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Autodesk University 2011 Special Edition

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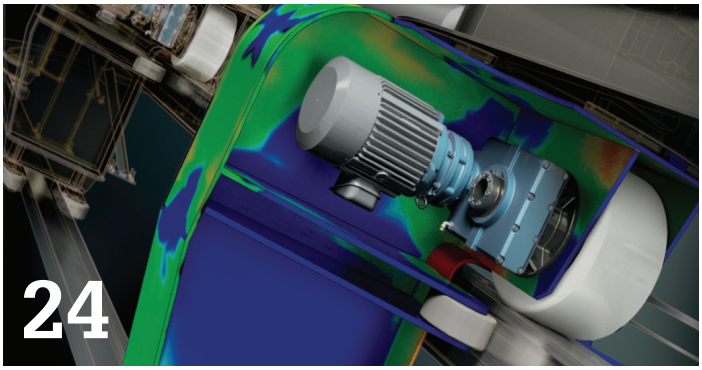

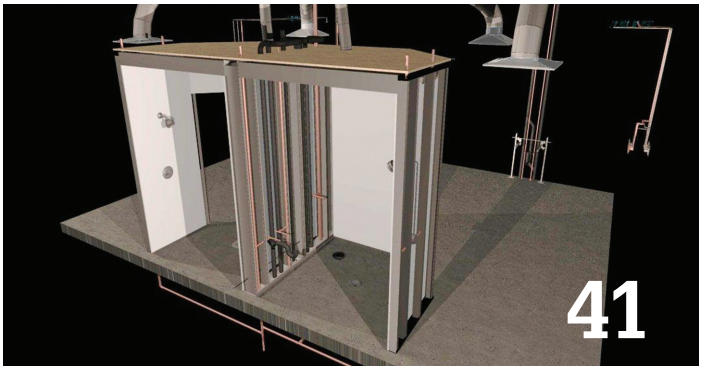

columns

AUGI

Welcome to AUGIWorld magazine!

We are very happy to present to you the best of the best for 2011. In reality, this isn't that inasmuch as a selection of very fine articles from a much larger pool of very fine articles published every month in *AUGIWorld* during 2011. Over at AUGI, our publications have gone through changes over the years. We began in September 2002, and amazingly so far we have published 60 issues of *AUGIWorld*! Now in 2009 we migrated to a digital format and added a new publication, *AUGI | AEC EDGE Magazine*. Then in Jan 2011 we merged that fine publication with *AUGIWorld* and transitioned to pumping out a magazine once a month.

The key to that was the introduction of specific Content Managers whom you see listed to the right. By their efforts, in specific industries and/or products, we get fresh content each and every issue. Some of our authors take on series of articles to cover the nitty-gritty aspects of Autodesk software. While other authors drop in for a single article on a passionate topic that has been driving them crazy. *AUGIWorld* provides a place, a very nice place I might add, to hone your writing skills and share your knowledge with the world wide AUGI audience.

Then around June 2011 the AUGI Board of Directors began to consider printing a hard copy version of *AUGIWorld* for the upcoming Autodesk University 2011. We had just distributed a limited print run of the "What's New in Autodesk 2012" April issue for the Revit Technology Conference 2011 North America and it was a huge success. In spite of the sustainability movement in our world now, people really do *like* paper – and so do we. So we began to plan for a print copy for AU2011, but what should we print? We had nearly settled on printing the Sep 2011 issue that contained the AUGI 2011 Salary Survey, but then thought about really using this opportunity to do something special.

Hence you have your hands the *AUGIWorld Autodesk University 2011 Special Edition*. It not only contains some of the best articles from 2011, many even regular subscribers probably missed, but it contains the "soul" of AUGI. *AUGIWorld* is a reflection of what AUGI is about. Members helping members and members communicating to Autodesk and even Autodesk communicating to members. I should also add our wonderful advertisers, without whom this special edition would not exist. They will be key to our future in a paper version.

So where do we go from here? Hopefully back to print! We hear our members; they want a paper magazine option so that is our next immediate goal – to figure out how to return to the paper medium. We will certainly keep the online digital edition and PDF downloads, but hopefully this time next year our *AUGIWorld* for AU will simply be our November 2012 issue in paper. This is a rare publication, a paper version of *AUGIWorld* exclusively for AU2011. It will take a little while to read through it and I know you will enjoy it!

Take care,

David Harrington

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AUGI

by: Elizabeth Shulok

Linking Revit Structure to Analysis Applications

More than a dozen analysis applications have bi-directional links to Autodesk® Revit® Structure. These links send structural analytical model data from Revit to the analysis application for structural analysis and often code checks as well. The analysis and design process often results in changes to the model, particularly member size changes, and the analysis links allow those changes to be brought back to Revit. We will look at the process of using a third-party analysis application to design a building modeled in Revit Structure.

The examples illustrated here will use SI Xchange v3.0 for Revit and STAAD.Pro, which will be released this summer. However, most of the issues covered below are applicable to any analysis link.

KNOW THE DIFFERENCES

Every 3D modeling program is different. Not only are the user interfaces different, but the way data is stored varies from program to program. In general, this is not an issue for the user. However, when interoperability comes into play, it is helpful to understand how your analysis application handles data in the model, including how it handles certain modeling conditions such as cantilevers or multistory columns. And it is essential to understand how your analysis link accounts for these types of differences between the two programs.

For example, because STAAD.Pro deals with a finite element model, beams and multistory columns must be discretized where other members frame into them. This is done automatically by SI Xchange so that one physical beam in Revit may correspond to multiple beam elements in STAAD.Pro. SI Xchange assigns a group in STAAD.Pro to the corresponding beam elements so they can be identified and assigned the same design and material properties.

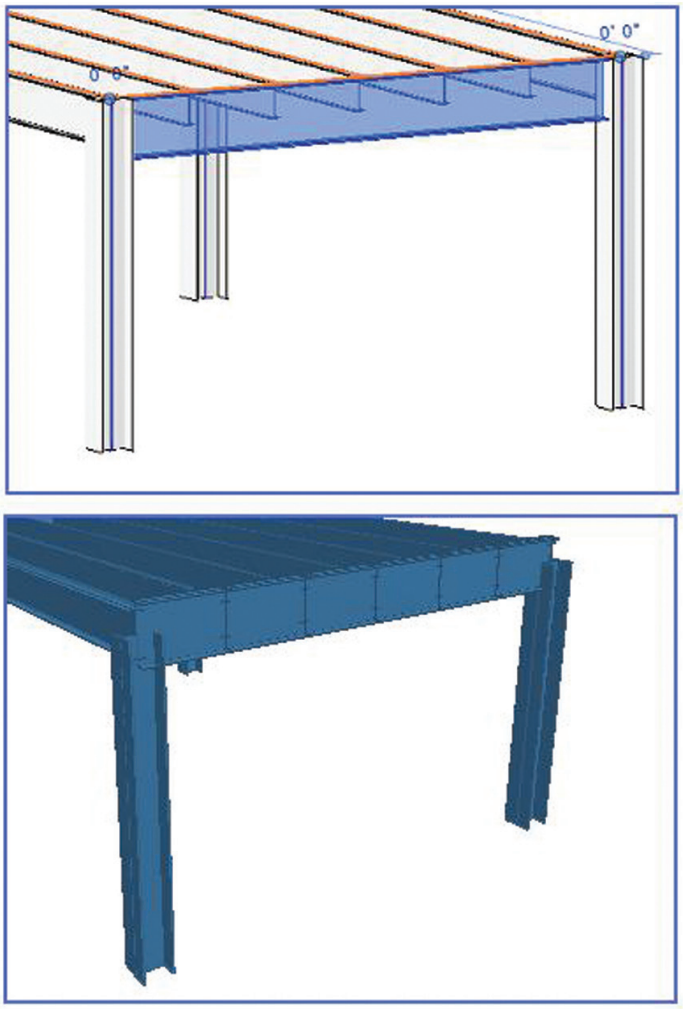

Figure 1: One beam in Revit (top) becomes multiple elements in STAAD (bottom).

Although SI Xchange assigns a group label to all of the elements corresponding to a single Revit member, the user is still able to assign different properties to each individual element inside STAAD.Pro. By understanding how SI Xchange handles this situation, the user can be careful not to assign different member sizes, materials, or rotations to elements belonging to a group generated by SI Xchange. When importing changes from STAAD.Pro, SI Xchange will check that the properties for all elements corresponding to one Revit member are identical and will issue a warning in the log file if any differences are found.

Another common difference between Revit and an analysis application is type or section property names. Although steel sections tend to have standardized names, they can differ between applications. Most analysis links provide some way to overcome these differences through customized settings. In many cases, differences in naming can be resolved automatically by the analysis link if given some additional information from the user, such as mapping of Revit families to a shape and member type.

In some cases, however, this is not possible—and a one-to-one mapping of type names is required. A case in point: STAAD.Pro does not use standardized section property names for all steel shapes. Single angle type L8x8x1in Revit Structure corresponds to L808016 in STAAD.Pro. To accommodate this, SI Xchange provides a text file that maps the STAAD.Pro names to the standardized names for each type.

Another example of an analysis link accounting for differences between model data is how the RAM Structural System link accommodates cantilever beams. In Revit, a cantilever beam is modeled as a separate beam, supported at only one end. In the RAM Structural System, a cantilever is specified as a length at the start or end of a beam, which projects out past the beam's support. To correctly export a cantilever to the RAM Structural System, the user must set the corresponding Start and End Connection properties for the corresponding beams in Revit to Cantilever Moment. On export to RAM, these beams will be merged into one cantilevered beam.

In an another example, RISA's documentation for the Revit 2011 link details how to model X-braces in Revit in order to achieve the correct geometry inside RISA for analysis and design.

CHECK THE SETTINGS

Correct program settings are essential to successful analysis integration. This includes settings in the analysis program and settings in the link itself.

As mentioned above, mapping of Revit type names to the names used by the analysis link is an important step. For standardized names, this can be done automatically; however, an analysis link typically needs some information to help with automatic mapping. In SI Xchange, Revit families are mapped to a shape, category, and material. The link then uses this information to find the correct section size in STAAD.Pro. Although SI Xchange comes preconfigured with mappings to common Imperial and Metric families, the Shape Map Editor allows the user to add any families not already included.

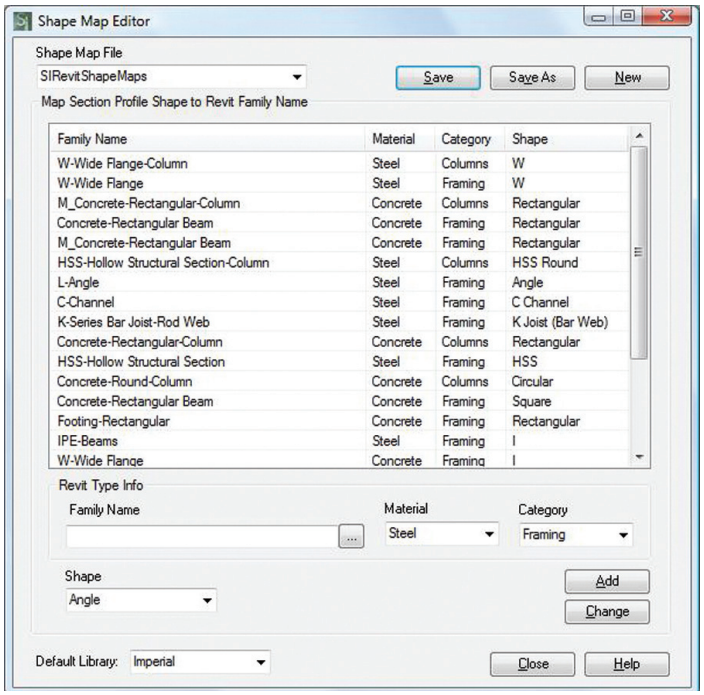

Figure 2: Shape Map Editor in SI Xchange.

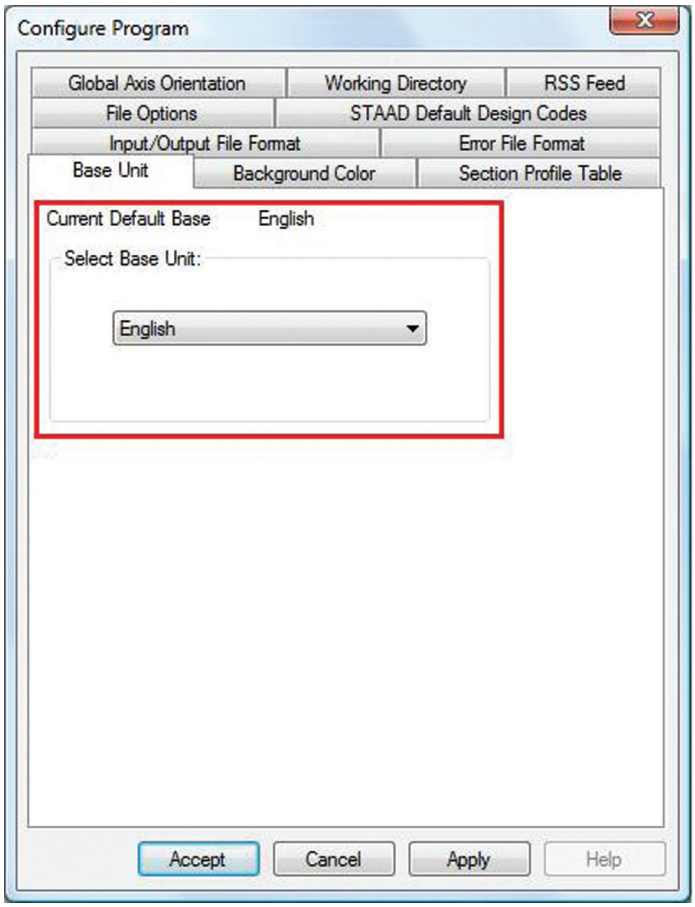

Figure 3: Set units in STAAD.Pro.

Another issue to consider is units. When exporting to STAAD.Pro, it is important to make sure your units are set correctly. Prior to export, be sure to set the Default Base Unit in the Configure Program dialog in STAAD.Pro to match the unit type in the Revit model, either English (Imperial) or Metric.

In the Export to STAAD.Pro dialog, you can also specify inches or feet for Imperial (English) units.

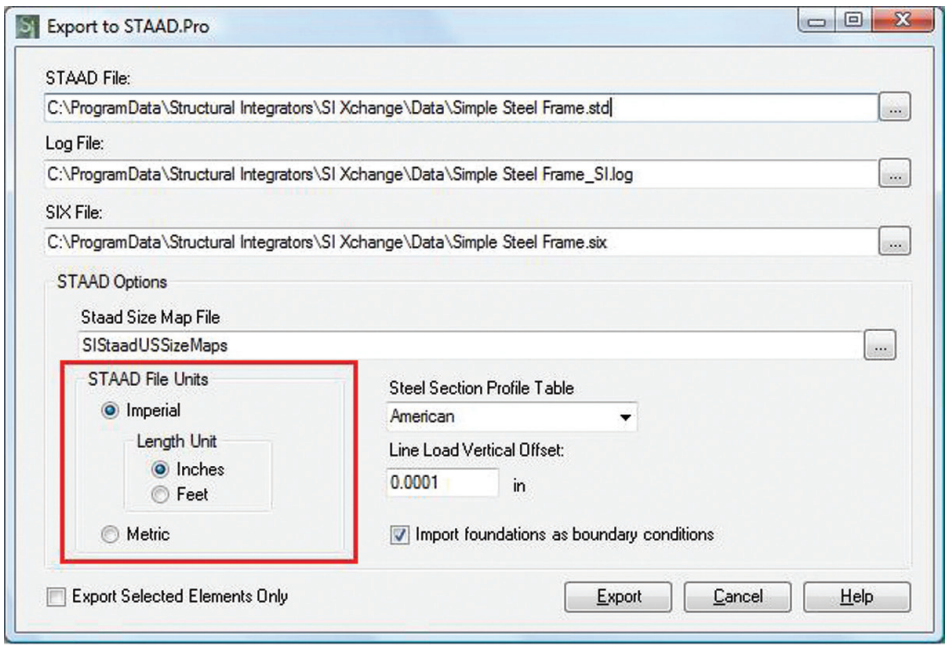

Figure 4: Specify unit type on export.

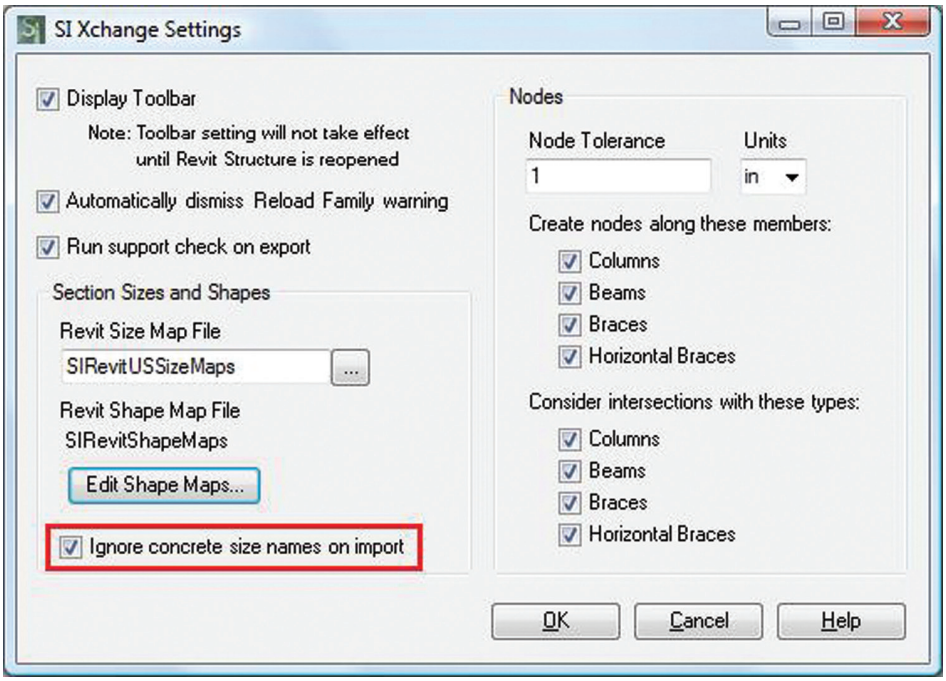

Figure 5: Ignore concrete size names on import.

Each analysis link has its own settings, specific to how that link and corresponding analysis application work. It is important to know what settings are available and how they will affect the outcome of the exchange.

KNOW THE LIMITATIONS

All analysis links to Revit Structure have some limitations. Some data may not be exported from Revit, or may be altered on export, either due to limitations in the link itself, or due to the inability of the analysis application to accommodate the data. For example, an analysis program that cannot handle curved beams may either ignore a curved beam or approximate the curve using a series of straight beams.

Limitations may affect the import of changes from the analysis program as well. One case that comes to mind is dealing with concrete sections from STAAD.Pro. STAAD.Pro does not allow user-assigned names for concrete sections, but instead generates a name based on the shape and dimensions. When importing changes from STAAD.Pro, names of concrete sections will not match the corresponding type names in Revit. For this reason, it is preferable to ignore the names and simply compare shape and dimensions so that the Revit type name is not changed to the STAAD.Pro name. The Settings for SI Xchange allows for this as shown in Figure 5.

It is important to read all of the documentation that accompanies an analysis link so that you understand any limitations and account for them as necessary.

EXPORT THE MODEL

Once you have accounted for any relevant limitations or differences between the Revit Structure model and your targeted analysis model, it is time to export the model. On export, most analysis links have one-time settings to consider. A common option in analysis links is to only export the selected elements from Revit. This is useful for excluding some portion of the model, or analyzing a single story.

When exporting from Revit using SI Xchange, you need to specify three file names. One name is for the STAAD file that will be generated, one is the log file, and one is an SI Xchange file. By default, names for these files are generated based on the Revit Structure project name. The SI Xchange file is an intermediate file that is used to map model data between STAAD.Pro and Revit

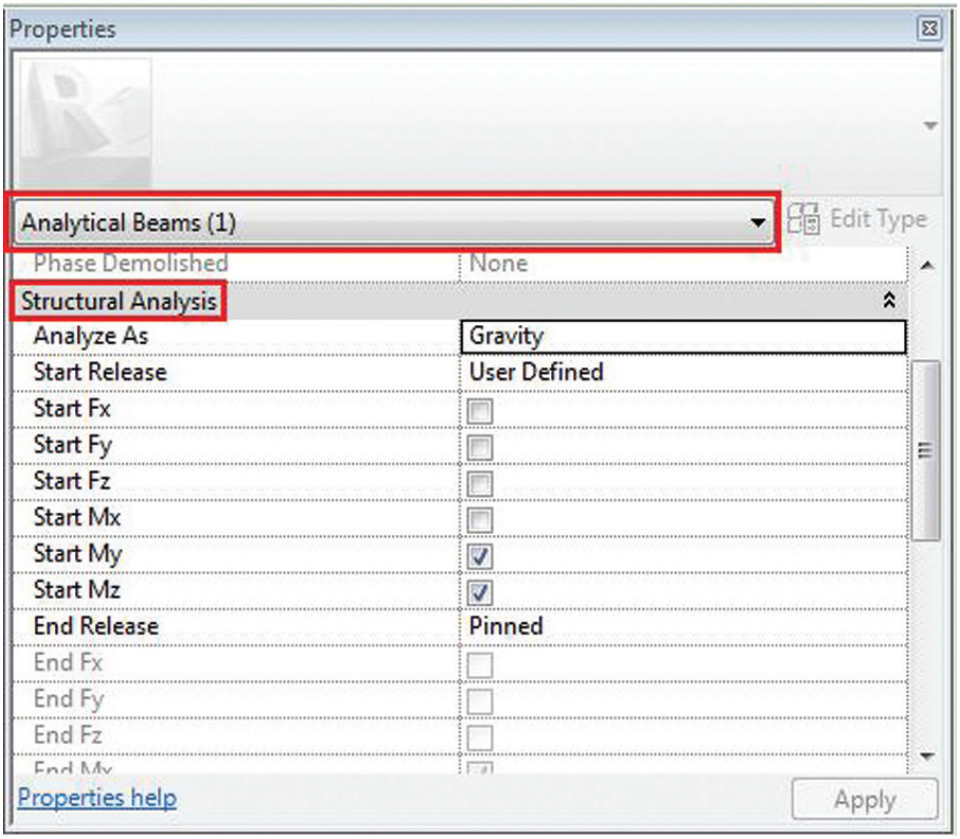

Figure 6: Structural Analysis Properties.

Structure to accommodate the two-way data exchange. This file is required when importing changes back to Revit. RISA uses a similar exchange file in their Revit link.

A useful option offered by most analysis links is the option to export to an existing file. This option updates the model with any changes from Revit, but will leave other data in the analysis model intact. This is useful if the Revit model has been updated after changes have been made in the analysis program to data, like analysis settings, that are not transferred from.

After exporting the model, be sure to look at any error, warning, or log messages generated by your analysis link. SI Xchange will generate a summary of the export indicating if any members failed to export, but you should always click the View Log File button to view a detailed export log to see if there were any issues on export. Sometimes a member will be exported to STAAD, but the type is missing because the corresponding member size was not found in the STAAD table. These types of warnings are only found in the log file.

Once the model is exported and any issues from the export are resolved, you can then analyze and design the model in the analysis application.

IMPORT CHANGES

After running through an analysis and design, the model may have many changes, most noticeably to sizes of members. These changes can be brought back to Revit in order to keep the Revit Structure model accurate. The analysis link may offer one-time options when importing changes. For example, there may be an option to delete members in Revit if they were deleted in the analysis application. Sometimes it is useful to have members deleted in Revit to keep the model in sync with the analysis model. Alternatively, members not necessary for analysis may have been deleted, but it may not be desirable to have the members deleted in Revit.

After importing, it is important once again to check any warning, error, or log messages to ensure all changes were imported back to Revit.

REVIEW THE MODEL

Once the model has been updated from the analysis link, you can review the changes in Revit. Member information such as type, rotation angle, and material can be viewed in the Properties palette, along with analytical results such as camber and stud information for beams.

In Revit Structure 2012, to view additional structural analysis properties you'll need to select the Analytical option in the drop-down Properties filter near the top of the Properties palette. This is where you can view the Start and End Releases for a member as well as other analytical properties.

The key to successful interoperability between Revit Structure and your analysis application is understanding the differences between the programs, knowing the limitations of the link, ensuring proper settings prior to export and import, and reviewing the results including any messages from the exchange process.

For more information on SI Xchange, please visit the product page at: www.structuralintegrators.com/products/si_xchange.php. For a comprehensive list of Autodesk Revit Structure Analysis and Design Links, visit: usa.autodesk.com/adsk/servlet/item?siteID=123112&id=14407681&linkID=9280963

Elizabeth Shulok is the founder of Structural Integrators, LLC, a software company based in Escondido, California, that provides integration tools for the structural engineering industry. As a software engineer, she has specialized in interoperability issues for over 12 years and has worked extensively with the Revit API for the last 7 years. She can be reached at Shulok@StructuralIntegrators.com.

by: Andra Marquardt

Speaking the Same Language

In an international world, where good communication is necessary, the ability of software to "speak" different languages—specifically to import and export multiple file formats—is crucial.

AutoCAD® Map handles this well. The software can import and export ArcGIS shape files and coverages, Microstation, and MapInfo, to name a few.

With more companies moving to GIS systems, it's imperative for companies to implement their own GIS, or at least create the ability to not only view but manipulate data provided by other companies or government agencies. Map is versatile enough to create and manipulate data based on a company's unique needs.

TYPICAL SCENARIO – USING CITY GIS SYSTEMS

The City of Bismarck in North Dakota has put together a robust GIS system of the entire city, including some parts of Burleigh County. Even better, all the data is made available to the public in ArcGIS shape files. They are organized first by data type such as land base (subdivisions, lots, blocks and address points), water, sanitary sewer, electrical, storm, topography, and image files. For private engineering and land survey firms, the data is not only useful, but saves a tremendous amount of research time (see Figure 1).

