example, see the recent article, [STRATUS: A Private Cloud Server Technology for Revit](#).) Revit's conceptual modeling environment, while being extremely powerful, still lacks the intuitiveness of other popular conceptual design tools, and it could do with some improvements on this front. Also, while I found the new Wiki Help quite useful, it did take me a while to get the information I needed, and I missed having a set of good, solid manuals to refer to for help. I also missed not having a set of training files that used to be earlier installed by default; I wasn't even able to find a set to install with the new release online and had to rely on the sample files from earlier releases to test out different aspects of the application for this review. The concept of a wiki Help as a resource is a good one, but Autodesk should not be expecting users to contribute to it and thereby absolve itself of the responsibility of providing comprehensive documentation for its different applications.

In conclusion, Revit Architecture 2012 is a solid release featuring many substantial enhancements across several different aspects of the application, thereby giving its vast set of users at least something each of them will appreciate. The application continues to improve at a steady pace every year instead of featuring any dramatic overhauls, which, given its leading position in the industry, seems to be exactly what it needs.

About the Author

Lachmi Khemlani is founder and editor of AECbytes. She has a Ph.D. in Architecture from UC Berkeley, specializing in intelligent building modeling, and [consults](#) and writes on AEC technology. She can be reached at lachmi@aecbytes.com.

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