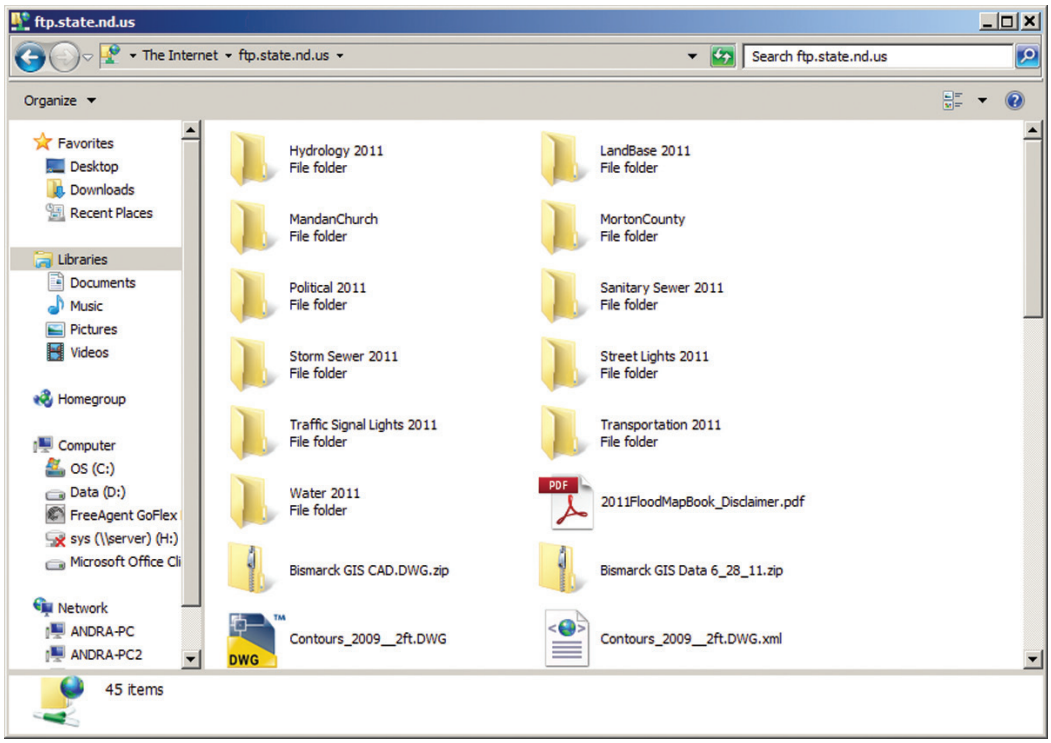

Figure 1: City of Bismarck's public GIS FTP site.

Once we decide what data we need, it's now a matter of deciding how to import it.

USING MAP IMPORT

The quickest way to import shape files is with Map Import (Insert Tab on the Ribbon > Map Import or type MAPIMPORT). Using this method, you can import multiple shape files at once. The benefit

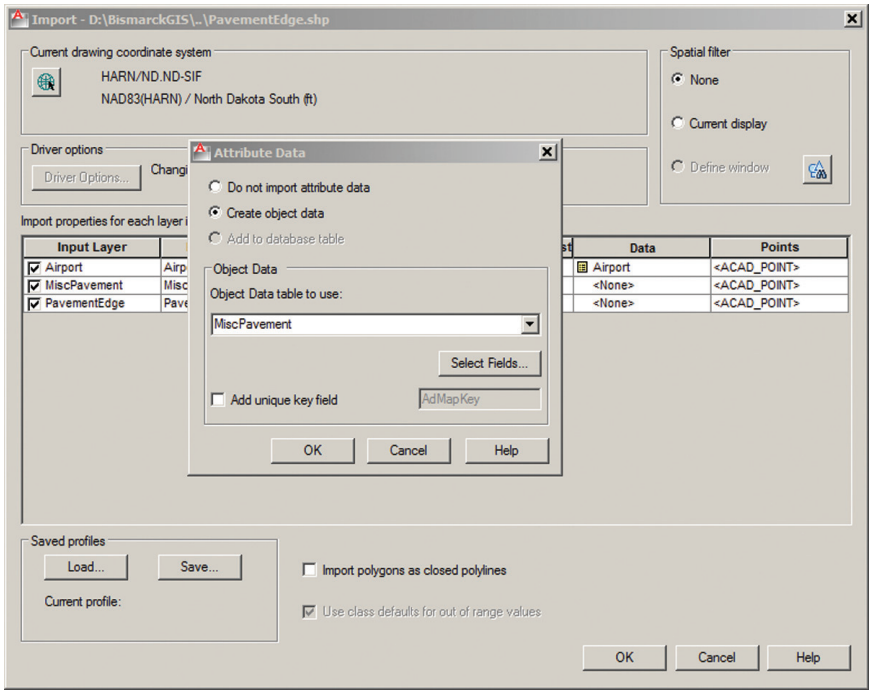

Figure 2: Using Map Import

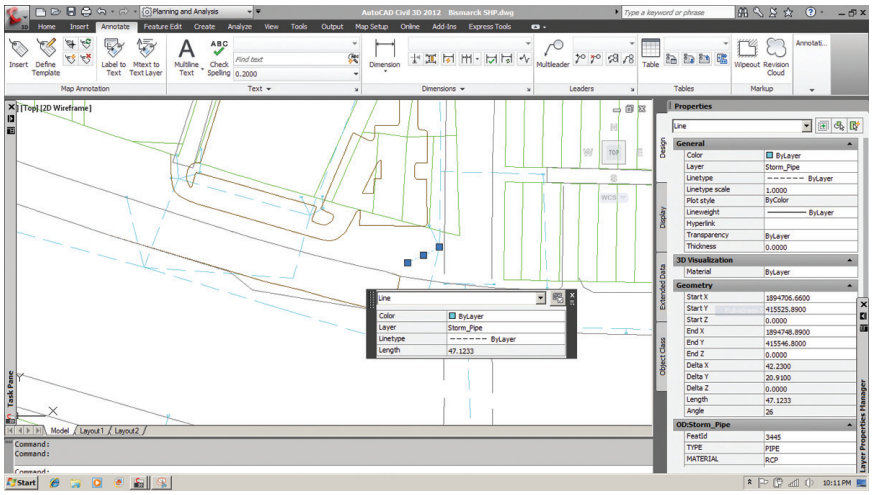

Figure 3: Viewing imported data

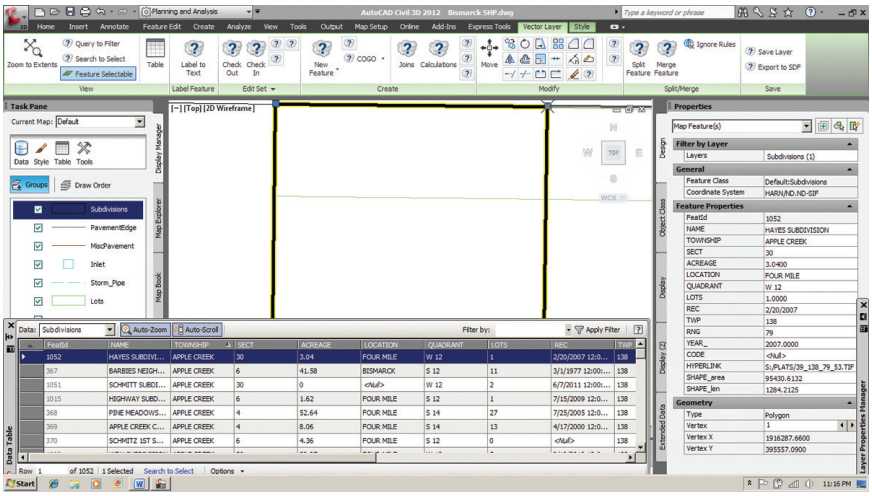

Figure 4: Using Data Tables

is time savings, because you're not importing data one type at a time. It's also useful for those who have AutoCAD® standard or AutoCAD® LT, and still need access to the linework of some data.

Another benefit to this method is the ability to determine how much data to bring in from the shape file (see Figure 2).

If you only want the linework, you can choose not to import any attribute data. Or you can choose the "Create object data" option. I usually choose this option, because as a surveyor and engineer, I'm equally interested in the data as well as its location.

The one downside to this method is you can't search for specific data such as a manhole type or subdivision. All you can do is pick it and view the data within Properties (see Figure 3).

Although the data is included in the AutoCAD entities, it is not linked to the original shape files. Therefore, any changes you make to the linework or properties will not be updated. This could be a good thing, because someone working in the AutoCAD file cannot inadvertently make changes or deletions to the original data.

USING DATA CONNECT

When it comes to being able to search data, especially within larger areas, using Data Connect is a better option.

Often we are hired to survey a specific lot in a subdivision, but sometimes we don't know exactly where it's located. For example, by bringing in the Subdivision and Lot shape files, I can bring up the data table (Task Pane > Right-Click on Feature > Show Data Table), and organize by column in ascending or descending order. I can also create a calculation or filter out specific data. Once I find what I'm looking for, all I need to do is double click on the gray box to the left of the table. Map will zoom in and highlight the feature I need (see Figure 4).

By using Data Connect, you can also modify or add any features, and the shape files will be updated. For instance, if we created a new subdivision within the City of Bismarck, instead of waiting for their GIS to be updated and uploaded to the FTP site, we can add it to our system.

EXPORTING DATA CONNECTED FEATURES

When working with shape files you might encounter a situation in which someone within your company or a different firm needs the same data, but has only AutoCAD. You could start another drawing and

Figure 5: Connected data

Figure 6: Exported drawing file

import using Map Import, but if there is a lot of data, that would take a considerable amount of time.

A better way is to Save Current Map to AutoCAD in the Output tab of the Ribbon (command MAPTOACAD). Note to AutoCAD® Civil 3D® users: Both the ribbon and typed command will give you an "Unknown command" error. Instead type MAPEXPORTCURRENTMAPTODWG. (How's that for a lengthy command?)

The drawing it creates now has all the linework, polygons, and symbols of the original drawing, but without the feature data (see Figures 5 and 6).

The difference is all the linework are polylines. Polygons, are closed polylines with hatches, and any symbols are basically exploded into their basic parts, such as lines and circles.

CREATING A SIMPLE GIS

My firm was recently hired by a small town about 30 miles outside of Bismarck to create a GIS system similar to Bismarck's. We showed them what Bismarck did with theirs, and they decided that's exactly what they wanted.

They also asked for our recommendation of software to view and manipulate the data once it was created. We went back and forth between AutoCAD Map and ArcGIS. Eventually we decided on ArcGIS, because it was designed for GIS, not drafting. AutoCAD Map would have too large of a learning curve for the city. However, we did decide to create their system using Map, because we were already familiar with the software. And with our experience using Bismarck's system, exporting out to shape files was fairly simple. The most time-consuming portion of building the system was compiling all the data and deciding what to include. Luckily we had surveyed most of the city and had all the data in an AutoCAD file using Civil 3D. From there it was a matter of creating Object Classes for each type of data such as storm sewer manholes and street lights.

Once we had all the data compiled into Map including Internet links to tax data and an Excel file of all parcel ownerships, all we have to do now is export ESRI Shape files using Map Export (under the Output Tab). Using ESRI's ArcGIS, all the city has to do is attach the shape files, create a link to the Excel file, and they are ready to roll.

There were other ways to create a system that would be more robust, secure, and efficient than shape files, but for a small city just starting out using GIS, it was the best option.

In the end it's about communicating data across a variety of software platforms made available to multiple companies and governmental agencies. Whether using AutoCAD, Microsoft Excel, or ESRI's ArcGIS, it is crucial that the software communicates as seamlessly as possible in today's information age. AutoCAD Map makes that happen.

Andra Marquardt is a Registered Land Surveyor in the State of North Dakota and has worked for Toman Engineering Company – a civil engineering firm – since 1997. She has used AutoCAD beginning with Version 9, and has been using the Map's GIS capabilities more extensively within the last year. If you'd like to write articles specific to Map, please email her at amarq013@yahoo.com

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Understanding the Customize User Interface (CUI)

Here's a guide to making the interface in AutoCAD Architecture uniquely yours

The Customize User Interface (CUI) in AutoCAD® Architecture allows you to tailor your drawing environment to suit your needs. Before you start customizing your own menus, toolbars, and workspaces, you should familiarize yourself with the customization environment. Open the Customize User Interface Editor by clicking the Manage tab of the ribbon, Customization panel, and then User Interface (see Figure 1). Once you have opened the Customize User Interface (CUI) Editor, you can view the contents of the loaded customization files by expanding the elements in the tree structure and viewing the properties of the elements by selecting them. You can also select the Transfer tab to see how to migrate or transfer customizations, and select the Customize tab to see how to create or modify user interface elements. Once you are familiar with the environment, you can start to take advantage of the capabilities of the tools.

Let's take a look at some of the great customizations that can be performed in the CUI in AutoCAD Architecture. Since there are so many possibilities, we will concentrate on workspaces, toolbars, and commands for the purposes of this article.

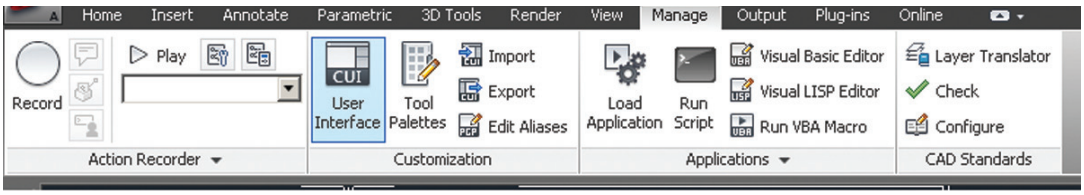


Figure 1: Customize User Interface

CUSTOMIZE WORKSPACES

The CUI Editor allows you to create or modify workspaces that have precise properties associated with the application and drawing windows, as well as user interface elements (toolbars, menus, ribbon tabs, and palettes). You can customize it by selecting a workspace from the Workspaces node in the Customizations In pane. The Workspace Contents and Properties panes will be displayed.

If you wish to create a new workspace, begin by clicking the Manage tab of the ribbon, Customization panel and then select User Interface. In the Customize User Interface Editor, Customize tab, in the Customizations In <file name> pane, right-click the Workspaces tree node and select New Workspace (see Figure 2). A new workspace (named Workspace1) is now placed at the bottom of the Workspaces tree node. Next, enter a new name over the default name Workspace1. In the Workspace Contents pane, click Customize Workspace (see Figure 3). In the Customizations In <file name> pane, click the plus sign (+) next to the tree nodes to expand them. Click the check box next to each user interface element that you want to add to the workspace. The selected user interface elements are added to the workspace. In the Workspace Contents pane, click Done and then click Apply.

The new workspace you have created can be set as the default workspace. To do this, click the Manage tab of the ribbon, Customization panel, and then select User Interface. In the Customize User Interface Editor, Customize tab, in the Customizations In <file name> pane, click the plus sign (+) next to Workspaces to expand it. Right-click the workspace you want to set as default and select Set Default then click Apply. It is important to note that in the Network Deployment Wizard, the main and enterprise CUIx files can be specified. If the main CUIx file has a default workspace set, that default workspace will be set as the current workspace when the file is loaded into AutoCAD Architecture for the first time.

If you wish to modify an existing workspace, you can do this by clicking the Customize Workspace button in the Workspace Contents pane. After you click Customize Workspace in

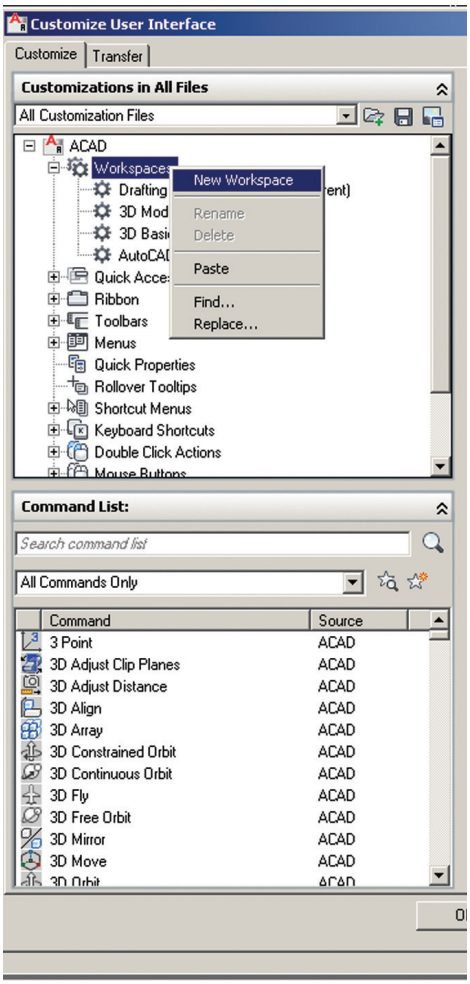


Figure 2: New Workspace

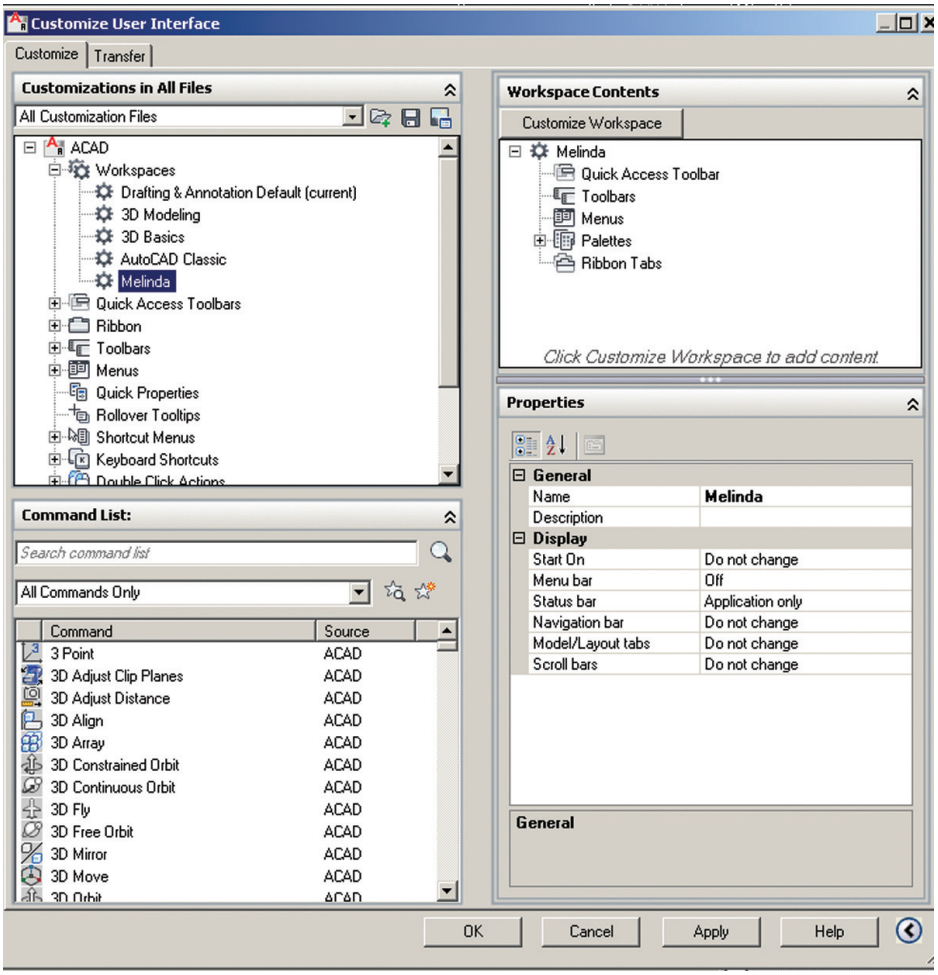


Figure 3: Customize Workspace

the Workspace Contents pane, the Customizations In <file name> pane lists the user interface elements that can be added to the workspace currently being modified. Check boxes are displayed next to each user interface element in the loaded CUIx files. You use the check boxes to add or remove user interface elements from a workspace.

You can use the Transfer tab of the Customize User Interface Editor to import a workspace to the main CUIx file. Workspaces that are in partially loaded CUIx files must be transferred to the main CUIx file if you want to set that workspace current. To import a workspace to a main CUIx file, begin by clicking the Manage tab of the ribbon, Customization panel, and then select User Interface. The Transfer tab is displayed, with the main CUIx file displayed in the Customizations In <file name> pane (left side). In the Customize User Interface Editor, Transfer tab, in the Customizations In <file name> pane (right side), select the Open Customization File button. In the Open dialog box, locate and select the customization file that contains the workspace you wish to add to the main CUIx file. In the Customizations In <file name> pane (right side), drag the workspace from the CUIx file to the Workspaces node of the main CUIx file in the Customizations In <file name> pane (left side) and click Apply.

CUSTOMIZING TOOLBARS

Simple toolbar customizations can make your daily drawing tasks much more efficient. For example, you can consolidate frequently used commands and controls onto one toolbar to give you a "one-stop-shop" for all your drawing needs. You can even create your own toolbars and flyout toolbars. You can also create a toolbar from scratch, create a copy of an existing toolbar or create a toolbar from an existing pull-down menu. Please note that sub-menu items are not included when a toolbar is created from a pull-down menu. By default, a new toolbar is displayed in all workspaces.

To create a new toolbar, begin by clicking the Manage tab of the ribbon, Customization panel, and then select User Interface. In the Customize User Interface Editor, Customize tab, right-click Toolbars in the Customizations In <file name> pane. Select New Toolbar (see Figure 4). A new toolbar (named Toolbar1) is placed at the bottom of the Toolbars tree. Next, right-click Toolbar1 and select Rename. Enter a new toolbar name. Now select the new toolbar in the tree view and update the Properties pane. In the Description box, enter a description for the toolbar. In the Default Display box, specify if the toolbar should be displayed by default when the CUIx file is loaded as a partial customization file. In the Orientation box, specify the orientation of the toolbar. In the Default X Location box, enter a number. In the Default Y Location box, enter a number. In the Rows box, enter

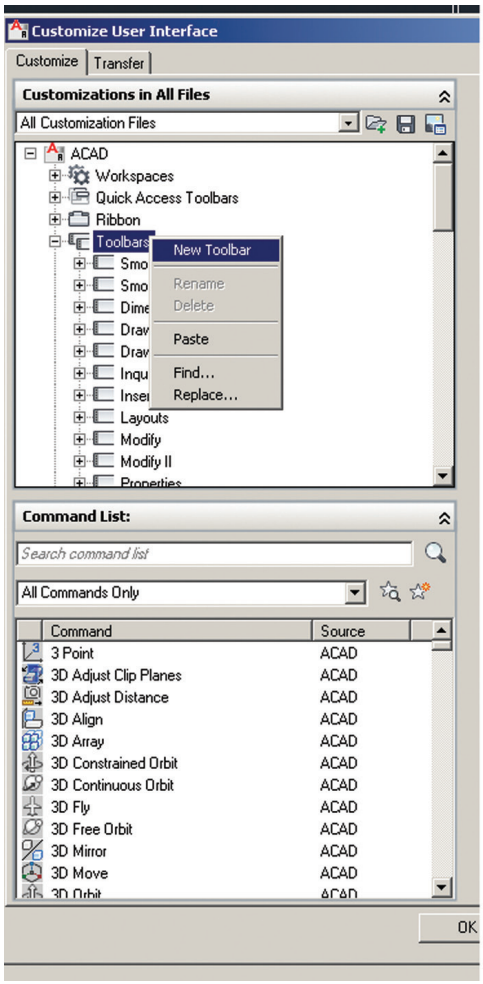


Figure 4: New toolbar

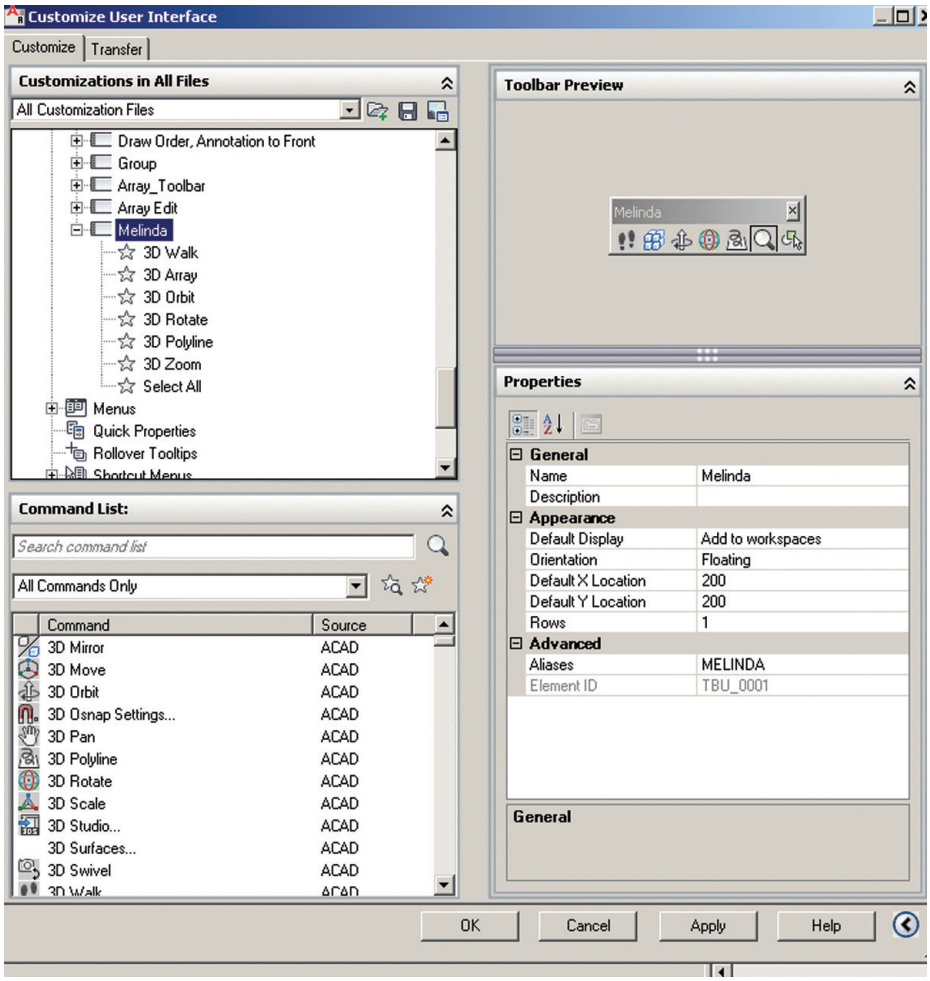


Figure 5: Customize toolbar

the number of rows for an undocked toolbar. In the Aliases box, enter an alias for the toolbar. In the Command List pane, drag the command you want to add to a location just below the name of the toolbar in the Customizations In <file name> pane. Select Apply (see Figure 5).

You can now customize your new toolbar using the Toolbar Preview pane. Begin by clicking the Manage tab of the ribbon, Customization panel, and then select User Interface. Now, select the new toolbar. In the Command List pane, drag the command you want to add to the toolbar and drop it on the toolbar's preview in the Toolbar Preview pane. You can control where the command is placed by releasing the mouse button when the black vertical splitter bar is displayed. Continue to do this until all commands you wish to add are on the toolbar and then select Apply.

AutoCAD Architecture allows you to customize toolbars that are displayed in the application when the CUI Editor is open. You can simply drag commands from the Command List pane and drop them directly onto a visible toolbar that is docked or floating in the application window. You can also reposition, remove, or copy commands on a visible toolbar while the CUI Editor is open. You can create new ribbon panels from a toolbar by dragging existing toolbars from the Toolbars node under the Customizations In <file name> pane to the Panels node under the ribbon in the Customizations In <file name> pane. You will be prompted to convert a copy of the toolbar to a ribbon panel when the toolbar is dropped.

CUSTOMIZING COMMANDS

You can easily create, edit, and reuse commands. The Customize tab of the CUI Editor allows you to add any command listed in the Command List pane to a toolbar or menu. You can create a new command from scratch, copy an existing command to create a new command, or edit the properties of an existing command within the CUI. When the properties of a command in the Command List pane are changed, the command is updated for all user interface elements that reference the command.

To create a new command in the CUI, begin by clicking the Manage tab of the ribbon, Customization panel, then User Interface. In the CUI Editor, Customize tab, Command List pane, select Create a New Command (see Figure 6). This will display a new command, named Command1, in both the Command List pane and the Properties pane. In the Properties pane, enter a name for the command in the Name box. It is important to note that the name is displayed as a tooltip or menu name when the command is added to a user interface element. In the Description box, enter a description for the command. The description will be displayed in a tooltip or on the status bar. In the Extended Help File box,

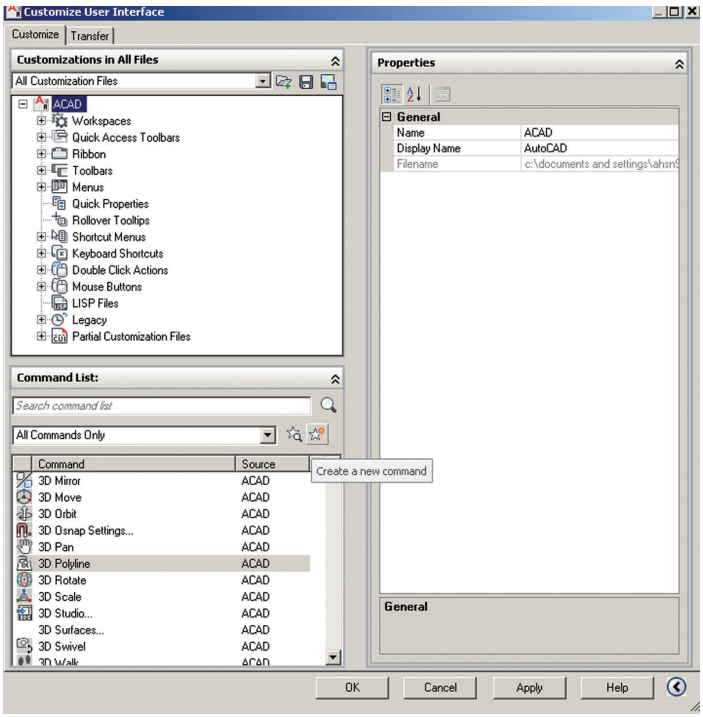


Figure 6: New command

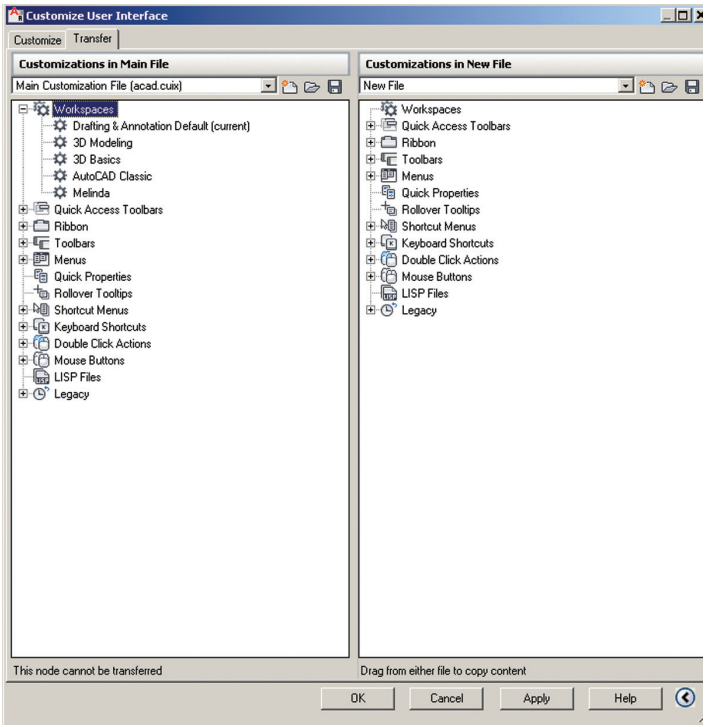


Figure 7: Transfer tab

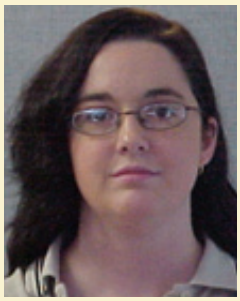
enter the name of the file and ID to use for the extended help for the command. In the Command Display Name box, enter the name of the command you want to display for the command. In the Macro box, enter a macro for the command. In the Tags box, enter the tags you want to use when searching for commands in the Search field of the application menu. In the Element ID box, enter an element ID for the command.

To edit a command, begin by clicking the Manage tab of the ribbon, Customization panel, and then select User Interface. In the Customize User Interface Editor, Customize tab, Command List pane, select the command you wish to edit. You can also select the command you wish to edit in the Customizations In <file name> pane tree view. In the Properties Pane, enter a name for the command in the Name box. In the Description box, enter a description for the command. In the Extended Help File box, enter the name of the file and ID to use for the extended help for the command. In the Command Display Name box, enter the name of the command you want to display for the command. In the Macro box, enter a macro for the command. In the Tags box, enter the tags you want to use when search for commands with the Search field of the application menu. In the Element ID box, enter an element ID for the command. Note that the element ID is for new commands only—you cannot modify the element ID of an existing command.

You can remove a command by right-clicking over the command and selecting remove; however, a command can only be removed when it is not being referenced by a user interface element, such as a toolbar or menu. It is extremely important to note that there is no way to undo the removal of a command from inside the CUI Editor. If you accidentally remove the wrong command, the best thing to do is click Cancel, but this will also undo any other changes that you might have made. If you already made several changes to the CUIx file and do not want to lose the changes that you already made, you can open the backup CUIx file that is automatically created after a change is made to a CUIx file from the Transfer tab (see Figure 7) and then proceed to recover the command that was accidentally removed. This applies to other user interface elements as well.

CONCLUSION

The Customize User Interface is a valuable tool in AutoCAD Architecture. This article only touches the surface of the vast possibilities offered by this tool. Try the customizations in the article and when you feel comfortable with these, try some more! AutoCAD Architecture's interface can quickly become everything you need it to be with a few simple customizations.



Melinda Heavrin is a CAD Coordinator & Facility Planner for Norton Healthcare in Louisville, Kentucky. She has been using AutoCAD Architecture since release 2000. Melinda can be reached for comments and questions at melinda.heavrin@nortonhealthcare.org.

1... 2... Civil 3D Implement

People often make AutoCAD® Civil 3D® implementation too big a deal. It isn't rocket science. Civil 3D is a software tool. It may be a big, new tool, so a bit of caution is probably in order. The fact of the matter is, we actually already know how to do it. We're engineers.

THE MISSION IMPOSSIBLE

"Houston. We have a problem." Barring a miracle, the astronauts on the Apollo 13 mission are dead already when they make this call. They don't know it. They can't see the problem—never mind get their hands on it to fix it. Their lifetimes of knowledge, training, and skill development are next to worthless.

The Successful Launch from 60+ Years ago

NASA has a BIGGER problem. NASA bet the store, the lives of national heroes, and the future of the world's foremost engineering organization to accomplish the mission. The three astronauts are lucky. They get home alive. The mission is not exactly a complete failure. Sound familiar?

Engineering organizations are risk-averse. We count every penny. We examine and avert every potential problem. Knowledge is power and more knowledge and experience will always help.

Engineers over-study problems for a living. We must use that wisely.

PEOPLE FIRST AND LAST

The most important thing to consider about AutoCAD Civil 3D implementation is your people. If you have not already tried to adopt Civil 3D by now, you have a people problem, not a software implementation problem. That's a brutal way to put it—maybe even unfair. But it's real.

NASA put teams of people to work on finding solutions to their life-and-death problem. Civil 3D implementation isn't a matter of life and death, but no one can argue with the productivity numbers and capabilities available. You just must learn to use the tool in a skillful way.

Actively engaged people who will work hard to retrain themselves are an adoption necessity. They need access to training resources. The basic resources are inexpensive and/or you already pay for them if you own the software.

Do all staff know and use your Autodesk Subscription benefits?

Where are the best and most informative Civil 3D sites and blogs

on the web? Who specializes in what? Why do they do that? How can these people and firms help us?

Expect to pay for more substantive help. Good news—these days it's a competitive marketplace. Help is always cheaper than trial and error.

EXPECT PROFESSIONAL

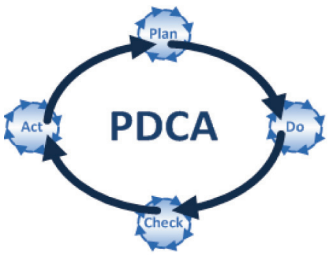
Engineering professionals are paid for the ability to apply working skills and experience to real-world problems. Continuing professional development is our personal responsibility. This is true for firm principals, project managers, and CADpilots. The position of CAD drafter went the way of blacksmiths the day that Civil 3D software arrived. This isn't fair. It is like gravity or the hard vacuum of space. Until the phone rings off the hook, we all have hard work to do.

THE ORGANIZATION GAME

Implementation is an organizational game. It is competitive. The larger the organization, the more competitive it should be. Implementation is managed change performed via process improvement to stated goals. It is not an event. This is business fact, not opinion.

Well-executed, the iterative engineering methodology responds to real-world project changes and differences better and faster. The method accepts the notion that a linear project timeline is human expectation and perception based. These must be proactively managed.

Model-based engineering design works based on these assumptions: A representative model of the engineered can be built, maintained, and tested. Acceptable deliverables that allow the engineered to be built can be produced from the model. Your people can do this under budget, on time. Lastly, by repetition you can get better at the process of doing all of that.



Implementation is iterative engineering process, too. It will follow the classic Plan|Do|Check|Act process loop. Skip steps in the repetitive PDCA loop and the process development only costs more and takes longer.

DIFFERENT BUSINESS PROBLEMS

Time matters in our project. Model-based design creates a major shift in project man-hour allotments to tasks. Man-hours shift forward into projects and are reduced in later stages. The tasks change significantly. Some cease to exist. Our known project completion metrics don't work either. Alarms will go off. Heads may roll.

Money matters. Financial, historical "truth" is a strong argument compared to an unseen potential. All adopters experience the crisis of project cost. *"Why are we doing this when we know we can do it the old way cheaper?"* This happens more than once. People assign actual training and process development costs to projects automatically.

Decision Frequency and Quantities matter. How fast can a senior designer make decisions? Four decisions a day become 16 or 20 or more. There is more information to process. It is expressed in new forms. Do and/or will they use the software to serve themselves?

Plan checkers may reject model publication because there is too much useful information on the sheet. *"Please show only the top of pipe."* This phenomenon also happened when paper became CAD. It's problematic when the boss is the checker.

Decisions take time. What does staff do while decisions are made? Do staff members offer options or wait for direction? How will you train staff to make more decisions and improve process? Are senior decision makers updated on evolving capabilities and limitations?

Data Scope matters. Is the survey dept now responsible to model the existing storm systems and produce surface models? Is their deliverable to design stylized drawings, images, and/or data, and in what forms?

WIDE AFFECTS

Model-based (data centric) design will and should affect everything sooner or later. Somehow you also have to figure out how to get paid for this while you do it. That's intimidating.

The jump to Civil 3D isn't a leap from a plane without a parachute. You are not sitting on top of a Saturn V rocket that has a blast radius that will kill spectators miles away. US presidents could not attend Apollo launches for that reason. They never knew.

Engineers keep secrets, minimize risks, and never let the competition know exactly how we succeed until it serves us. Engineers are people. We also love to talk shop about what we do, our tools, and work. We avidly reengineer the tools we use and how we do our work to make it better. Where does that conversation go on? Do you pay attention? External input pays.

You know how to implement Civil 3D. It's a project. A simple business engineering project aptly based on the engineering data you can massage in your sleep. We do need a project separate from our on-going work. Divide and conquer works.

PROJECT IT TO THE FUTURE

Civil 3D is specifically built to be model and data centric and not recreate CAD methodology. It is built to improve and optimize our design and quality control capabilities and reduce the annotative CAD work. The difference is good but bad.

Many experienced people have a personal issue with this. What we've done all day every day for years is create, edit, and manage CAD stuff. It's what we do—that for which we receive praise, pay, and value. If the CAD stuff goes away, our years of skill and experience appear useless.

Designers, project managers, and principals are no less aware. We all want Civil 3D to still be the CAD we know, only better. Engineers are smart people. The responsibilities, tasks, and rewards will get redistributed. To implement, we need to acknowledge the reality. Reward continuing, active, personal engagement and not passive, obstructive behavior.

NO MAJORS IN MINORS

Traction, Vectors, and Velocity matter. You cannot, or should not, remake Civil 3D and recreate exactly what you do today. Why not? If you focus on that, you will get exactly what you ask for. You will spend your time, attention, and human energy in the CAD weeds. Focus on the wrong details and you ignore the productive crop.

We must be practical and employ the new tool's built-in assumptions and advantages.

CIVIL 3D FEATURES MATTER MOST

Data centric and model-based means that Civil 3D features are more important than anything else. That's where the data is stored; the way it is displayed and published, and where and how we create and edit the data model.

Features matter most. Every feature is a collection of components (objects). Features can and do interact with one another in a dynamic model. Some key features are collectors and managers of the feature interactions. All the statements are true and inseparable in Civil 3D.

CAD layers are no longer the primary collector. Features are (usually) contained in drawings, But a Civil 3D project is not a collection of drawings like a CAD project. The Civil 3D project is more a collection of connected and/or disconnected features. This current "state" we call the "dynamic model."

The critical path task of Civil 3D project management is then about managing these critical features and their interaction. At this point in time, the feature interaction occurs inside drawings and/or within one of the "collector" features in a drawing. Users do this work. A "managed" dynamic model is the real-world deal. Doing that depends on people understanding and always doing that work first.

Our implementation project has a feature centric structure and the structure must adapt to dynamic model changes. It must contain and track data going in and published feature data coming out. To test we need known feature data to test our tools and processes to our final delivery endpoints.

IDENTIFY AND TRACK FEATURE LIMITATIONS

All development is a work in progress. The features are not perfect. Feature capabilities and limitations must be assessed. Are you learning the known feature limitations that may affect your work? Are you searching out a work-around before the limitation becomes a crisis? Do you reassess? Have CAD-based expectations generated false limitations? Assumption happens to expert and novice alike.

Due to the object-oriented methodology by which Civil 3D is developed and maintained, our access to the features and our ability to affect them is consistent. Features do change, but how a feature works and how we can get at it cannot be significantly changed without undermining the previous work. You can bet that happens rarely. Programmers are people, too.

FEATURES ARE NOT PEOPLE

You can love or hate them, but features are not people. Features don't care if they are understood. They don't mind being objectified.

Feature fundamentals are in the project's critical path. Assign the learning and delivery task to different feature mission specialists. Civil 3D training includes the care and feeding of each feature. Almost all features have properties that can only be set on creation and every feature has properties that can be changed later. The subtle and identifiable differences are important.

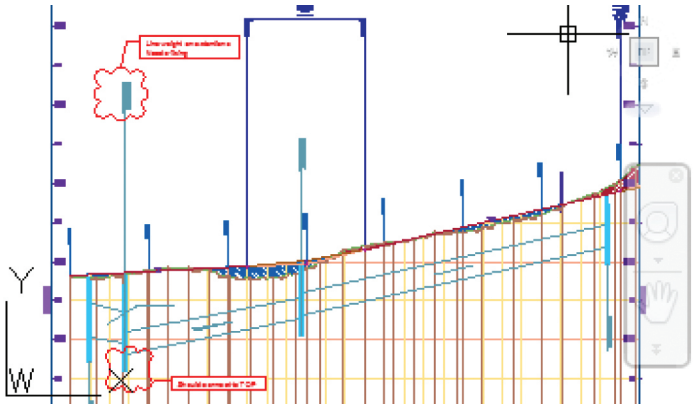
LOOKS DON'T MATTER TO FEATURES

All Civil 3D feature representations and the annotations are "abstracted" to named style references. What features look like are sets of properties collected separately and independently. There are features that don't separate perfectly because they are representative features anyway. We hear the words but we may misinterpret what this means to our implementation project strategy and tactics.

Our CAD perception of style and our immediate intent is to turn style into what I want. *Isn't that what style is there for?* Yes and No. Features don't care about AutoCAD stuff like layers, colors, and specifically how the features and their annotations appear. You care, but they don't. Used wisely, our applied AutoCAD skill can pay off here.

THE POWER OF NAMES

The feature style separation says we can redefine the displayed specifics (what it looks like, where the CAD stuff is assigned, etc.) anytime we want, if—and only if—we are very careful about the names we use. The name is far more important than what it looks like or where the CAD stuff goes now.



Design Review at use in the style markup process

FEATURE SEPARATIONS

Our projects must store features separately from applied style definitions whenever possible. This is especially critical for quality controlled (done) features that are referenced throughout a working project. Preserve and protect the feature data first.

We must usually separate both features to be published and their companion and dependent publishing features from our existing

and design features, too.

Our project has create and edit drawings (model drawings), reference drawings, collector drawings, and multiple forms of publish drawings.

How many Civil 3D templates do we need? One template will never work. How many styles and sets do we need? In practice this is potentially a staggering and overwhelming number. You don't need all of them all at once. Process first.

THE IMPLEMENTATION PROJECT DEFINITION

All the pieces of our implementation project are built into Civil 3D by the software's own scope definition. They ship with it. The examples may be inadequate or bad from our perspective, but the parts and pieces are all there. Be wary of adding more. KISS.

The Civil 3D Project Template – this is the core working project structure, the container for your approved in-use resources, your backup and archival strategy, and ultimately your delivery method to the troops. It represents the current "approved" snapshot of our on-going implementation project. All the rest is in here.

The Sheet Set Template and Sheet Templates – these define the published model output in Civil 3D. There is a folder structure, naming conventions, standard resources, and methods to hold that buried in here. If the daily project quality control and check loops do not happen here, plans become the crisis.

Civil 3D Model templates – these contain the styles and set tools we need to create, edit, maintain, and publish the model features. The Civil 3D template is the Holy Grail of implementation. The good news? You can now avoid that work as much as possible.

Engineers are smart people. Don't reinvent the wheel. Build on known standards of your choosing. Build on the work of others. Go find that. You know more about what to look for and how to judge it. It is out there.

"We have liftoff…"

Tench Tilghman writes the Get the Jump on Civil 3D blog. He is President of MoreCompetency, Inc., an Autodesk Developer Partner, specializing in innovative Civil 3D adoption products and consulting services. He is a regular speaker at Autodesk University and AEC industry events on the topics of technology adoption, innovation, and (his personal favorite) people skills.

HEADS UP!

Updates, Service Packs and Top Known Issues obtained from product pages at Autodesk.com

AUTOCAD/ACA/AMEP

(2011-Aug-03) Understanding Previous Version support for Autodesk Point products

(2011-Aug-03) Understanding Previous Version support for Autodesk Suite products

(2011-Aug-09) Understanding Cascade Licensing for Autodesk Products

(2011-Aug-12) Building Design Suite Premium/Ultimate 2012 doesn't license AutoCAD 2012

(2011-Aug-16) How is AutoCAD for Mac different from AutoCAD?

(2011-Aug-16) System Requirements for AutoCAD for Mac

(2011-Aug-16) Support for AutoCAD and AutoCAD LT on Apple computers

(2011-Aug-26) AutoCAD Plant 3D 2012 Object Enablers

(2011-Aug-30) AutoCAD Architecture 2012 & AutoCAD MEP 2012 Localization Hotfix: Corner Windows

(2011-Aug-31) Citrix Installation and User Configuration for AutoCAD Plant 3D and AutoCAD P&ID

REVIT ARCHITECTURE/MEP/STRUCTURE

(2011-Aug-10) Revit 2011 or 2012 products crash when attempting to replace material render appearance

AUTODESK INVENTOR/FUSION/SIMULATION/ALIAS

(2011-Aug-31) Autodesk Inventor 2012 Service Pack 1

(2011-Sept-01) LiveUpdate fails to apply service pack on Inventor 2012 or Inventor LT 2012

(2011-Sept-01) Error 1402 installing the SP1 for Inventor 2012 on XP 32 bit machine

FUSION

(2011-Aug-18) Autodesk Inventor Fusion Technology 2012 Service Pack 1

(2011-Sept-01) Autodesk Inventor Publisher 2012 Service Pack 2

SIMULATION

(2011-Aug-02) Error Message – Connection and Communication Errors

(2011-Aug-02) Autodesk Simulation CFD 2012 DVD Insert

(2011-Aug-08) Motion: Total Torque appears to lag behind Hydraulic Torque in an Angular Motion Simulation

(2011-Aug-08) Error Message – Errors when launching from Pro/Engineer or CATIA v5

(2011-Aug-08) Mesh – Analysis Types that cannot be Continued from a Saved Iteration after a Re-Mesh

(2011-Aug-08) Messing Error – Model or Geometric Query Failure

(2011-Aug-08) Heat Transfer: Transient heat transfer converges to a different temperature field than steady-state

(2011-Aug-08) Error Message – Dissimilar Contacting Fluids Detected

(2011-Aug-12) Error Message – Unable to write Signal File

(2011-Aug-15) Resolving unexpected flow near distributed resistance regions

(2011-Aug-15) Alternative Meshing Strategy when Transferring Results to FEA

(2011-Aug-15) Log and Output Files for Troubleshooting

(2011-Aug-17) Turbulence terms change during thermal-only stage of de-coupled simulation

(2011-Aug-17) Reducing localized velocity flow instability

ALIAS

(2011-Aug-02) Alias 2012 SP1

3DS MAX/MAYA/SHOWCASE

(2011-Aug-12) Composite 2012 Hotfix

(2011-Aug-22) Hotfix – Discrepancy and high density tessellation noticed using Showcase 2012 with imported JT Models

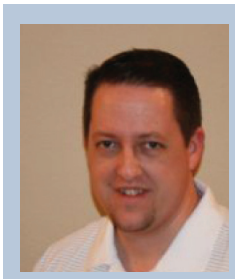
MULTIPLE AUTODESK PRODUCTS

(2011-Aug-01) 2012: FLEXnet feature codes for Autodesk products

(2011-Aug-01) 2012: FLEXnet feature codes for Autodesk products

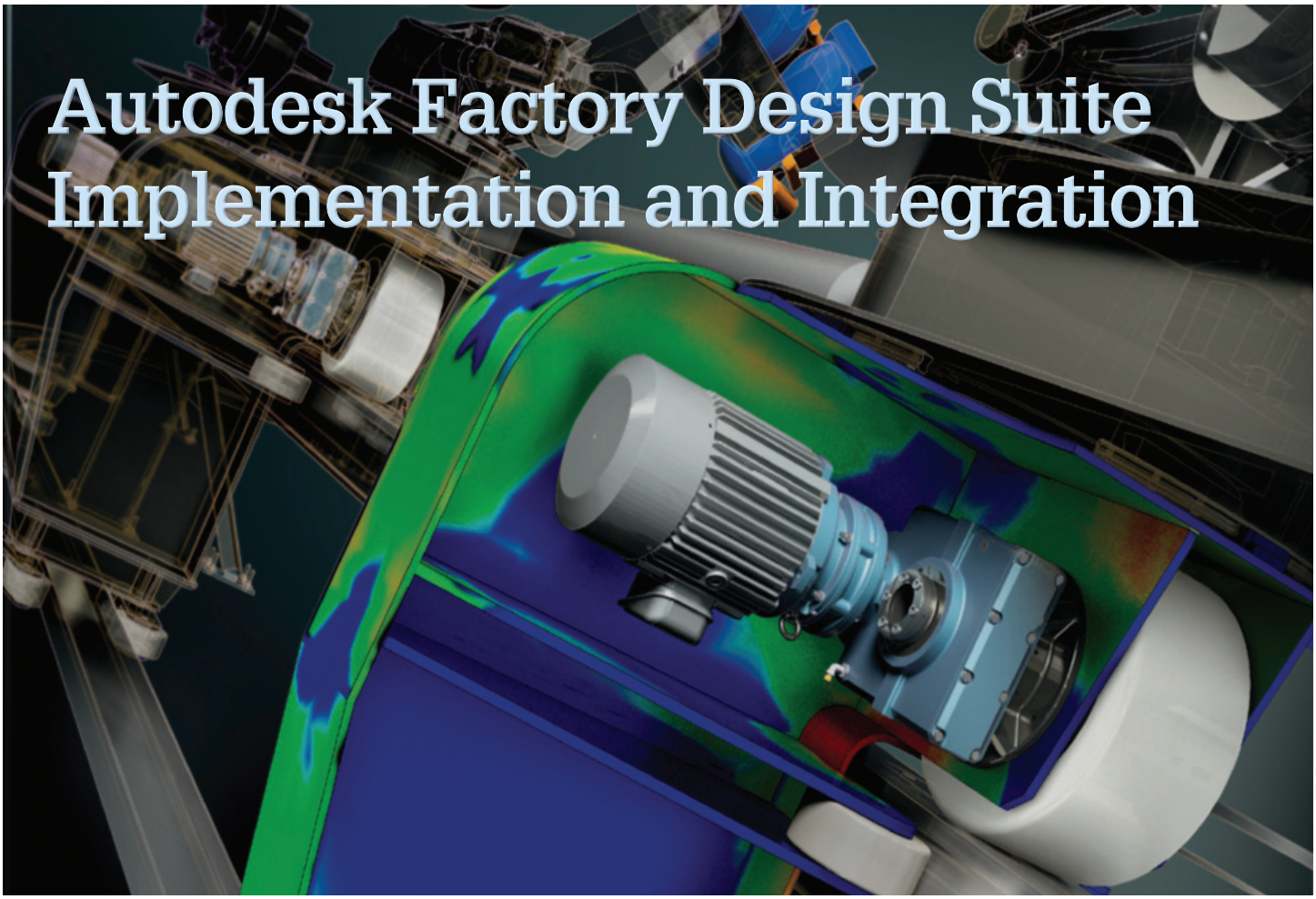
(2011-Aug-19) How to remove all Autodesk products from a Windows system

(2011-Aug-29) Service Pack 2 for Factory Design Suite 2012



William Troeak is an Architectural Technical Specialist for U.S. CAD with over 10 years of experience in the architectural industry. Prior to joining U.S. CAD, William worked as a drafter, job captain and BIM Manager for various Architectural firms where he worked on institutional, commercial and residential projects. In addition, William is a Revit Architecture instructor at Long Beach City College and an Autodesk Certified Professional in Revit Architecture and AutoCAD. He regularly conducts seminars on the use of Autodesk technology for Architecture and sustainable design and provides implementation, customization, training, and technical support services to AEC design professionals.

Autodesk Factory Design Suite Implementation and Integration



Autodesk® Factory Design Suite is a comprehensive factory layout and mechanical design solution that helps machine and equipment builders, system integrators, and manufacturing better design, optimize, and visualize factory layouts and equipment.

In this article, we will investigate the integration and implementation of the Factory Design Suite, and some high-level aspects of the different programs included in the Suite.

The goal of Factory Design Suite is to enable users to easily move their factory layouts from a 2D work environment to the 3D world. Having this extra dimension allows engineers to avoid costly mistakes due to collisions, as well as provide extra details for installing new work cells.

There are three variations of Factory Design Suite available for consumer use.

Standard: For layout designers, drafters, and detailers who need to efficiently design, document, and share factory layout drawings in the DWG file format in a single economical and convenient package.

- AutoCAD® Architecture
- AutoCAD® Mechanical
- Autodesk® Showcase
- Autodesk® Sketchbook Designer
- Autodesk® Factory Design Utilities
- Autodesk® Vault
- Autodesk Inventor® Fusion

Premium: For system integrators and manufacturers who want to create digital factory models to improve communication and make better layout decisions prior to the installation and commission of equipment on the factory floor. This Suite adds three products to the mix.

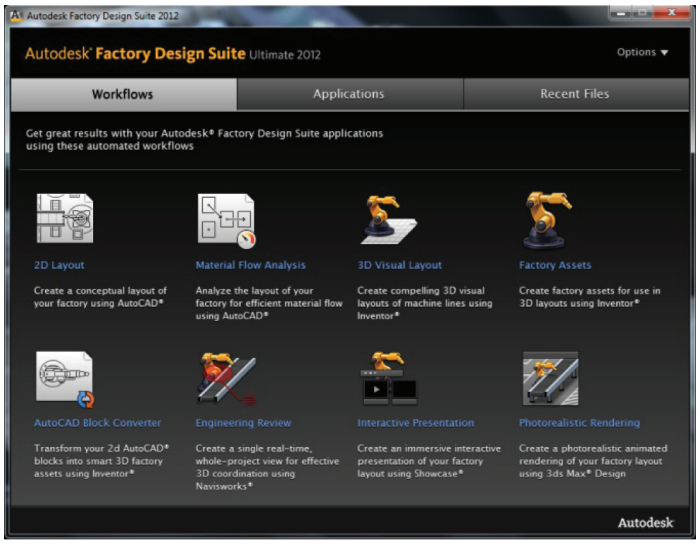
- Autodesk Inventor
- Autodesk 3ds Max Design
- Autodesk Navisworks Simulate

Ultimate: Ideally suited for machine builders and system integrators who need to win more business with advanced tools that can design, visualize, and simulate factory lines and factory equipment. This Suite delivers two more products.

- Autodesk Inventor Professional
- Autodesk Navisworks Manage

THE SUITE ADVANTAGE – PROGRAM LAUNCHER

Factory Design installs with a Program Launcher that helps direct users to the correct programs for the task at hand. This type of interaction is a welcome addition to the occasional users or high-level managers who need some simplification in their ever- growing software library.



INSTALL AND DEPLOYMENT

While it seems like big news that this year's new suite products are coming on a flash drive, Factory Design started this trend with its 2011 release.

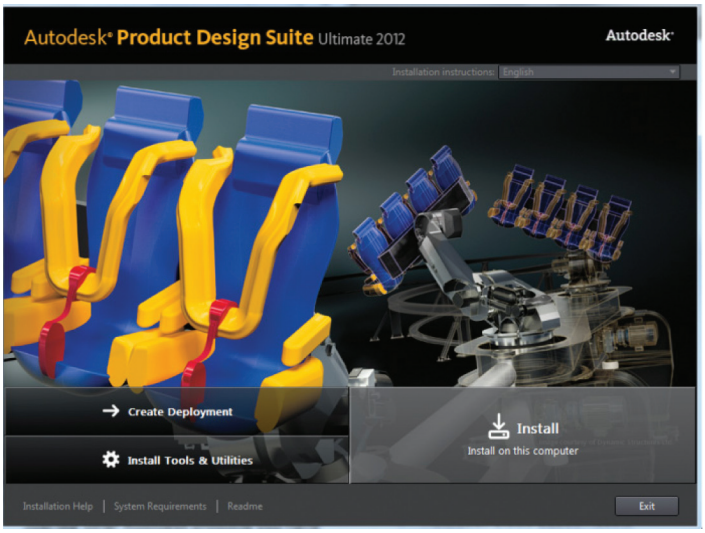
The Suite is also available on the subscription site. Expect some time to download though, as the entire Suite installer is about 20 GB once extracted.

Standalone Installation

If you are the lone gun using this software, the new install screen will be a welcome addition to the suite style of product. All of the installation options have been simplified , and everything can be managed from the main screen including the search for current service packs.

Install will require Serial Number and Product Codes. Here are the Product Codes in case you misplaced them:

- Standard: 789D1
- Premium: 757D1
- Ultimate: 760D1



Network Installation

Network Deployments haven't really changed much with the Suite except in size, obviously.

If you want to get a jump on creating a deployment before you actually get your Serial Number you can use the number 111-11111111 and the Product Code. You can always modify the deployment for the correct number later.

Remember that if you have a combination of 32- and 64-bit machines in your company, you'll need to make separate deployments for each type.

Licensing

Just like other Autodesk products, you have the options of Standalone and Network licensing, but there are some caveats to consider.

Since Factory Design is a complete product suite, you cannot have a portion of the products spread across multiple machines. These products are here for the designated user of that suite. Choose your users wisely.

For network licensing you may already know that you can install anywhere and, as long as a license is available, the products can be used elsewhere. Just make sure you have enough to spread out over your team's bandwidth or you will receive the dreaded "*cannot find a valid license*" message.

If you find yourself with users of varying degrees of desired functionality, consider adding a license of Standard Suite or Premium where it will do the most good, and only deploy those versions to the users.

FACTORY ASSET LIBRARY

The Factory Library is shared through the 2D AutoCAD-based programs as well as the 3D system of Inventor.

In 2011 Factory Design, this was exclusive to the 3D side of the work, and the assets had no representation inside of the 2D world. This led users to create 2D blocks that they would try to match up to the 3D assets in Autodesk Inventor®. As you can imagine, it became quite a struggle to keep assets up to date within a company let alone revision changes.

In 2012 that was changed with a very welcome enhancement for both 2D and 3D publishing of assets, which are then shared between the two programs. Organizing and locating these libraries is an important part of integrating this suite into your workflow.

When looking at these libraries you must consider the different types of assets.

- Autodesk supplied assets
- Autodesk cloud-based assets
- User-created assets

Location for a Single User

When working as a single user of this suite without the need to share assets, the default Windows 7/Vista directories are as follows:

Autodesk Supplied Assets…(hidden folder)

C:\ProgramData\Autodesk\Factory Design Suite 2012\FactoryLibrary

Autodesk Cloud Assets…

C:\Users\username\Documents\FactoryCloudLibrary

User Assets…

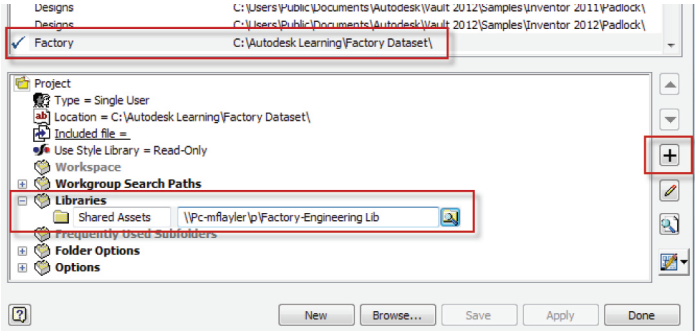
C:\Users\username\Documents\Factory Library

Location for Engineering Teams

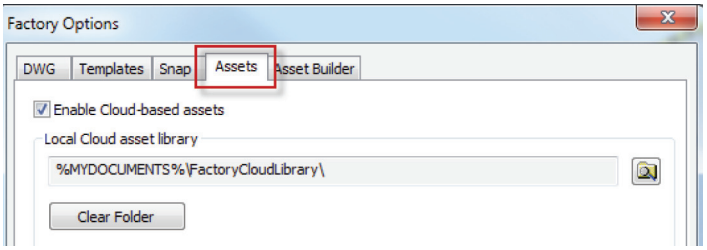
When teams need to share these assets, especially for the Cloud and User libraries, network paths will have to be assigned to the locations of these libraries.

The settings for library locations are found in the Application options of the AutoCAD®- based programs and the Factory Options of Inventor. The Autodesk supplied library cannot be relocated but the assets can be copied if you desire to change them.

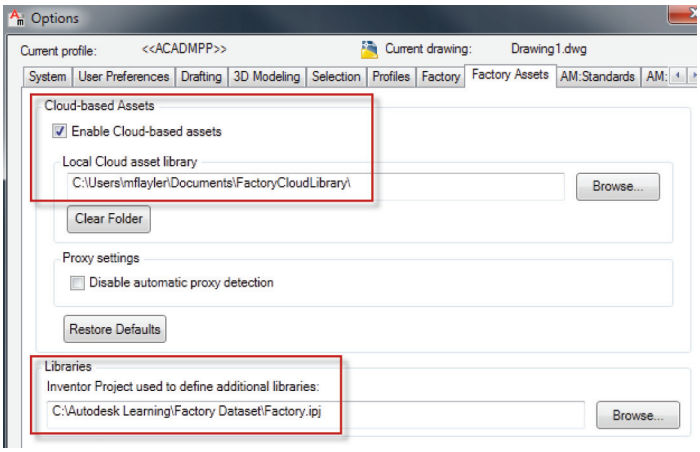
To start linking network assets for the 3D and 2D libraries, go to Inventor first and properly set up a project file with a Library location.



Also look at the Factory Options (*Factory Tab→ Options Panel*) for where cloud-based assets will reside.



Next, in the AutoCAD-based products go to the Application Options, and select the Inventor project file for additional libraries to be the same project file as in Inventor.



2D LAYOUT

The 2D Layout is the first step in Factory Design. Normally this 2D layout is one of two variations for a designer to work with inside the software.

- 2D layout is provided from existing building as-built.
- 2D layout is to be created from scratch for a new build

Consider seeding your license server with one or two Standard suites for the users that do not use 3D such as managers or industrial engineers.

The Factory 2D layout can be done in either AutoCAD program here as well as the Material Flow Analysis. The launcher will fire up whichever application was opened last.

AutoCAD Architecture

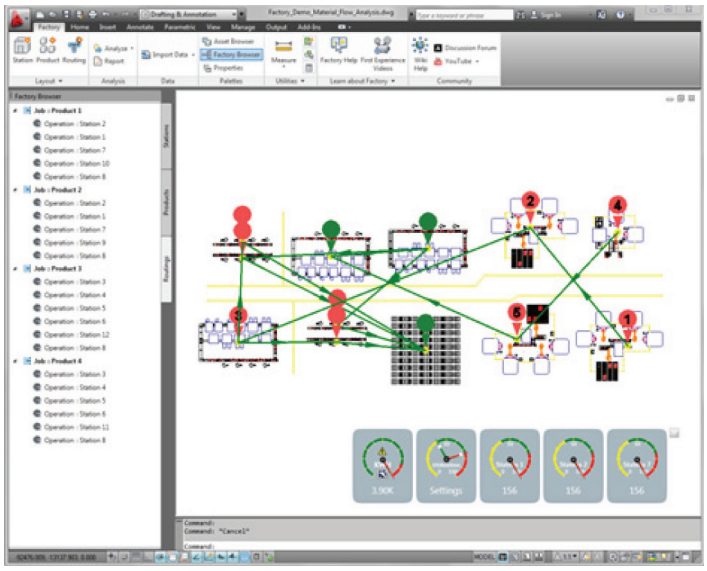
This product is included with the Factory Design Suite for its features that specifically target the creating of buildings and supporting structures quickly and accurately. Most commonly this is for wall, door, and window creation but can also technically create the whole building if desired.

AutoCAD Mechanical

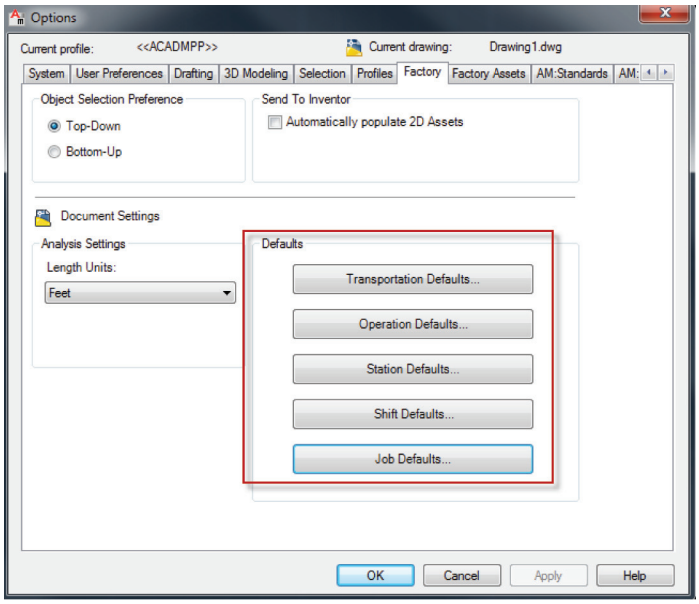
Mechanical was added to supplement the Mechanical user's need for top-notch mechanical design and layout in 2D as well as the library of standard components and 2D quick FEA it provides. If you prefer to not perform any 3D building and just want to do layouts with perhaps a few Structural Steel beams here or there to represent columns, then this would a wise choice over AutoCAD Architecture.

MATERIAL FLOW ANALYSIS

Factory provides tools to define products that are to be manufactured in the facility, the stations where the processes occur, and the routes between the stations. Once you have a layout you can analyze the transportation costs, machine utilization, and power consumption. Reports can also be produced so that multiple scenarios can be compared.

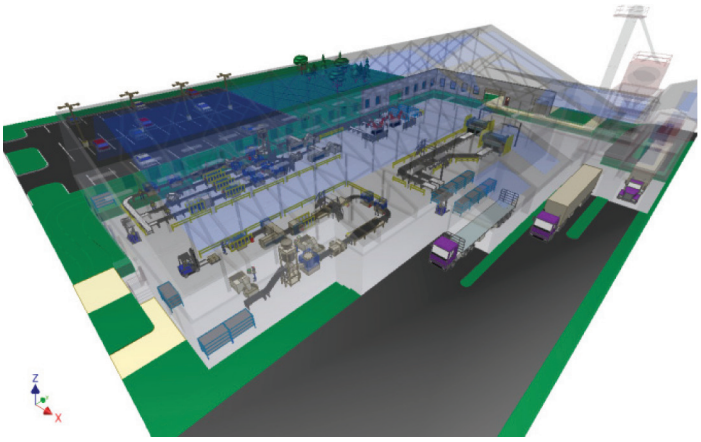


The default settings for the Material Flow Analysis can be found in the Application Options of either Architecture or Mechanical. Each asset and flow criteria can be tweaked with the Factory Object Properties palette.

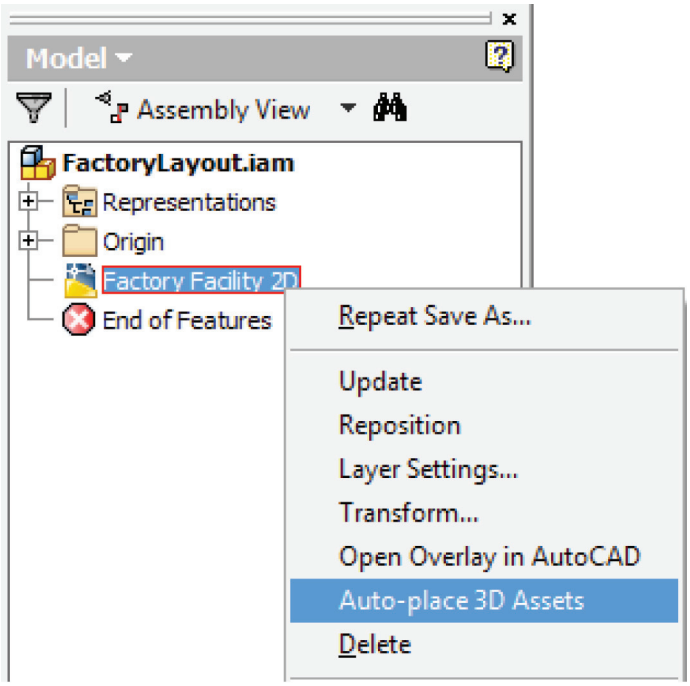


3D VISUAL LAYOUT

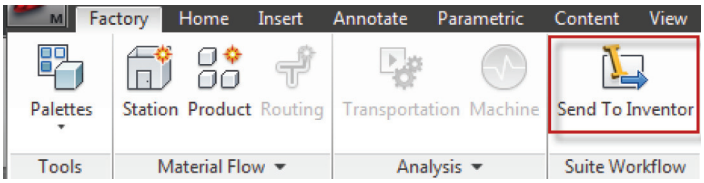
The Inventor component of the Suite is where the planning in the 2D layout comes to fruition.



With the Factory component of Inventor you can either place the DWG manually and then place the assets with the Auto Place tool, or have it pushed from the AutoCAD side. The method chosen will depend on how your company is structured with different users completing perhaps very different tasks. Factory Standard users will not have Inventor on their machines, for example, but will do the Material Flow Analysis.



The process of sending the information to Inventor from an AutoCAD-based product is done with the '*Send to Inventor*' command located on the Factory Tab.

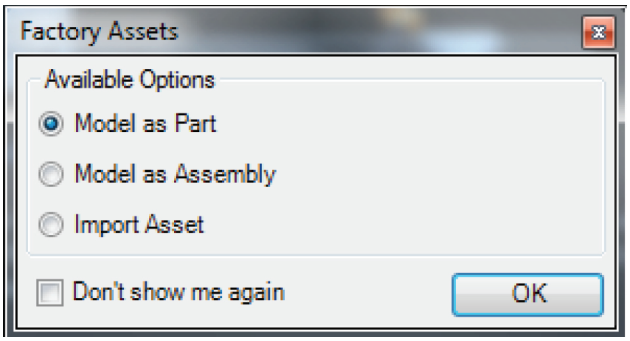


This will open Inventor. Place the DWG Overlay and optionally (setting on the Factory Tab of Application Options) place the 3D versions of the 2D blocks automatically.

Once the DWG Overlay is in Inventor, it can be updated, repositioned, layers can be turned off and on, and transformed for scaling or relative positioning. Updates will appear if the 2D layout change after it is brought into Inventor so there is no need to start over after a 2D layout change.


ASSET BUILDER

Two options exist on the suite launcher for creating factory assets. Factory Assets will launch Inventor and ask for one of three options, which will start asset authoring. Use the first two options if you are modeling from scratch. The last option is reserved for those models that have already been created, and need to be authored directly and subsequently published to the user/network library.

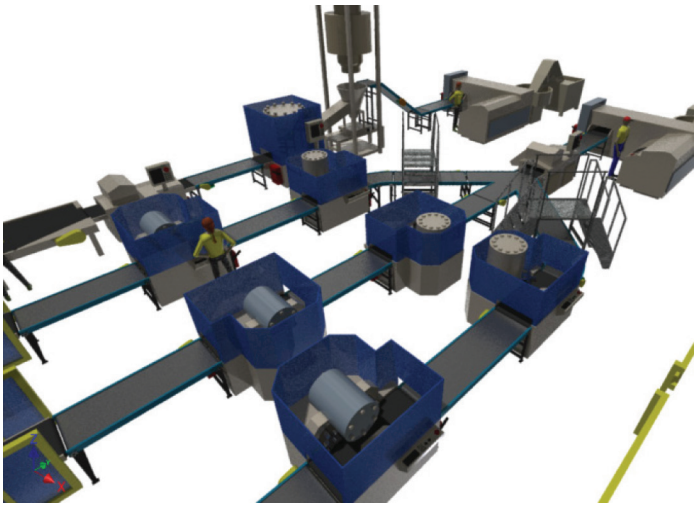


The AutoCAD Block Converter will launch Inventor and prompt for a 2D block import to use as a reference for creating a new part or assembly asset.

Asset creation is the most important part of what makes Factory Design efficient. Several factors go into what makes a viable asset inside the suite.

- Adding iLogic Rules (this is what makes an asset configurable).
- Creating Substitute Levels of Detail for large assets.
- Simplifying or modifying Vendor models with Inventor Fusion.
- Adding Safety Zones into the asset that can be turned on and off.
- Connectors and Landing surfaces for Factory placement.

These are just some of the considerations to make when creating 3D and 2D assets for use through the products.

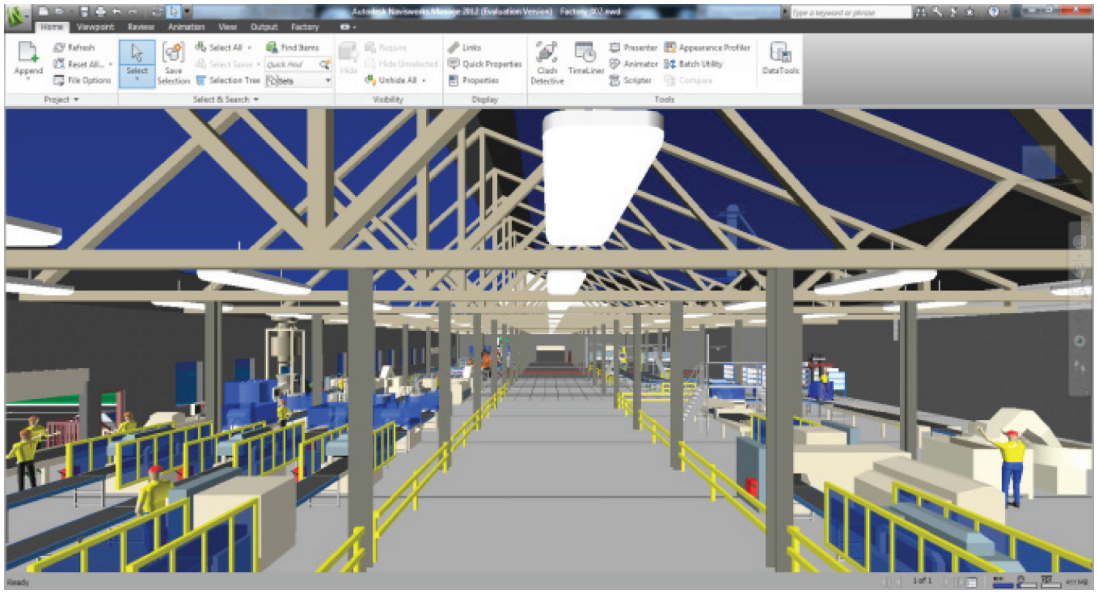


Care should be taken to understand what your system can and can't perform, as well as which detail is actually necessary for layout purposes. Here, more than ever, Levels of Detail, Shrinkwraps, and Substitutes are your friends. Study up on them if you do not know the specifics of these tools.

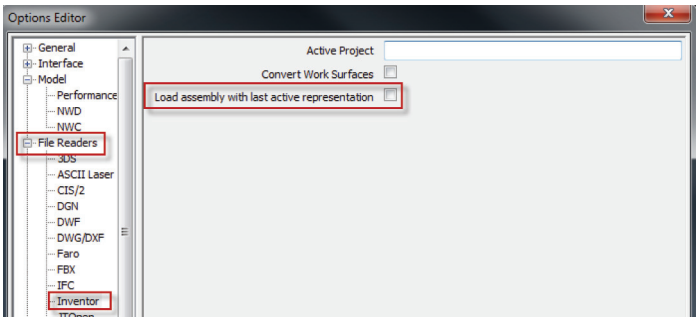
ENGINEERING REVIEW

When started, the Engineering Review will ask for files to open or append into Autodesk® Navisworks.

Navisworks is famous for its data aggregation and ability to handle very large datasets and point clouds, which programs like Inventor and its competition are simply not meant to do. Here clash detection, 3D flythrough, and 4D timeline simulations are accomplished to make sure everything fits together. Along with Multi-CAD support, Revit, Civil, Plant3D, and non-Autodesk files can also be brought in.



The factory version of Navisworks has a few separate settings for use here. Once of the most notable is how Assets are brought in from Inventor. There is an application option that will allow for the last active Inventor Representation to be the visible object. If this is not checked, then Navisworks will bring in the Master representation by default which includes all faces and edges of the asset rather than a simplified model.




VISUALIZATIONS

While the aforementioned products all contribute to the Factory Layout procedures, the rest of the products in the suite provide ancillary advantages to the overall design process.

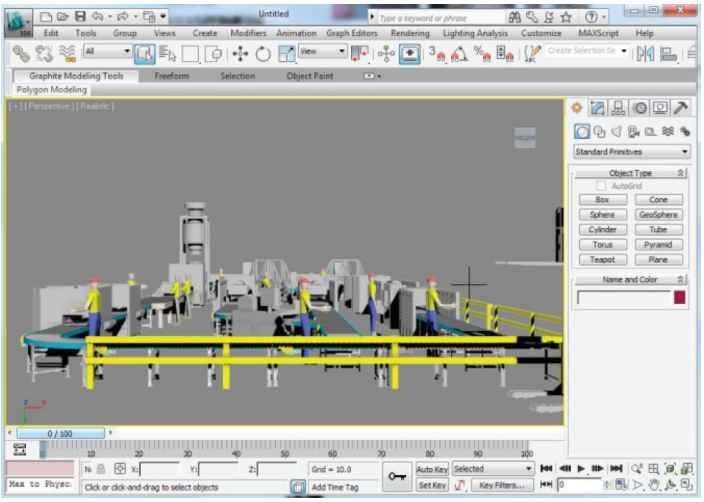
> **This visualization product is great for high- resolution and high-fidelity imagery of design variations and marketing material.**

Showcase

This visualization product is great for high-resolution and high-fidelity imagery of design variations and marketing material. Import of Inventor Factory Designs and scenes files such as FBX can aid in creating sharp imagery for both print and web media. Simple animations here are also possible.

3ds Max Design

While 3ds Max is known as video game and special effects software, 3ds Max Design focuses more on the visualization of the design. The interface is different between the two identical pieces of software to aid in this process. Consider spray booths, shot blasting, or polishing processes and how hard it is to show that happening in Inventor. This is your solution to those complex visualizations.

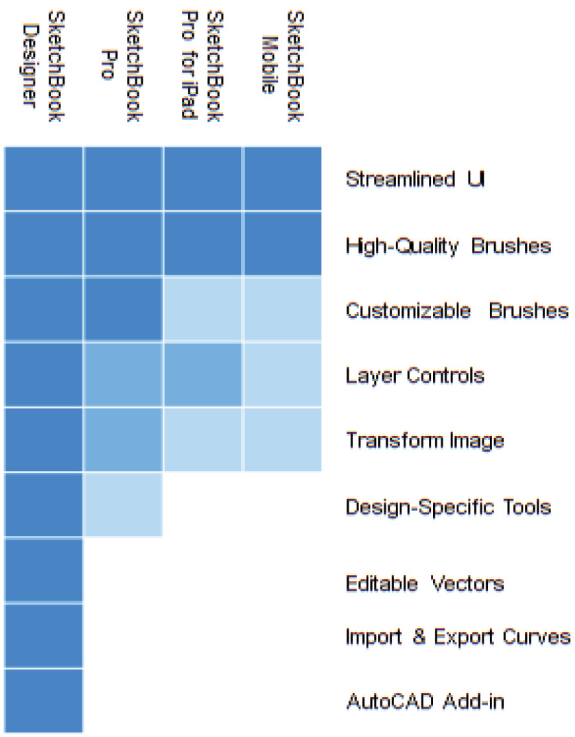


Inventor Fusion

Fusion 2012 adds the ability to quickly modify CAD data from other non-native sources, and it will not consume a precious Factory Design Suite license. Additional tools inside Fusion allow for model simplification. Conversely, Fusion also has the ability to perform fluid changes to parts in order to create more complex designs.

Sketchbook Designer

Designer is very similar to the Sketchbook Mobile App but with a lot of extra features for more practical design work.



Vault

Autodesk Vault is an implementation topic all its own. The version that ships with Factory Design Suite is the free Vault, which will aid in fundamental file management in groups, design copies, version, and revision tracking. All the core products in the suite have integration to Vault. For more implementation information on this topic, Autodesk has already published the advanced configuration guide for Vault 2012 on its website.

Mark Flayler is an application engineer with IMAGINiT Technologies, specializing in manufacturing environments. He has implemented Autodesk® manufacturing products within several industries including the blow/injection molding, automotive, and custom machinery markets.
Mark has extensive experience and a comprehensive understanding of the technical, practical business, and human dimensions of implementation. When not providing training, support and implementation, he writes the IMAGINiT Manufacturing Blog and takes an active role in the manufacturing community. Mark is an ATC certified instructor, and is PSE and ATC certified in AutoCAD®, AutoCAD® Mechanical, AutoCAD® Electrical, Autodesk® Data Management, and Autodesk® Inventor®.

Calculating Flows For Sizing Duct and Pipe

Over the course of my last few Autodesk® Revit® MEP projects, I have been able to use the information in the models to calculate flows, which has assisted with sizing of duct and pipe. This has made the process more productive and eliminates the need to calculate everything on paper. In addition, it has made it easier to adapt to changes as the design process evolves. While this works well on simple projects, it can get challenging when applying it to more complex designs. In this article, I intend to show the capabilities of using Revit MEP for these calculations.

HOW IT WORKS

Revit MEP is doing these calculations based off the properties in the duct and pipe connectors within the families. The connectors have system type properties for supply air, return air, exhaust air, hydronic supply, hydronic return, domestic cold water, domestic hot water, and sanitary systems. Depending on the system type and flow stream, the connectors are set up in different ways to calculate CFM, Fixture Units, and GPM.

LESSONS LEARNED

- Everything must be connected. No exceptions!
- Depending on the source of the Revit MEP family, the connectors might need to be edited in order to calculate accurately.
- Some of the plumbing fixture families may be in the architect's model. For this reason I have created connector placeholder families with parameters for cold water fixture units, hot water fixture units, waste fixture units, and diameter of pipe. Ideally these should be set up at the beginning of the project to match the plumbing fixture schedule and the fixture load based on the IPC.
- Hot water circulation systems are not currently available in Revit MEP. I used a separate domestic hot water system for the hot water circulation. I did this by creating a domestic hot water connector with 0 flow on one side. On the other side is domestic hot water with an input for HWC flow.
- Vent systems are not currently in Revit MEP. I used a separate sanitary system that calculates waste fixture units for the vents. I did this by creating a sanitary connector with 0 fixture units on one side. On the other side is a sanitary connector with an input for vent fixture units. Vent lengths will need to be added up manually for sizing.
- Duct, hydronic, and domestic water systems need to be closed. Any open ends need to be capped.
- Sanitary and vent systems need to have one open end. The open end is typically the pipe leaving the building.
- Creating information schedules has been a great way to manage the parameters in the families.
- Some scenarios need to be calculated manually. For example, complex duct and piping in a mechanical room.
- These systems have proven to be accurate and easy to troubleshoot. For example, if you click on a duct or a pipe and the flow is 0 that means something is not connected or there is an opening in the system somewhere.

CALCULATING CFMS AND SIZING DUCT

The CFM airflows are entered into the supply diffusers and all the duct is connected back to the terminal unit. Revit MEP calculates the CFMs all the way through the duct back to the VAV unit. You can click on a duct anywhere in the system and see the calculated airflow (see Figure 1). It can then calculate the total airflows between the terminal unit systems and the air handling unit.

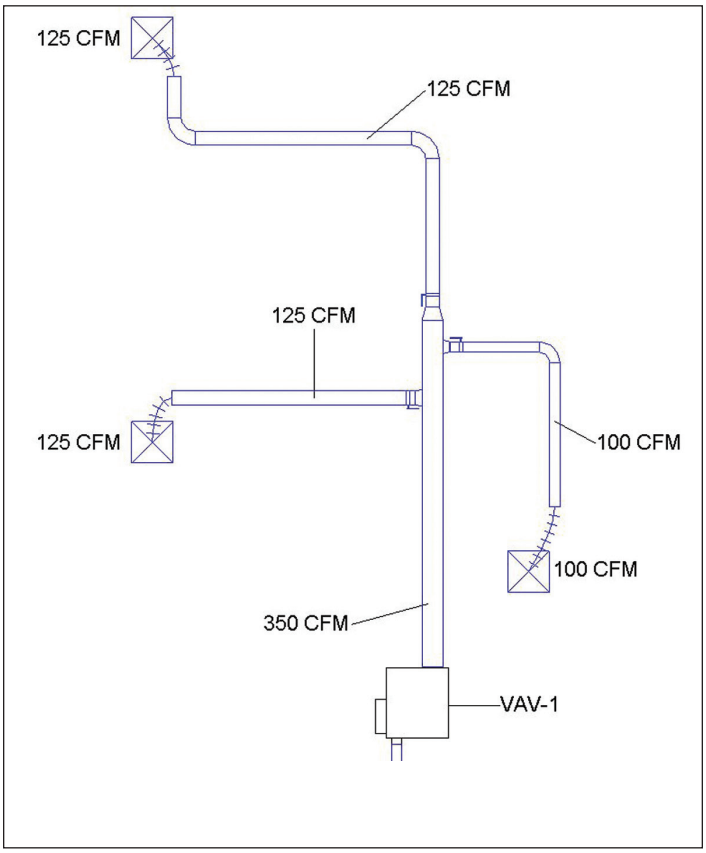


Figure 1: Duct air flows

CALCULATING GPM AND SIZING HYDRONIC PIPE

The GPMs are entered into the terminal units using a simple information schedule (see Figure 2). Revit MEP calculates the GPM all the way through the pipe back to the mechanical room. You can click on a pipe anywhere in the system and see the calculated GPM (see Figure 3). If a GPM changes on a unit, you can go to the schedule and change the flow. Then go back to the model, view the calculated GPM, and change the size if necessary.

_HVAC HP Flows

Mark	Condenser Water Flow
HP-1	2.0 GPM
HP-2	1.8 GPM
HP-3	1.5 GPM
HP-4	1.3 GPM
HP-5	2.3 GPM
HP-6	1.5 GPM
HP-7	1.5 GPM
HP-8	2.0 GPM
HP-9	2.8 GPM
HP-10	2.0 GPM

Figure 2: Hydronic flow schedule

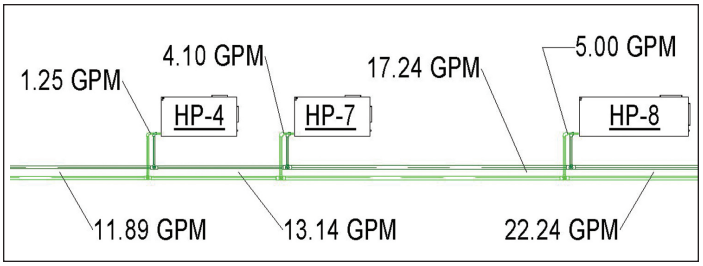


Figure 3: Hydronic pipe flows

CALCULATING FIXTURE UNITS/GPM FOR SIZING DOMESTIC WATER PIPE

Revit MEP will do the conversion from fixture units to GPM using the values from the 2006 International Plumbing Code (IPC). It does this for both flush tank and flush valve systems. This will work for domestic cold water and domestic hot water systems.

Note: I created a separate domestic hot water system for the hot water circulation. Revit MEP does not currently have a system type for HWC.

The GPM totals shown are calculated from all the fixture units in the building. From top to bottom: CW, HW, HWC (see Figure 4).

You can click on a pipe anywhere in the system and see the calculated Fixture Units and GPM. If a fixture is removed or you have to re-route piping, you can view the calculated GPM and change the size as necessary. Here you can see the fixture units [86.5] being converted to (63.2) GPM using predominantly flush valves (see Figure 5).

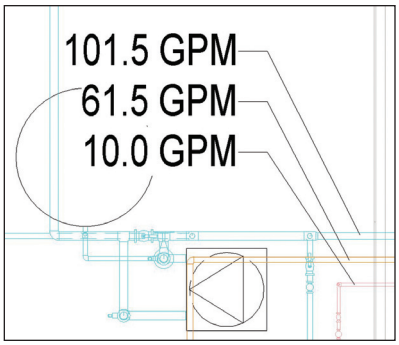


Figure 4: Mechanical room domestic water flows

CALCULATING FIXTURE UNITS FOR SIZING SANITARY AND VENT PIPE

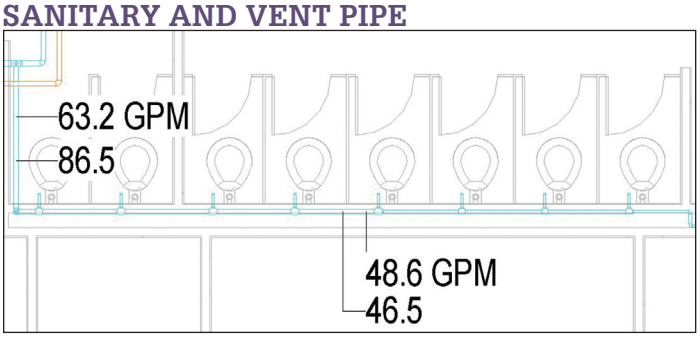


Figure 5: Domestic cold water flows

Revit MEP will calculate fixture units through sanitary pipe based on the fixture units assigned to each fixture family. The total fixture units in the sanitary pipe leaving the building are calculated. Revit MEP automatically calculates the fixture units all the way through the pipe to the open end leaving the building (see Figure 6).

You can click on a pipe anywhere in the system and see the calculated fixture units. If a fixture unit changes on a fixture or you have to reroute piping, you can view the calculated fixture units and change the size as necessary. There are 93 total waste fixture units for this bathroom (see Figure 7). The same applies to the vents for this bathroom (see Figure 8).

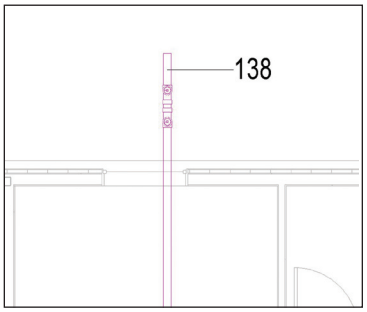


Figure 6: Total sanitary fixture units

Note: I created separate sanitary systems for the vents. Revit does not currently have a system type for vents.

DUCT AND PIPE FLOW LEGENDS

I set up a view with a duct legend, an editable legend that can be set up to apply colors to ducts based on the flow. I was able to use this to help size duct based off the flows calculated from a ductulator (see Figure 9).

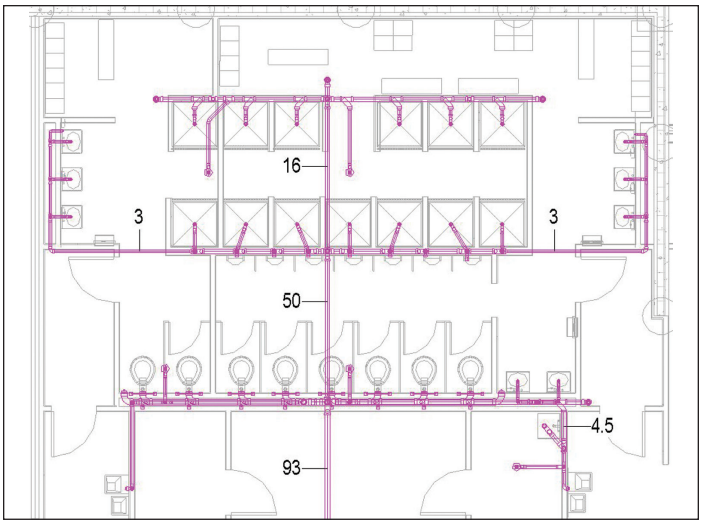


Figure 7: Bathroom sanitary fixture units

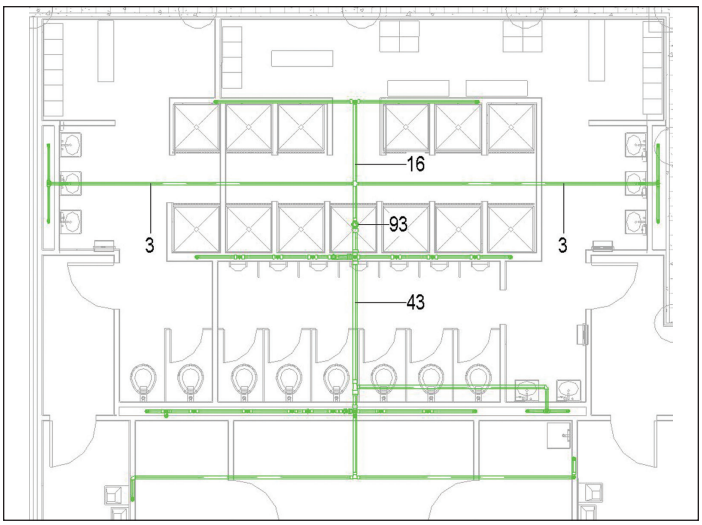


Figure 8: Bathroom vent fixture units

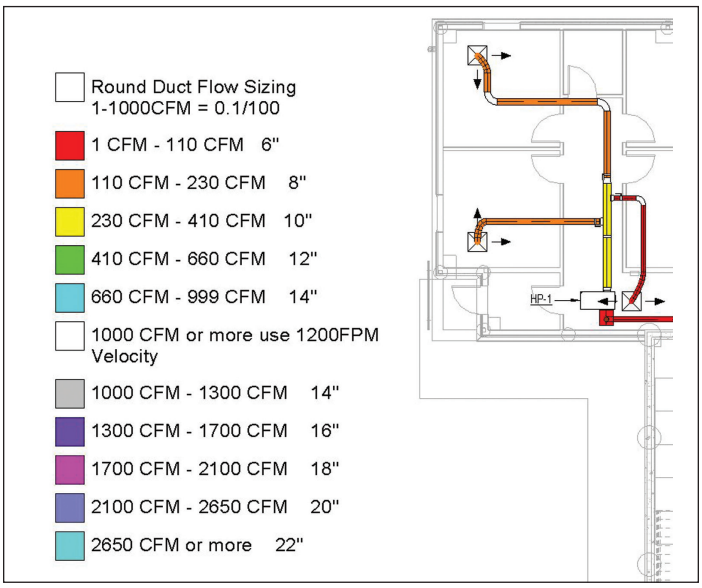


Figure 9: Duct flow legend

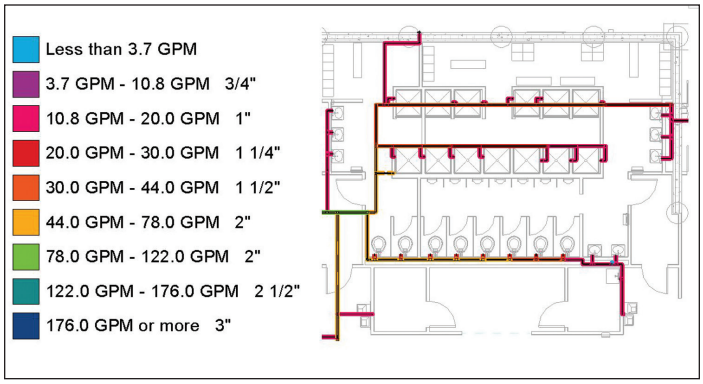


Figure 10: Pipe flow legend

I set up a view with a pipe legend. I was able to use this to help size pipe based off the 2006 International Plumbing Code Figure E103.3(3) Friction Loss in Smooth Pipe (see Figure 10).

Phil Pleiss is a Designer with the Mechanical Facilities Group at Merrick & Company in Denver, Colorado. He works primarily with Revit MEP. He is an Autodesk Revit Architecture Certified Professional and an active AUGI Forum Member. His blog is http://mep-bim-guru.blogspot.com/.

Third-Party Apps for AutoCAD

AutoCAD® is a complicated and powerful design tool containing several hundred features, commands, tools, and settings. Users can create almost any type of design with this software, yet very often, they want even more tools—those that don't come installed in AutoCAD. These tools might make drawing and modeling easier, provide features that AutoCAD doesn't, make AutoCAD's features easier to use. Regardless of why users want these added features, the fact is they do. Luckily, Autodesk has provided a means for users and companies to create them. These new or modified tools are often referred to as third-party applications.

WHAT ARE THIRD-PARTY APPLICATIONS?

Third-party applications are programs or routines designed to work inside another program or operating system, that are created by parties other than the creators of the host program or system. The ability to run third-party applications is one of the reasons AutoCAD rose to the top and became the premier CAD system. AutoCAD can run several different types of third-party software including .NET programs, .LSP routines, script files, ObjectARX, ActiveX, and others.

AutoCAD makes it easy for "regular" users to create their own third-party apps through Visual LISP. Visual LISP, a programming tool for creating code in AutoCAD, is a form of the programming language LISP. Visual LISP is a full-featured programming language that can call AutoCAD commands, system variables, and dialog boxes in order to interface with the user. AutoCAD comes with a LISP writer inside; the files are saved in a .LSP file format. These files can be simple command macros or more complicated routines that create, save, and manipulate data. LISP files are so easy to use that users can drag and drop the file into AutoCAD to load it.

The ObjectARX programming environment can be used to customize AutoCAD (and AutoCAD-based products) to gain direct access to AutoCAD's database structure. It also provides access to the graphics system, command definitions, and object-oriented C++ programming interfaces. ObjectARX is a powerful tool that can be used to extend AutoCAD software. The ObjectARX SDK (Software Developers Kit) also includes a managed API, typically known as the AutoCAD .NET API. This API can use any .NET supporting language to further customize AutoCAD and its vertical platforms.

The ActiveX can utilize COM automation. It can use VBA-enabled applications such as Microsoft Office products. It can also be used from AutoCAD add-ins built using Visual LISP, ObjectARX, or the AutoCAD .NET API.

There are many choices for developers who are interested in programming third-party applications for AutoCAD. Which ones are you familiar with? What are the needs and goals for the application?

WHERE CAN I FIND THEM?

AutoCAD third-party applications are easy enough to find. Before the Internet, many AutoCAD-based magazines would provide routines with yearly subscriptions. These days, users only need to conduct a simple Internet search to find the routine they need. Users can also access the AUGI forums to find routines. If you can't find one, or can't find somebody who knows what you are looking for, then perhaps you can find a person to create one for you!

Autodesk has many third-party applications listed on its Partners Products & Services website (http://partnerproducts.autodesk.com/catalog/default.asp). These programs are much more complicated than a simple LISP routine, but many of them can complete your design needs. At this website, users can search by category, product name, company, language, Autodesk product, and more. If you need it, or simply want it, it might be here. Keep in mind that these applications are premium applications. They aren't free, but they are much more advanced.

If you are looking for simple or task-based solutions, then a LISP routine may fit your needs. Try an Internet search with your favorite search engine after you look through the AUGI forums.

CREATING THIRD-PARTY APPLICATIONS

This article cannot cover the many methods for creating a third-party application for AutoCAD, but there are many sources out there. If all you need is to streamline your workflow, then LISP is the way to go. Autodesk comes with a LISP tutorial (in PDF format) and reference guide that can help you. There are also many books, blogs, and AUGI Training Programs that can help you get started.

If you are really serious about creating programs to run inside AutoCAD, then you may want to check out the Autodesk Developer Network (ADN). This network provides insight, tools, helps, and other aids to help you create your very own third-party application for AutoCAD or other Autodesk products.

AUTODESK DEVELOPER NETWORK

The ADN is Autodesk's formal platform for third-party developers. It's not for everybody, but there are many benefits to joining this network. From a business standpoint it provides access to potential customers as well as access to many of Autodesk's sales partners. A big benefit of being part of the ADN is exposure. After all, how can users purchase an application they have never heard of? The ADN also conducts numerous conferences and provides business development consultations. From a business perspective, the ADN can be a big benefit.

Technically speaking, the ADN provides a developer access to nearly all Autodesk software! ADN members are also part of the beta teams. These licenses are not to be used for production purposes, but are for review and development of applications, marketing information, and support. Autodesk software engineers are also available for support and guidance.

Autodesk has its own API (Application Programming Interface) for its products, provided through the ADN. An API is a set of programming rules and/or specifications unique to a program, like AutoCAD. The API provides a way for developers to create code that can communicate with AutoCAD (or other Autodesk products.) If developers get stuck or have questions about Autodesk's API, consultations with Autodesk are available.

JOINING THE AUTODESK DEVELOPER NETWORK

The ADN is not intended for your average user—it was created for developers. There are rules and guidelines to follow as well as qualifications to meet. For example, there must be at least one full time professional software developer on staff. An application must be submitted that includes an agreement (with signature) as well as membership fee. This fee varies depending on the number of individuals in your group that will be using ADN-provided software. The fee also varies by country. Membership is for a calendar year license that runs from January 1 to December 31.

There are three user levels for ADN membership: one user, two to five users, or more than five users. Users are the employees that will be using the ADN software and that will be provided support by Autodesk. There also three levels of service: Standard, Professional, and Premier Partner. The Standard level provides a base level of service for software developers. The Professional service level provides service to developers with a more aggressive schedule and who require more support from Autodesk. The Premier Partner level of service is for developers who are creating major software applications.

CONCLUSION

AutoCAD has become the industry standard in design software. This is a title it has held for decades. One of the reasons AutoCAD became number one is because of the ability to customize it internally and through third-party applications. The average user can program AutoCAD through AutoLISP. Software developers of small add on programs to major program enhancements can also create and run application inside of AutoCAD. If you are a developer or are interested in becoming a developer of third-party applications, consider joining the Autodesk Developer Network (ADN). This network can provide software, training, and support to you and your team

Brian C. Benton is senior engineering CAD technician/designer for Heidt & Associates, Inc, Fort Myers, Florida. Brian has been working with AutoCAD since release 10 in the mechanical, structural, and civil engineering fields. He has been a detailer, drafter, designer, IT assistant, CAD software manager, protector of standards, and proverbial "Help Desk." He can be reached at benton.brian@gmail.com.

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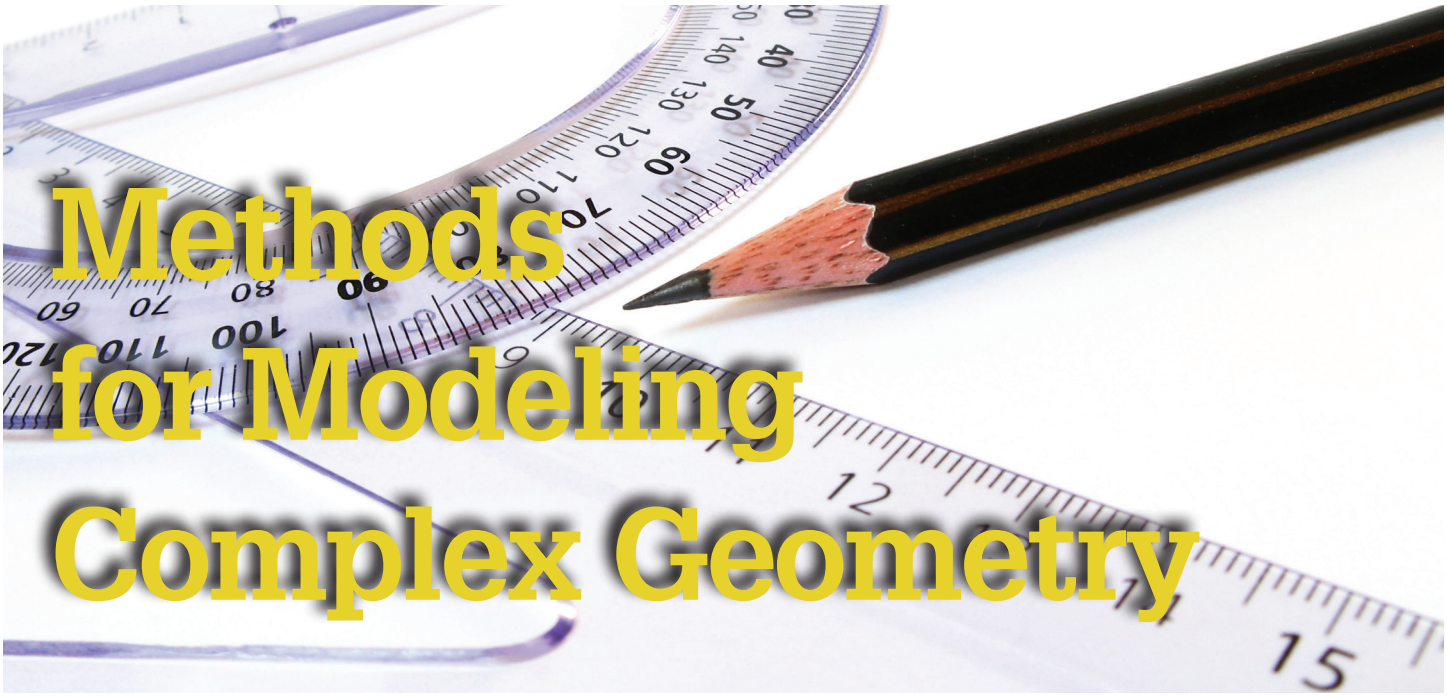
Methods for Modeling Complex Geometry

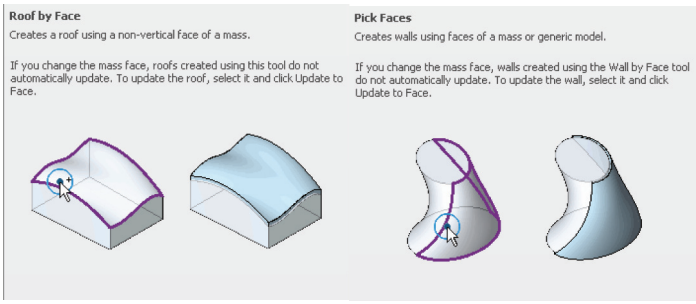


Let's admit it: modeling complex geometry in Autodesk® Revit® has always been difficult. This is because Revit has lacked modeling tools and commands that have been a staple in other 3D modeling programs such as 3ds Max. With the introduction of the new mass modeling tools in Revit 2010, this has changed somewhat. However, modeling complex geometry on "real" non-mass elements such as walls, floors, and beams is still difficult in Revit…until now. This article describes how to model complex roofs, walls, beams, and floors by using the "pick by face" command and by finding the intersections of their surfaces.

ROOF SURFACES

CREATING BY FACE

Let's start with something simple, pick by face. This is the simplest way to create complex geometry because all you have to do is simply "pick" a surface and apply a roof or wall element to it as shown in Figures 1 and 2.



Figures 1 and 2: Roof and wall by face.

Some of the most complex roofs and walls are created by the pick by face command. Let's illustrate this by using an example of a complex roof surface. Let us consider the following in-place mass surface shown in Figure 3. This surface consists of four planar reference lines.

The spline by points command was used to create the reference line and the surface was created by creating a form over those reference lines. This in-place mass surface will be used throughout this article.

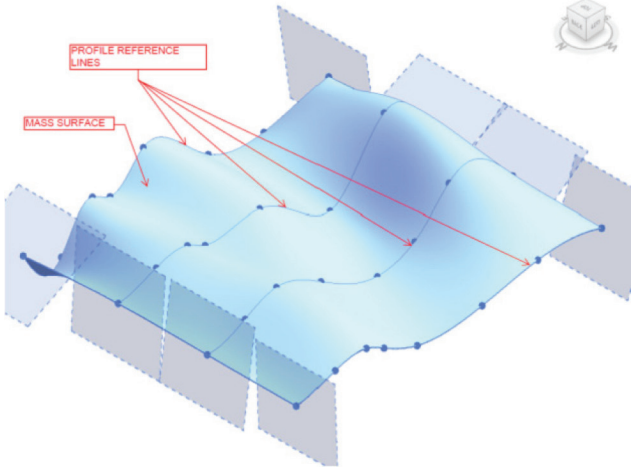


Figure 3: Complex in-place mass surface.

Once the mass surface is created, simply activate the roof command by face and pick the mass surface. The resulting roof geometry is shown in Figure 4.

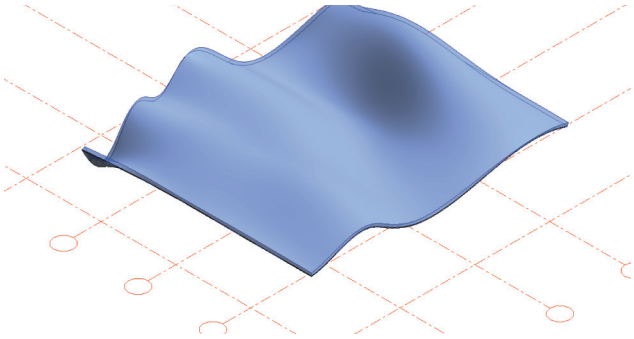


Figure 4: Roof by face on complex roof surface geometry.

Note: Some complex roof surfaces, will not allow the roof to be placed on its face because the geometry is too complicated. In this case, use a wall by face instead of a roof and follow the same procedure described above.

ROOF SURFACE SUPPORTS

CREATING COMPLEX WALL PROFILES BY ATTACHMENT

Next let's build a wall to the underside of the roof surface. All you do is build a wall in its desired location, select it, click on the "attach top/base" and select the roof element. The resulting geometry is shown in Figure 5. This seems simple enough. However, this attachment method is limited to a roof surface and a vertical wall surface because a vertical wall will only attach to a roof element. What do you do if a wall element was used instead of a roof element as described in the previous section? Use the edit wall profile command.

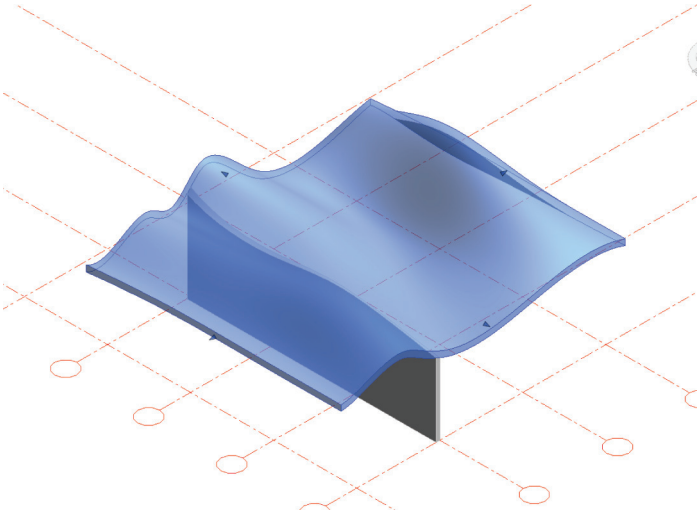


Figure 5: Placing a wall by attaching to roof.

CREATING COMPLEX WALL PROFILES BY EDIT PROFILE

We are able to get the same result as Figure 5 by using the edit wall profile command. The edit wall profile command allows you to define the "extents" of the wall including the bottoms, sides, and top. The command is shown in Figure 6.

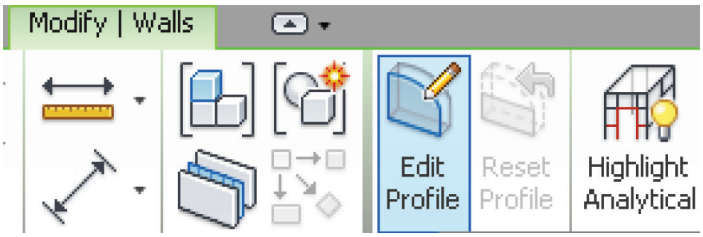


Figure 6: The edit wall profile command.

The top of the profile of the wall will need to be defined. How is this done? How could the top of the wall be found? Create a wall and create an elevation view as shown in Figure 7.

Next try "picking" the profile line using the "pick" line command. However, you cannot pick the bottom of the roof surface in the elevation view as shown in Figure 7.

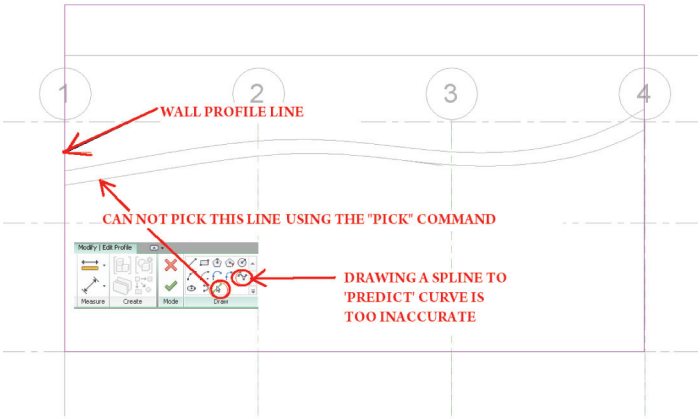


Figure 7: Wall elevation showing the wall profile.

The inability to pick this line in elevation is a big limitation in Revit. So rather than wait for Revit developers to add this feature, I will use another solution. There is a very useful method that will allow you to "pick" that line at the bottom of the roof surface. It is so useful that we will show how it could be applied to other elements including beams. For now, let's take a step back and examine what that line at the bottom of the roof surface really is.

The bottom of the roof surface/top of the wall is simply the intersection of the roof surface and the vertical wall surface. All we have to do then is find the intersection of those surfaces as shown in Figure 8.

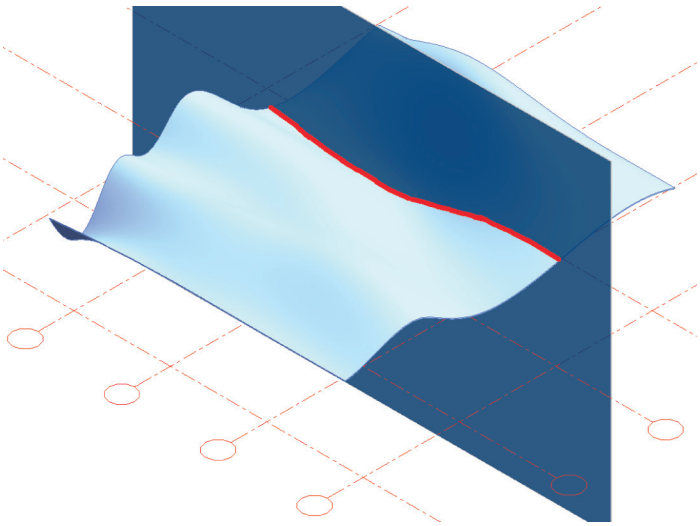


Figure 8: The intersection line of the roof and wall surfaces.

NOTE: I don't recommend using the spline command to find the top of the wall profile because it is only an "estimate" of the location of the bottom of the roof surface.

PICKING THE INTERSECTION OF TWO SURFACES

I am sorry to say that unlike 3ds Max, Revit has no simple command that allows you to "find" or "pick" the intersection of two surfaces. However, there is a phenomenon in Revit whereas if you "join" any two solids together, they result in a new entity, the edges of which are "pickable." To illustrate this method, let's create a sacrificial wall at the same location as the wall shown in Figure 9. Join the wall and the roof surface. Notice that the roof surface now has new edges where the wall profile line is located. Select the wall to which you want to apply the profile. Select edit profile. Select "pick" line and select the new edge of the bottom of the roof. The result is the same as shown in Figure 5. As mentioned above, this method I call "the intersection method" is powerful. Let's now apply it to beam framing on the roof surface.

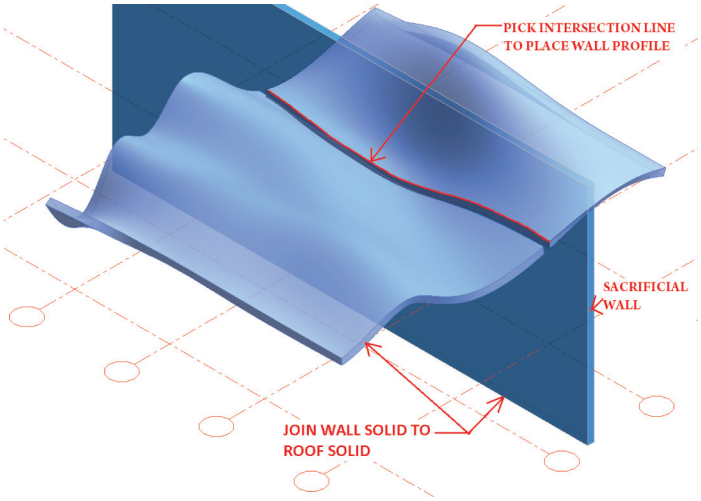


Figure 9: Picking the intersection of two surfaces.

NOTE: The sole purpose of modeling reference planes, reference lines, and reference points is to use them as "guides" to model other Revit elements such as gridlines, walls, etc. However, there is nothing preventing you from using Revit elements such as walls and slabs as guide entities. I call these elements sacrificial elements because they are to be used and discarded at a later time. In fact, using sacrificial walls and slabs as guide entities is sometimes the only way to model complex elements.

CREATING COMPLEX BEAM GEOMETRY WITH THE INTERSECTION METHOD

The following method below describes how to place beams that curve in one direction using the standard structural beam > pick command and the intersection method.

Determine in what plane the curved beam will be located and place a vertical sacrificial wall whose face lines up with the plane of the curved beam. This vertical wall is used as a "guide entity" as described earlier and may be discarded later

Join the vertical wall to the roof using the join command. Note that when the wall and the roof are joined, then the wall "cuts" out a portion of the roof as shown in Figure 9.

Repeat the above steps for all beam locations and the final roof surface should look similar to Figure 10

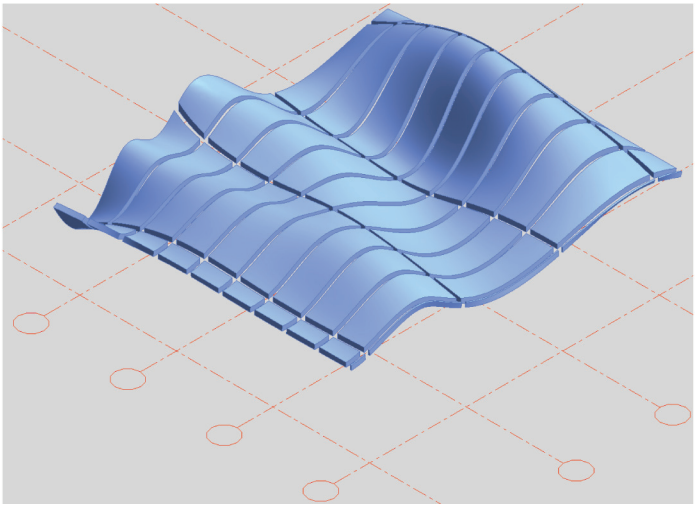


Figure 10: Roof solid with all wall joins before beams are placed.

Before a beam is placed, the work plane has to be defined. Simply set the work plane to the face of the wall solid.

To place the beam, activate the beam > pick command and pick the intersection of the vertical wall and the roof surface as shown in Figure 9.

Repeat these steps until all the beams are placed. The final roof framing should look similar to Figure 11.

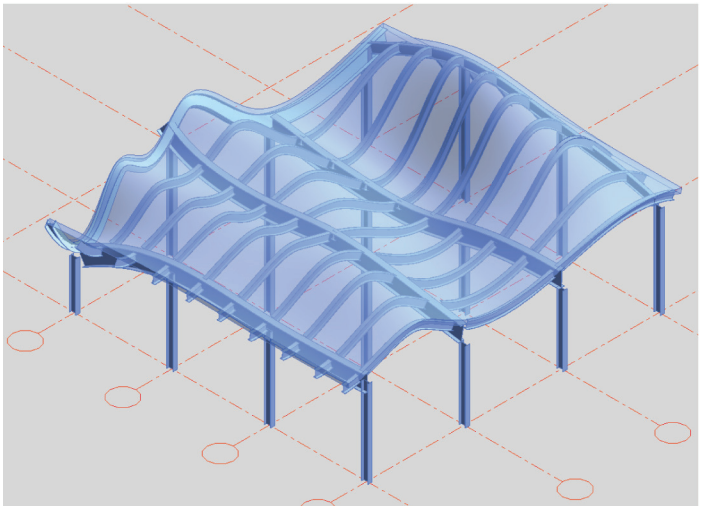


Figure 11: 3D view of final beam framing.

Note: Sometimes the roof surface is too complex and a structural beam family cannot be created when using the pick command. In these rare cases, use an in-place mass and create a beam cross section/profile.

A COW? ARE YOU KIDDING?

Now that we have studied how to apply a roof and wall element by face and how to create wall geometry and beam geometry by the intersection method on a complex roof surface, it's time to apply these new methods to something extremely complex. Let's consider using the Revit Cow (Figure 12) as an example.

Figure 12: The Revit Cow mass family.

Figure 13: Wall by face applied on cow surface.

I built this cow out of surfaces in the mass family editor that consists of hundreds of reference lines and thousands of reference points. I chose this cow family to represent an extreme example of complex geometry. Hopefully, this is nothing that you would ever encounter in your projects. However, if you are able to apply the methods described above to something as complicated as the Revit Cow, then I am confident you will be able to apply these methods to any complex surface that anyone could throw at you in the future. Let's get started.

WALL AND ROOF SURFACES

CREATING BY FACE

To apply the wall surface by face, select wall >wall by face> pick the cow mass surface. Note that when picking by face you are only able to pick mass surfaces or generic model faces. The results are shown in Figure 13. For clarity, only half the cow is shown in realistic view. Can you believe that is a wall? Note that the roof by face does not work on the Revit Cow mass family because the surfaces are too complex.

COMPLEX FLOOR ELEMENTS

Next, let's create a floor element inside the cow and use the newly applied wall by face as the boundary. The following steps illustrate how to do this.

Create a wide and thick sacrificial floor surface at the desired location of the floor and make that floor location the current work plane. In this case it will be about halfway up the cow's body. Join the cow wall and floor. The result is shown in Figure 14.

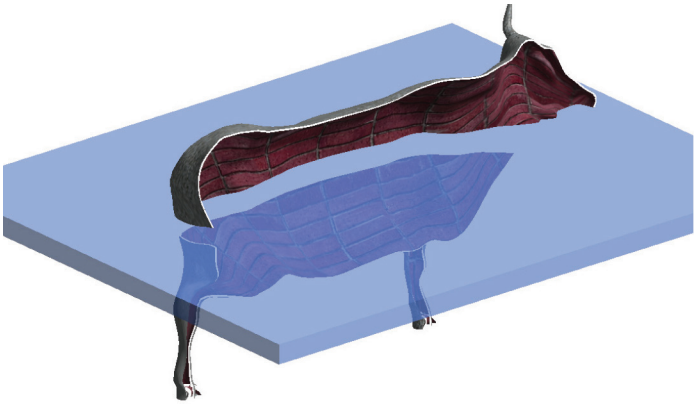


Figure 14: Sacrificial floor element joined to wall.

With the floor active as the work plan, create a new floor and click on the "pick" line tool. Select the edge of the newly created joined wall. Complete the sketch so the floor boundary creates a closed loop. Click finish. The final product should look like Figure 15.

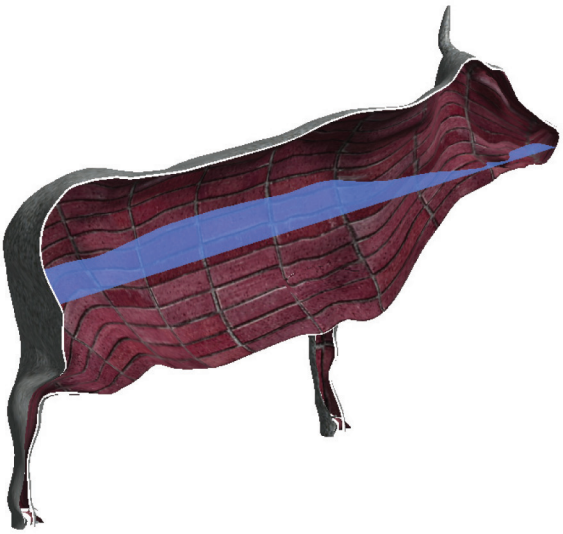


Figure 15: Floor element using Cow as boundary.

CREATING COMPLEX BEAM GEOMETRY WITH THE INTERSECTION METHOD

Finally, let's see how modeling complex beam geometry with the intersection method will look on the Revit Cow. Follow the steps given in the previous section and the following geometry will result as shown in Figure 16.

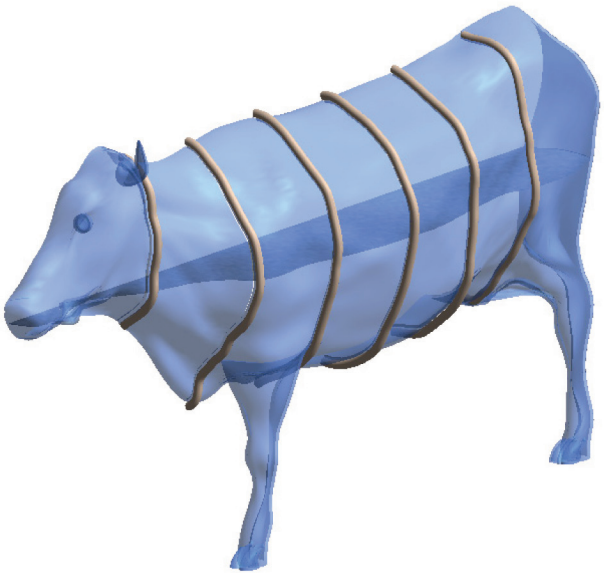


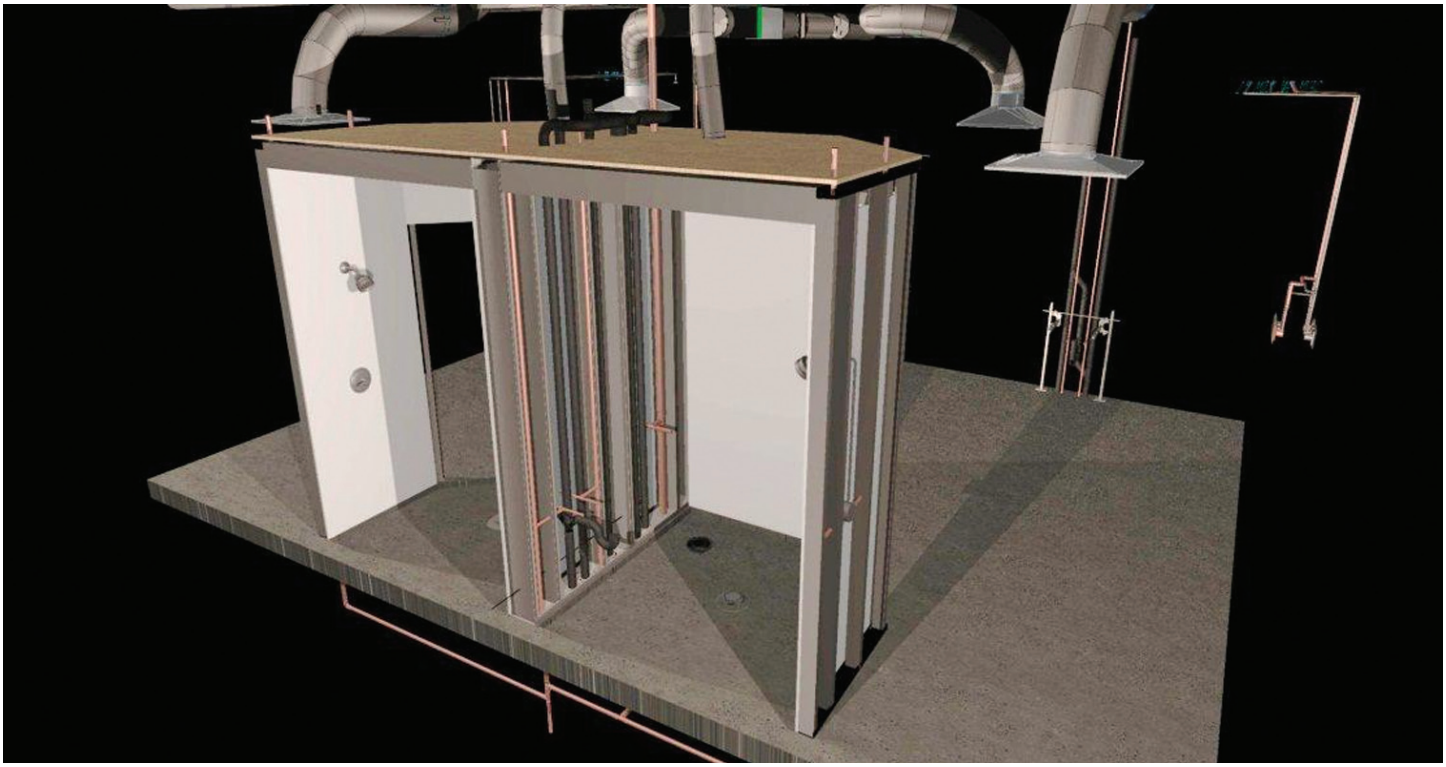
Figure 16: Structural beams applied to the Revit Cow.

CONCLUSION

Hopefully, after reading this article you are able to take away some tips on how to model complex roofs, walls, floors, and beams. Apply these methods to your projects at the office, especially the intersection method, and I am sure you will be ready to tackle any complicated geometry your clients can throw at you. Tell them to hit you with their best shot! Good luck.

Marcello is the BIM Director at John A. Martin & Associates Structural Engineers in Los Angeles, CA. He has been using Autodesk products for over 15 years including AutoCAD, 3ds Max, and Revit Structure. He is a member of the ASCE-SEI BIM committee and continually speaks at structural professional conferences across the country. Marcello teaches classes regularly at Autodesk University that focuses on free form modeling in Revit and he beta tests the yearly releases of Revit Structure. He has worked on many projects that incorporated complex geometry including the Walt Disney Concert Hall in Los Angeles, CA, the Stata Center at MIT, and the International Terminal Expansion at LAX. Marcello received B.S. and M.S. degrees in Civil Engineering and is a licensed Civil and Structural Engineer. He can be reached at marcellojs@johnmartin.com.

Navisworks Manage, from a Contractor's Perspective



There is more to the saying "a picture is worth a thousand words." For us this statement is very true and has paid off in many different ways using Autodesk® Navisworks® Manage and Presenter as a way to coordinate, get a point across, or deliver what we like to call "the WOW factor."

At first the thought of rendering from a contractor's perspective is almost always seen as a waste of time and money. Why would we as a company be willing to spend any effort on making things look pretty in a picture? You cannot use it for submittals or fabrication; it takes time away from production and essentially is billed as the dreaded word "OVERHEAD." Visuals are everything in this age of 3D BIM and IPD. Trying to coordinate is pretty easy now with the tools we have at our fingertips if we look at things from an outside-the-box approach.

We started a large hospital IPD project last year and for most of the team this type of trade partnership and integrated design with the owner/architect and contractors was a new experience. As a design build mechanical contactor, we are accustomed to the coordination process and very familiar with 3D modeling. Getting in on the ground floor of the design and 3D modeling up front is a huge benefit for us and an opportunity to give some input into some of the building's design with the architect to get a better-built, cost-effective system for us to build. Prefabrication was a hot item and the obvious choice in cost saving for all trades.

The first task for the design team was designing a prefabricated back-to-back patient restroom that could be designed on the ground in a fabrication environment and then be hoisted into the five-story building as floors were ready. The restroom was on the exterior of the building so they would be lifted and pushed into place with the connected utilities between floors added after installation.

I was tasked with getting the project model off the ground. Starting with the 2D arch plans I created the models walls and slab portions adding plumbing, piping, and ductwork then sent the model to the fire and electrical contractors for them to model their portions. We put it all together in Navisworks and did a couple online group meetings with the owner's rep and the design team. The presentation was good, but in basic Navisworks Manage shaded views it just didn't quite pop for me. So the persistent side of me came out and I started playing with the rendering tools in Manage. I had always been into rendering in AutoCAD with Accurender and 3ds. So I jumped in with both feet and gave it a shot. The outcome was rewarding and fairly easy. This image (Figure 1) is the first saved rendering after about 10 test render-

ings. The best part of the rendering was finding out that half the team had made the image the wallpaper on their workstations. The design was a success and we are in production of the mock-up now.

Let's take an example from a collision/coordination meeting I was in today. The soffit design in the new medical center atrium was too small to fit all the required ductwork supplying the linear diffusers below. Navisworks was the perfect solution to show this situation. This is the typical viewing style for most of us using Navisworks today in the contractor's world and was effective in showing our concern. But with a little bit of time and effort, this viewpoint could transform into an almost photorealistic picture.

I am going to try to use this viewpoint as an example and take you through a fairly easy way to get a life-like rendering. This view (Figure 2) is the basic render style set to full render. This is basically just a shaded view with some shadowing and highlights.

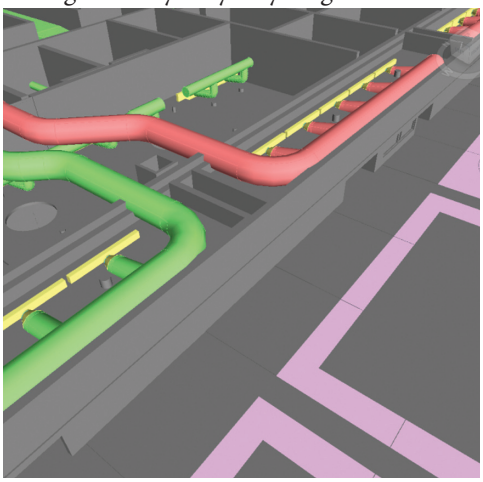


Figure 2

There are seven tabs on the Presenter palette and I will touch on most of them in this article. Figure 3 shows a screen shot of the tabs in Presenter.

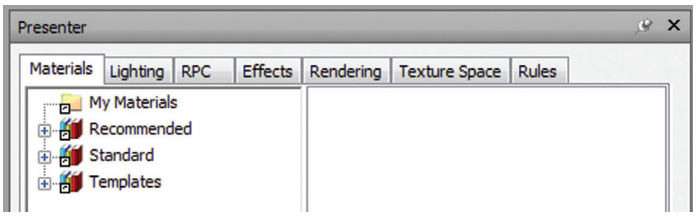


Figure 3

The first tab we visit is Materials. The Materials tab is actually really easy to use to create a materials library and apply it to selected items in a variety of ways. You can drag and drop right onto any object, apply it to selection sets or layers by selecting objects and then materials, or choosing a material then the objects. Figure 4 is hitting the render button and Figure 5 is the same rendering after materials are added. Figure 6 is a screenshot of my Materials palette by simply browsing through the library and dragging them into your library on the right side of this tab.

The next tab to visit is Lighting. This is a bit intimidating at first, but trial and error will let you get comfortable pretty quick with something other than the generic lighting defaults. There are three default light types in a typical model when you start rendering. You can toggle the existing lights on or off and control the intensity as well. I found it is best to keep them around until you are really set on a light to manually insert into the project. Figure 7 shows the default lighting and Figure 8 is after I dragged an environment sky light from the recommended lighting archive onto my lighting palette then un-checked the default lights and hit the render key. This alone made quite a visual difference seen in the rendering (Figure 9).

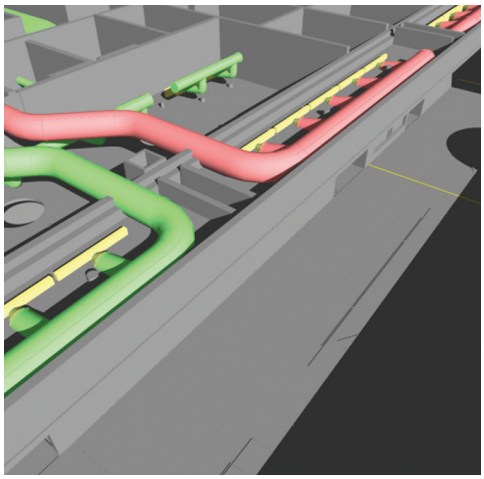


Figure 4

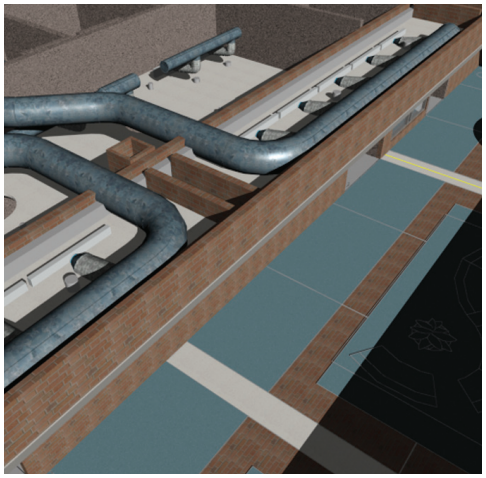


Figure 5

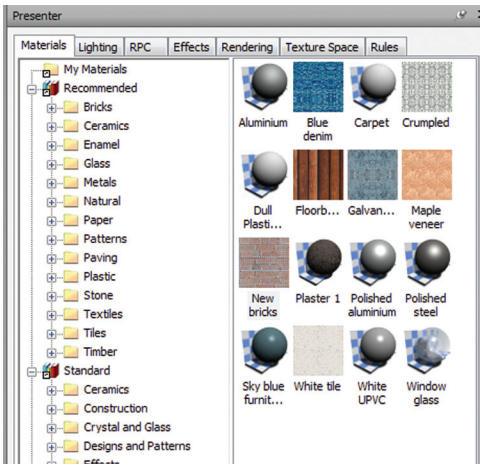


Figure 6

The next tab to visit is RPC. This tab is used to add fairly realistic people into your renderings. I found that the best way to get through some parts of the software is to just try it and to learn by trial. I added a few people and a tree to my scene and hit the render button. When it rendered I didn't see the people I had inserted. I knew I had just added three people and a tree but where were they? After some digging I discovered that the images are deep inside the Navisworks Manage folder and that I had to browse to them in their individual properties dialog box to get them to show. Figure 10 is the populated rendering.

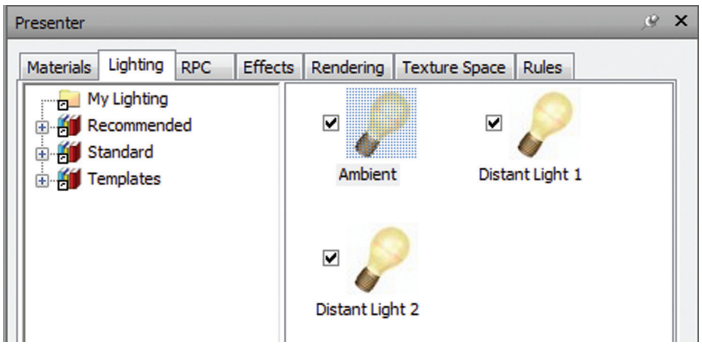


Figure 7

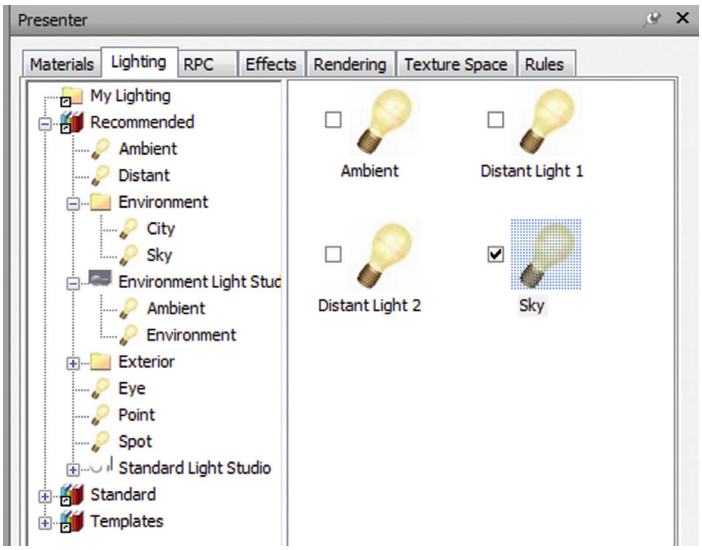


Figure 8

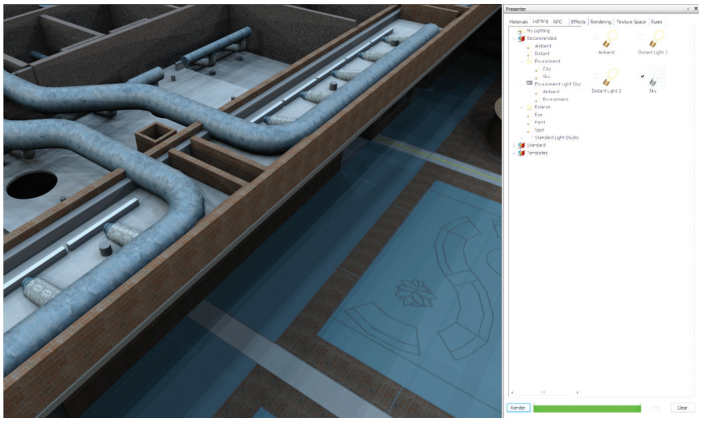


Figure 9

Not really sure if this is normal, but these steps are what I had to go through in putting this demonstration together. Figure 11 is

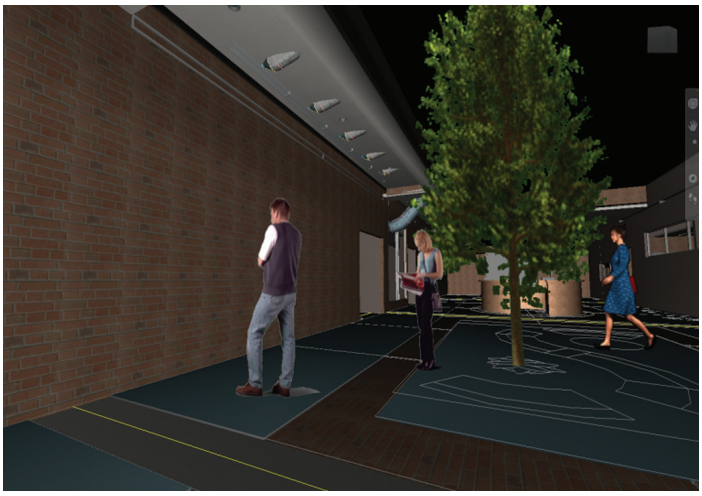


Figure 10

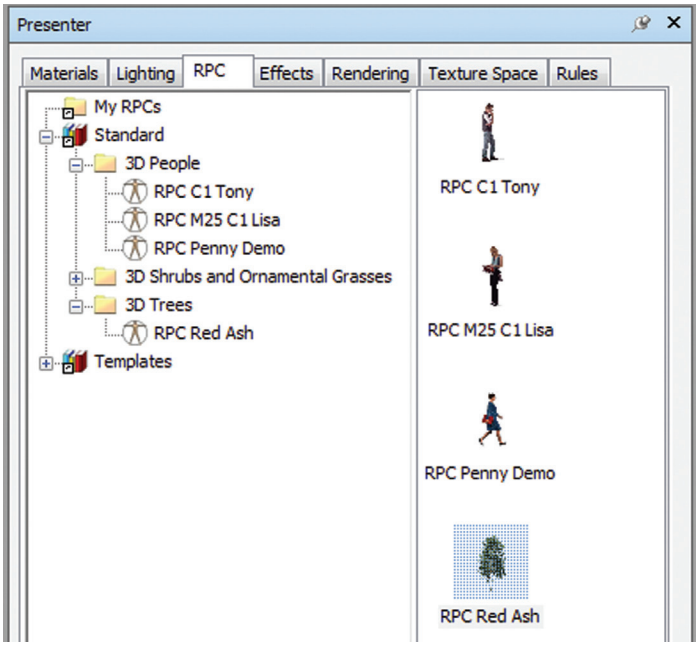


Figure 11

after browsing for the files and Figure 12 is the path to where I finally found them.

The next tab is Effects. This is a fun tab to play with to try different things in your renderings. Under this tab, you can add backgrounds, sky scenes, cloudy sky, and even street or factory scenes. Depending on your desired outcome, this can really add realism to your images. Figure 13 is after adding a cloudy sky from the archive and Figure 14 is after I did the final render-

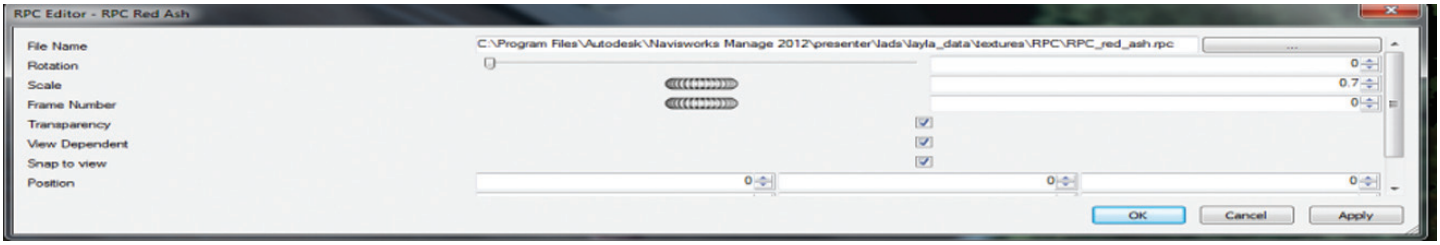


Figure 12

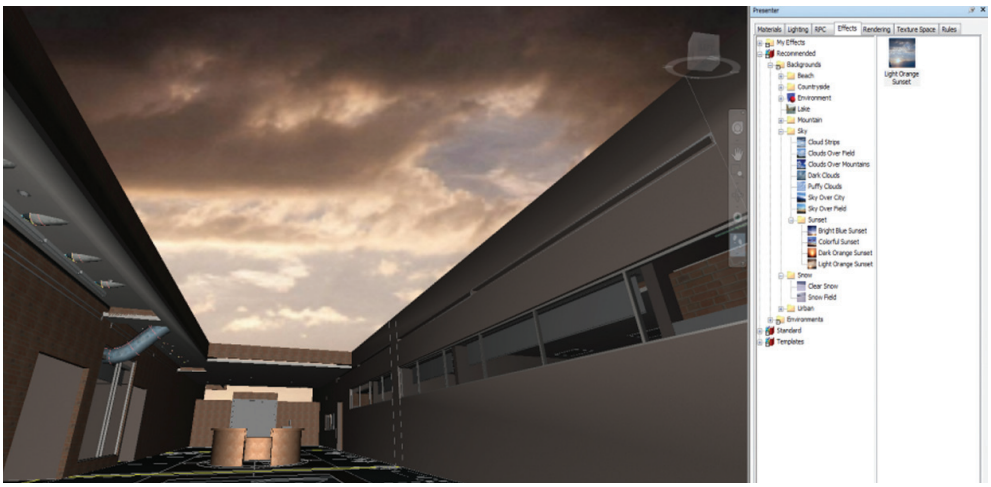


Figure 13

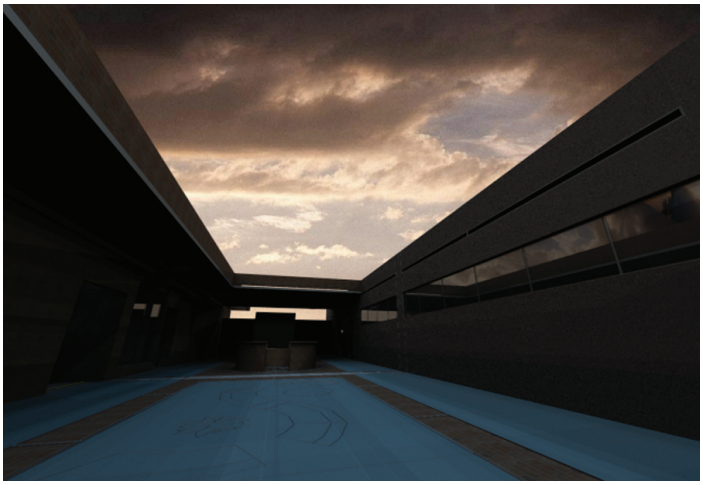


Figure 14

ing. Notice the reflection in the window material added earlier. (Pretty realistic!)

There are more really cool things you can do in the Effects tab such as adding foreground fog and background images.

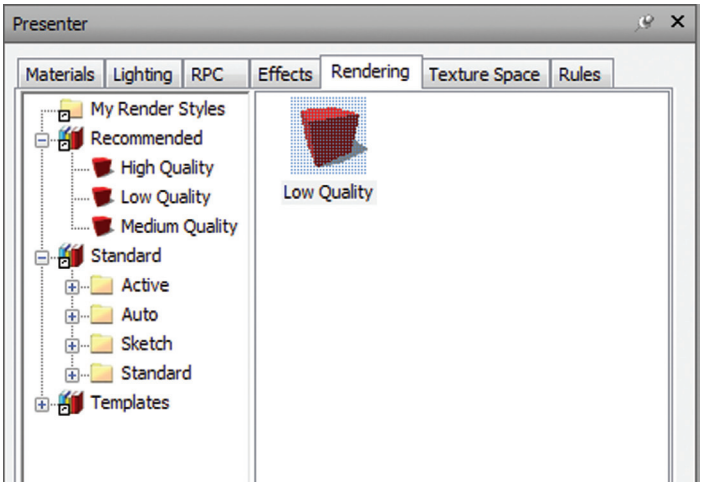


Figure 15

The Rendering tab is next in the Presenter palette and the one where I quickly notice a big difference in the quality of a rendering. You can do test renderings with a low setting (Figure 15) and then when you get set to save the image to a final output you switch to a high quality setting. It's as easy as dragging and dropping the higher setting (Figure 16) render to your palette. You also can do some crazy effects as seen in Figure 17. You can only have one render setting at a time in your palette.

There are two more tabs in the Presenter palette. The Texture Space tab is used for mapping textures to objects. You can think of it as a form of shrink wrap for an object or geometry. You can select an object and apply a jpeg or bitmap image to it through the Materials tab and palette, then in the Texture tab change how the image is "wrapped" around the object. An example would be to apply a label to a cylindrical object and then apply a cylindrical texture space or wrap to it. This would make the image curl around the can and look better than just a square image on the front of the object.

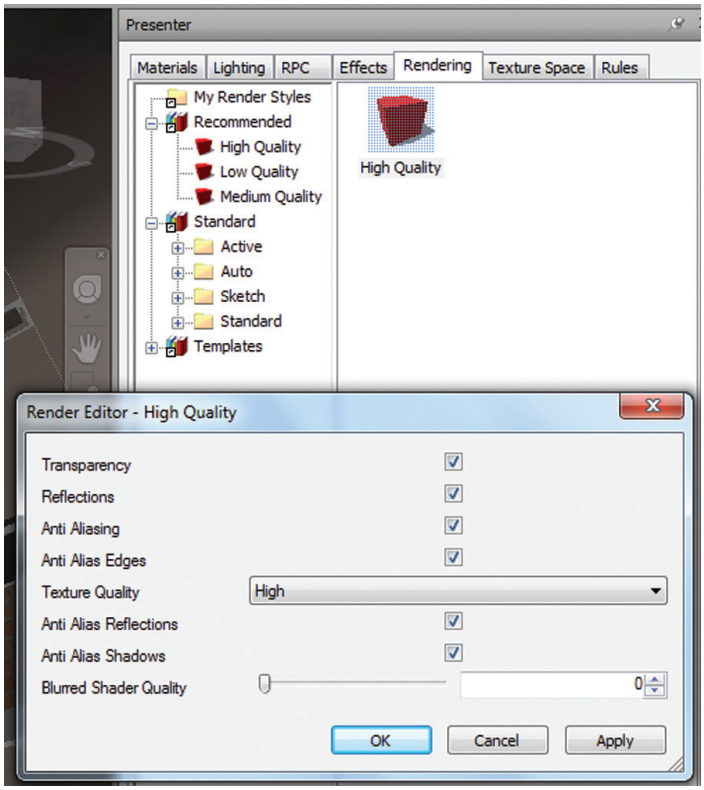


Figure 16

Texture takes some time to master, so my advice is to start simple with a few types of objects. Let's say start with a cylinder, a box, and a sphere in basic AutoCAD®. Import them into Navisworks and try a few different types of texture mapping to the objects (Figure 18).

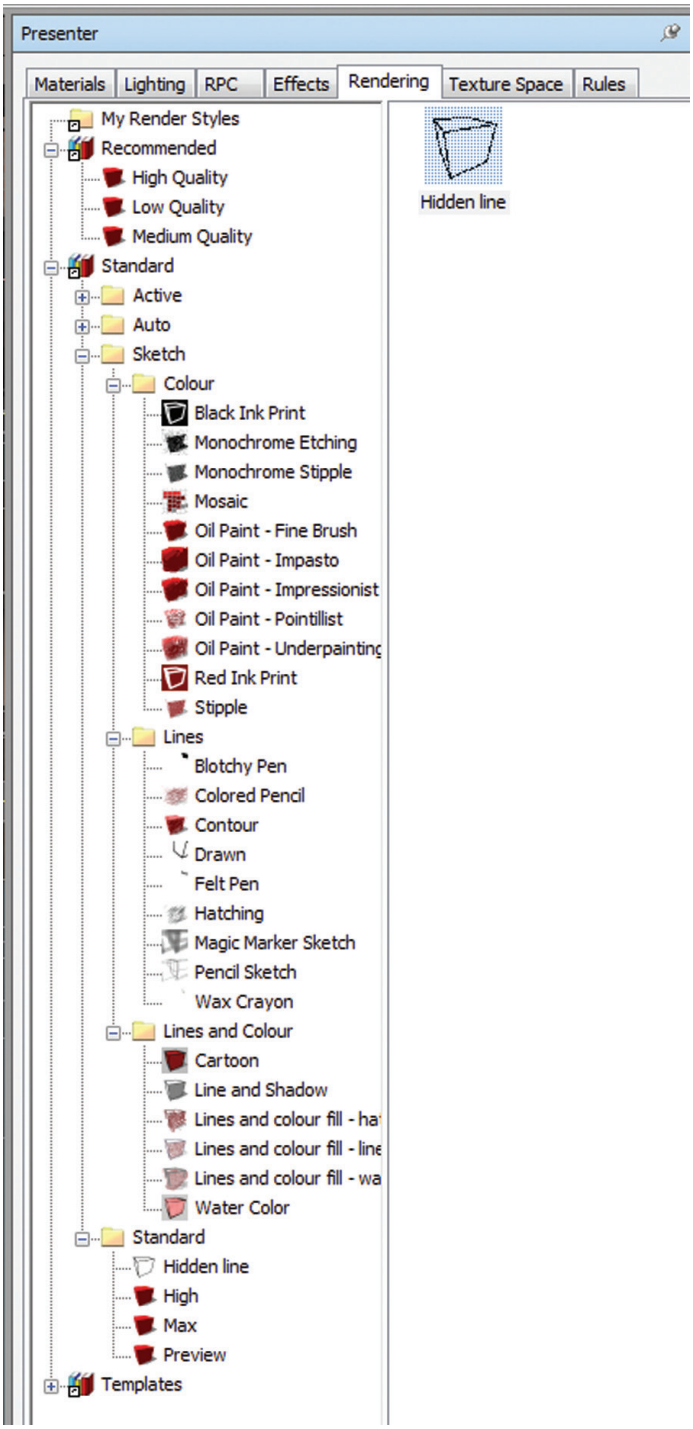


Figure 17

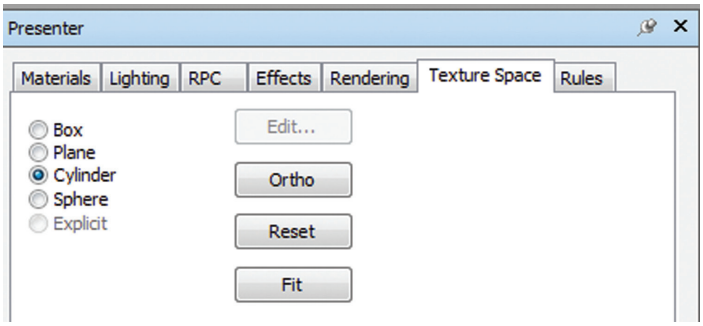


Figure 18

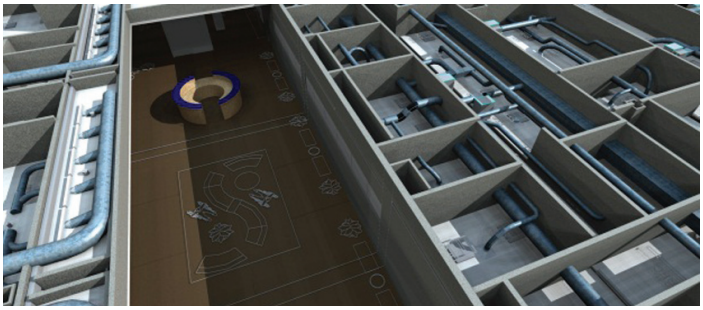


Figure 19

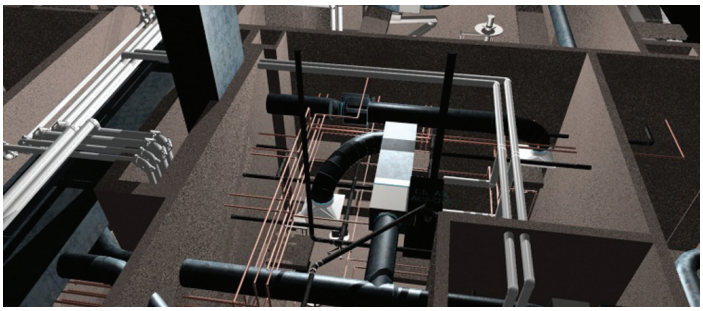


Figure 20

The final tab is for setting up rules in the Presenter palette. This is an excerpt from the Navisworks help file and explains it quite clearly; *The Rules tab of the Presenter window allows you to apply materials to models according to certain user-defined criteria, rather than by dragging and dropping onto individual layers, groups or components. For example, all layers that are floors can be assigned a material called "floorboards," without having to manually drag and drop the material on to each floorboard. Each time the model is updated, the rules then just need reapplying, rather than manually reapplying materials to all items.*

With a little patience and practice you can easily render any of your models in Navisworks Manage using Presenter and impress your clients or possibly land that new job if the owner is on the fence about making the big decision.

Good luck and happy rendering.

Chris Lanahan is the BIM/Cad Manager at Southland Industries as well as a plumbing designer. He has 18 years experience in design/operation of software. His experience includes: Autodesk University Presenter, AutoCAD® 2D and 3D design for mechanical and plumbing systems, AutoCad MEP Specialist, 3D Solid modeling and rendering in Inventor and Solidworks, Navis Manage Trainer, Lean manufacturing, prototyping, and creating mechanical designs for new and existing construction. His experience also includes 17 years of plumbing as a contractor, designer, estimator and service repair plumber.

Revit, in a Database

Building information modeling (BIM) is often seen by outsiders and unfortunately, many insiders, as the creation of a 3D model. Actually, BIM is much more. BIM is about information—architectural design information, systems information, cost information, and schedule information. The information model is equally important, if not more, than the physical model.

Autodesk® Revit® stores not only the location and types of components required to make up the building, but also a host of information about those components—height, length, width, cost, manufacturer, and custom parameters. More often than not, the information included in a model is limited to what is needed to be scheduled in the construction documents. In this article, I will demonstrate how the Revit DB Link plug-in—available in the Autodesk Subscription Center—allows all the information in a model to be exported to a database and imported back into Revit. I will conclude by discussing some of the benefits of having a model in a database.

REVIT TO ACCESS

The Revit DB Link plug-in is available at the Autodesk Subscription Center. After downloading and installing the file, it will become available under Add-Ins > External Tools > Revit DB Link. When you are ready to export your model, select the plug-in and you will be prompted with a dialog box.

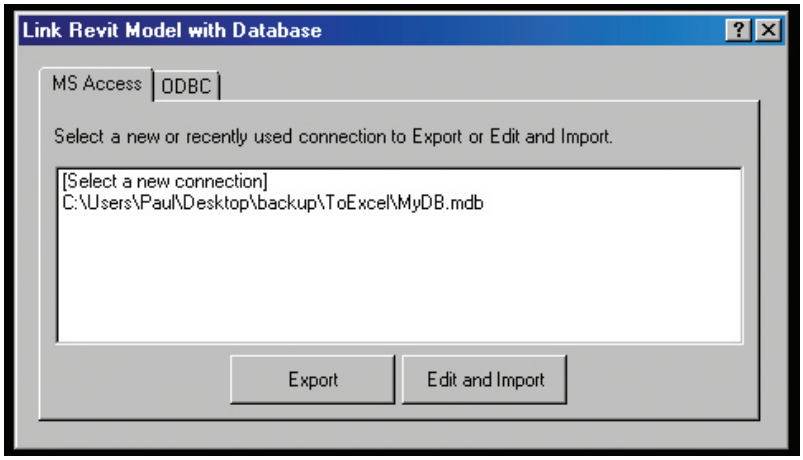


Figure 1: Link a Revit model with a database.).

You can export to MS Access via an ODBC link, which will also link to other databases, and MS Excel; however, the plug-in will allow us to go straight to Access.

First, create a new Access database and save it as a 2002-2003 database. Next, select the Revit DB Link plug-in. Under the MS Access tab, highlight [Select a new connection] and click EXPORT. Select the database you created in the first step and click SAVE. If your model is large, the exporting may take several minutes. When the progress bar completes, open the database. You should now have a database with several tables.

Congratulations, you have a Revit model in a database. Now what? Let's modify the database and upload those changes back to Revit.

ACCESS TO REVIT

Once a model has been exported to a database, any changes made in that database can be brought back into the Revit model. These changes can be both attribute modifications such as room occupancy information, and modifications to the components such as wall height.

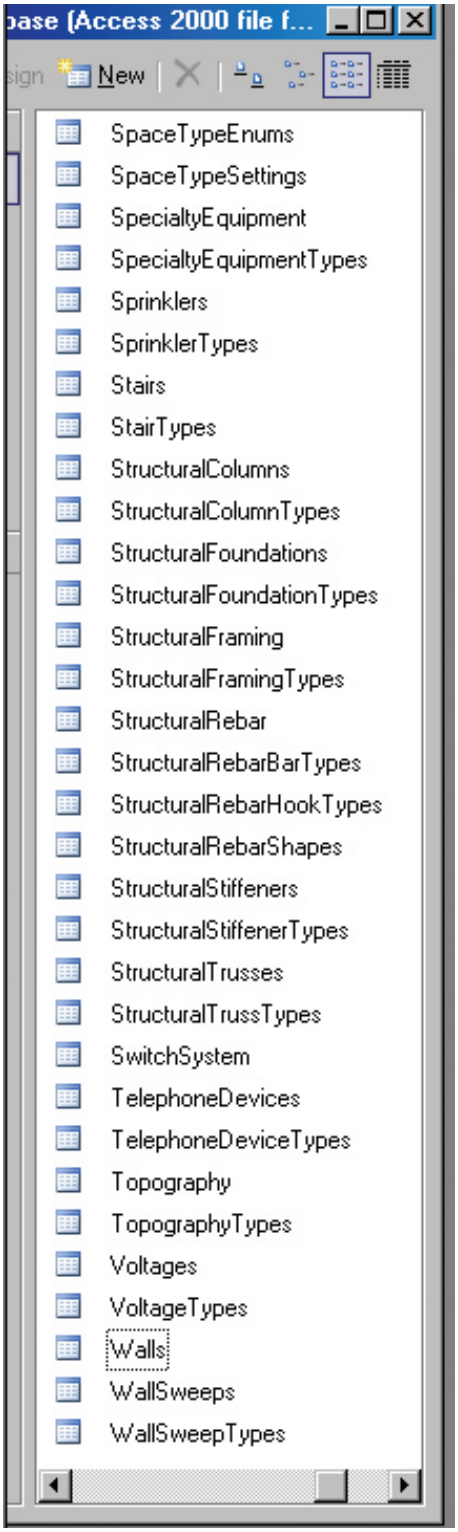


Figure 2: List of Revit tables in Access.

My model is four walls with a room. I have exported the model to a database and will demonstrate how to modify an attribute and a component. Scroll down to the Rooms table in the database. There will be an "Occupancy" field. In the box, add a number—I added "25." Next, scroll down to the Walls table. Find the "Unconnected Height Field." There should be four entries with the value "20." Modify the heights – I made them 50, 25, 20, and 10. Save the database.

To load the changes back to Revit, select the DB Link plug-in and highlight the connection to the database. Last time we clicked EXPORT, but this time we will click EDIT and IMPORT. As Revit uploads the database, it will prompt you with a list of the tables you can import. First, select the rooms table. Revit will use your default web browser to display a report of the changes that have been made. Notice that there is a list of tables that cannot be imported. Go back to the model and select the room. The occupancy field has been updated. In the model, select a 3D view. Follow the same steps as with the room EDIT and IMPORT, but select the WALLS table. The 3D view will automatically update and the walls are now different heights.

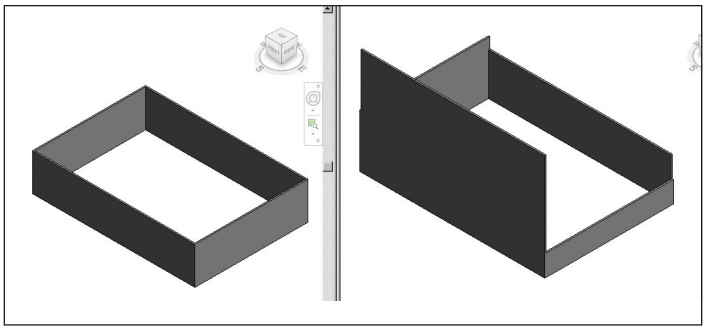


Figure 3: Original and modified models via DBlink.

REVIT TO EXCEL

Revit can also export to other databases and MS Excel. To export to Excel, you need to create an ODBC connection. You can either select a new DSN after clicking EXPORT in Revit, or you can create the connection from Windows under Control Panel > Administrative Tools > Data Sources (ODBC). Follow the same steps as exporting and importing from Access.

I know more people may be familiar with Excel than with Access, but it is my opinion that exporting to Access is, in most cases, a better choice. For one, an Excel export can be uploaded back to Revit only one time. The sheet must be deleted and re-exported if you wish to upload it again. If you must use Excel, I would recommend exporting the model to Access and then link the Excel sheets to a table in your database—always going through Access to Revit.

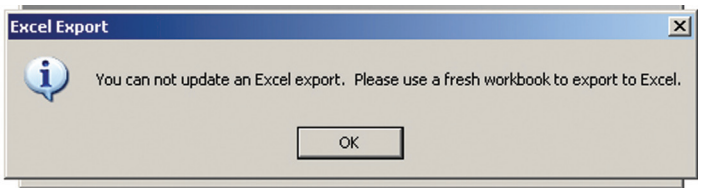


Figure 4: Trying to export to Excel for a second time.

BENEFITS OF REVIT IN A DATABASE

One of the most obvious benefits of having a Revit model in a database is the ability to generate reports and schedules that are much more advanced than those created natively in Revit. Currently, Revit cannot concatenate strings or use an IF statement with text. Access can.

Just as we create project templates in Revit, we can do the same with Access. Because Revit always exports the same way—tables always have the same names and there are set parameters that always export—schedules can be created in advance. Other tools,

such as Pivot tables, queries, and forms can also be created in a template. When the model is exported into the template database, these tools will auto-populate or can be run immediately.

We can create database templates for Revit because when Revit exports to a database, it only writes its data to the database. This even applies to fields within a Revit table. For example, Revit will write out a Wall table. If we add a field to this table in Access, Revit will ignore it when importing the model back to Revit and when exporting it out.

This is important because it means we can load data into a project that may not need to exist within the Revit model. For example, a table with wall assemblies and costs could be loaded into the Access database and joined with the Walls table from Revit. We could then create a report of all assemblies and their costs.

When large amounts of data are added to components in Revit, performance takes a hit. By splitting the model—adding only the necessary information in Revit and joining the rest within Access—we can keep our file sizes down and work more efficiently.

Access allows for the creation of forms. A form is a portal to the database. The creator of the form can select what the user has the ability to query or modify. This gives others in the office the ability to query and modify a model without using Revit. This could be valuable if an employee from marketing needed certain information from models. They could pull this information through the form in the database.

We can take the form concept even further. Databases serve as the back-end to many websites. Through the use of the commonly used programming language PHP, a website can be built and connected to a Revit model which has been exported to a database.

> One of the most obvious benefits of having a Revit model in a database is the ability to generate reports and schedules that are much more advanced than those created natively in Revit.

This would allow queries or modifications of the model from anywhere in the world.

Finally, by separating the modeling from the data entry we can allow the architect and drafters to work on the physical model while another employee updates the database with attributes. After the architect places rooms, he or she can export the model to a database. A coworker can then open the Rooms table and enter the department, room number, and occupancy attributes. Because Revit asks us to select which tables are imported back to the model, we can make sure that only the Rooms table is uploaded. Any changes to other tables that may have occurred by mistake are ignored. Furthermore, because Revit generates an HTML report of the changes made, we have a document trail to show us if any mistakes have occurred and when.

CONCLUSION

Once a Revit model has been exported to a database, the things that can now be done with it are limited only by your imagination. Build web-based or stand-alone front ends to access and modify your model—without knowledge of the Revit API. Bring existing data into a database and join it with the Revit model.

The importance of the "I" in BIM should not be overlooked. Hopefully, I have shown you a way that makes it easier and less costly to add and maintain the data associated with your project. The greatest benefit of the Revit DB Link is the ability to load the data back in to the model, making sure it is always up to date.

Paul Crickard is an educational facility planner in Albuquerque, New Mexico. He is one of the first planners to adopt Revit and Building Information Modeling (BIM) in the preparation of master plans for the state. Currently, he has been working on the integration of Revit and BIM in Geographic Information Systems (GIS). With a Masters degree in Political Science and a background in Community, Regional, and Educational Facility Planning, Paul combines rigorous social science theory and techniques with practical planning and architectural projects. He has presented papers at the United States Naval Academy's Foreign Affairs Conference and the American Journalism Historians Association Regional Conference in Salt Lake City. He has given demonstrations on the use of Revit, BIM, and GIS to the Public School Facility Authority in New Mexico and the Albuquerque BIM505 Users Group. He can be reached at paulcrickard@educationalfacilityplanning.com

Tryba Architects
renderBOXX Plays Key Role in High Profile Projects

Tryba Architects is an architecture, urban design and planning firm with a national reputation for design excellence. Led by Colorado native David Tryba, the Denver-based firm embodies its founder's passion for cities, as well as his design philosophy—coupling modernist design techniques with a respect for historic and urban context. The result is a new standard for modern contextual urbanism in numerous civic, cultural, corporate, and mixed-use projects. Recognized for his skill in the design of complex projects and recipient of numerous architecture and design awards, Tryba and his firm have been remarkably successful in the design of large infill projects and systems that inspire new neighborhoods and districts in emerging American cities.

Cesar E. Chavez Federal Building and Parking Complex
Location: Denver, Colorado
Square footage: 179,375 sf
Cost: $33 million
Completion Date: 2012

History Colorado Center
Location: Denver, Colorado
Square footage: 198,000 sf
Cost: $110 million
Completion Date: Fall 2011

Tryba Architects' image of the History Colorado Center rendered using a renderBOXX system from BOXX

The Design Process

Before beginning the process of formal design, Tryba Architects engages the client as early as possible in order to develop their program and investigate the inherent possibilities and opportunities. "It is vital that we understand to the greatest extent possible their mission, business plan and goals before developing the physical aspects of the building and spaces that will serve those functions," says founder and president David Tryba.

And as different clients have unique ideas, plans, and goals, they also have different preferences with regard to presentation graphics. While some are more comfortable in their understanding of traditional architectural drawings, i.e., plans, section and elevations, etc., others need to see more detailed renderings in order to fully grasp all of the concepts involved in a project. Fortunately, Tryba Architects is able to adapt their graphic style to a client's particular needs while still maintaining a consistent, high quality palette.

"Internally, we use digital models and detailed renderings more and more frequently

in the early design stages to understand complex detail conditions as well as general concepts," says associate principal Collin Kemberlin. "And having the capability to simulate materials, lighting, and architectural features quickly and accurately speeds our ability to make design recommendations to our clients."

In many cases, the ability to depict aspects of the finished building continues through documentation and into the construction phases. However, Kemberlin is quick to point out that as opposed to a linear process, Tryba Architects' design process is more akin to a spiral since it often circulates through and tests concepts at increasing levels of detail and sophistication.

"Our process is cyclical in a way," he says. "We will quickly test concepts in rough sketches or models (both physical and digital) before developing those concepts with input from our consultants. As concepts are developed though, new information may be obtained that requires a re-evaluation of the basic concept."

With regard to both software and workflow, the Tryba team incorporates two separate processes, though on complex projects (where design issues may be at different stages of development and sophistication) it is not uncommon for both processes to run simultaneously. Their workflow process, which used to begin with original hand sketches followed by Autodesk® AutoCAD® 2D drawings, now favors digital 3D modeling and rendering with products such as Autodesk® Revit® Architecture, Autodesk® 3ds Max® Design, Adobe® Photoshop® CS5, or Google SketchUp. Constantly evolving, Tryba is experimenting with a new digital ideation process as they move forward with Autodesk® Alias® Sketch and Adobe Photoshop CS5.

With Autodesk applications and renderBOXX, Tryba Architects created a photo realistic look at the inside of the Cesar E. Chavez Federal Building.

The Projects

The ten-story Cesar Chavez Federal Building (constructed in 1984) is home to a number of federal tenants including The Internal Revenue Service. Plagued by outdated and inferior mechanical systems, inadequate parking, and a deteriorating exterior, the structure was due for a major modernization. The project includes demolition of an existing parking structure deemed unsafe, full site work, design, construction, commissioning, and construction management.

History Colorado Center is a new building, just completed near the site of the old Colorado History Museum which closed in 2010. The new History Colorado Center will house a museum, curatorial and collections storage space, educational and public programs, the Office of Archaeology and Historic Preservation, the State Historical Fund, The Stephen H. Hart Research Library, and other Colorado Historical Society functions. It will open to the public in three phases beginning in the spring of 2012.

The Challenges

Because of the size and scope of this pair of high profile projects, principal architects David Tryba and Collin Kemberlin decided at the earliest stages that they would need renderings at all design phases, as well as detailed documentation of all design iterations throughout the creative process. By doing so, they would be delivering the best design possible for the client, and ultimately, the local community. However, it soon became apparent to the team of Saul Hayutin (Designer), Ken Roberts (Intern Architect) and then BIM Manager Richard Lopez, that it was going to be difficult to fulfill that request. At first, the team took their Revit Architecture model and imported it via FBX File Link to 3ds Max Design. By doing so, they could ensure that when the client, Tryba, or Kemberlin were reviewing design options, they were looking at what was actually going to be built by the contractor. They soon encountered a problem however, since their computer systems (Dell Precision 490 models) were taking anywhere from 8-36 hours to render. And since the team's system could no longer keep up with rendering

requests, a backlog formed in the production pipeline. “We needed a system that would deliver rendering quickly in order for us to make rapid decisions on design options,” says Roberts.

The Solution

They also determined that a new system would have to arrive with specific requirements. It would have to be flexible (allowing multiple users “points of entry” to the processing power /parallel workflow), expandable and upgradable over time, reliable, and have a user interface simple enough for non-technical staff to monitor progress and access basic features. Voicing their concerns, the team was authorized to find a system that could meet the firm’s needs. As it turned out, they didn’t have to look very far. A number of employees had been involved with the Autodesk Beta program (customer feedback forum) for some time, and it was there that many Autodesk users highly recommended BOXX systems. The enthusiasm for BOXX hardware didn’t stop there, however.

“Every time I did my research and approached my contacts with Autodesk and other resellers, BOXX always came up,” says Lopez, “so I called and spoke with (global solutions manager) Dustin Leifheit. Working with Dustin was great. He was informative and helpful. I was able to give him our parameters and expectations of rendering required for our firm and the time expected for each rendering. Armed with this information, he was able to provide many options, enabling us to pinpoint with laser accuracy, the system needed to perform the task at hand. In the end, we felt that BOXX was the best value.”

Featuring a multi-processor (Intel® Xeon® Processor 5600 Series running at up to 3.33GHz) and networked architecture, a renderBOXX dedicated rendering system is specifically designed to deliver outstanding rendering performance for intensive architectural visualization, animation, product design, and engineering workflows. Tryba elected to purchase three renderBOXX modules with upgraded video cards based on an assumption that if the renderBOXX units were ever not being utilized as a render farm, they could possibly be employed as a Revit production system.

Update and Upgrade: A detailed street view rendering of the Cesar E. Chavez Federal Building.

The Test

When the modules arrived and it became time to put them to work, the Tryba team was pleasantly surprised to discover that BOXX’s claims of easy installation rang true. “We received the computer on Friday and I had my team up and running Monday morning with the use of Autodesk® Backburner™ and our new BOXX render farm which we named Kyle,” says Lopez. “Kyle” was given a baptism by fire when Roberts took a rendering which had taken twelve hours to render on Tryba’s former computer system and ran it through the new renderBOXX farm. The results were astounding, with renderBOXX requiring only 45 minutes to finish the job.

Then Ken took a previous eight hour render and tried it on “Kyle.” The rendering time was reduced to a mere 20 minutes.

Then Ken took a previous eight hour render and tried it on “Kyle.” The rendering time was reduced to a mere 20 minutes. With the new render farm, Roberts and Hayutin were now able to produce an amazing forty large format renders in one week. When the team did the math with the different level of detail to each rendering, they concluded that it would have taken their old system approximately four weeks to complete the same task. “Allowing our firm to produce this many renderings, we were able to put the rendering in front of the design team and they were able to modify and course correct the design,” says Roberts. “The renderBOXX system has increased our rendering effectiveness eight-fold in terms of quantity and turnaround, which so far has translated into countless hours saved each month.”

In addition to fulfilling their need for a system that could deliver fast renderings, Tryba has also managed to fulfill their plan of utilizing the system in another capacity, namely, as a system for backup production units. The decision to upgrade the graphics cards was a wise one, for when Tryba experiences a decrease in rendering demand, they are able to have staff members benefit from renderBOXX processing power by using the system for Revit Architecture or 3ds Max Design.

Intel® Xeon®-based renderBOXX increased rendering performance for the History Colorado Center project by 90%.

The Future

Tryba Architects is so enamored with their new render farm that they jokingly provided Kyle with his own spot on the firm's staffing sheet; yet all kidding is pushed aside when they are asked to discuss the profound impact it has made at the firm.

"We really consider this system to be a valuable, collective resource worth managing effectively across all of our projects," says Kemberlin. "I can see this being a big part of the way we work in the future. We spend a lot of money upgrading our systems, and as you know, the average life span of a computer system is 2 to 3 years. We would like to expand the renderBOXX farm and allow our rendering department to push the boundaries with their renderings and start producing high quality animation."

There is also consideration of utilizing the renderBOXX system as Tryba Architects' own cloud computing system for projects.

There is also consideration of utilizing the renderBOXX system as Tryba Architects' own cloud computing system for projects. "As demand increases," Kemberlin says, "instead of purchasing desktop workstations for our staff, I would rather purchase BOXX modules and maintain a user login to them. We are currently doing this with our Autodesk products and the feedback has been positive."

As building progresses on schedule at the Cesar Chavez Federal Building and has reached completion on History Colorado Center, Tryba Architects is certain that their decision to build a renderBOXX dedicated render farm was critical to the success of both buildings—as well as any future projects. Having earned a reputation for unique design, the professionals at Tryba regard renderBOXX as the solution that enables them to keep pushing that envelope while saving time, money, and increasing productivity and profit. It has provided another key benefit as well.

"Most importantly, the ability to quickly produce detailed renderings has required us to consider, at an early stage, the physical reality of the building, its components, and systems," says Kemberlin. "Accurate rendering, when combined with powerful modeling tools, helps us detect and resolve conflicts in the building design before documentation and construction ever get underway."

The Task: Produce 40 renderings in one week
Previous hardware: Dell Precision 490
Time required: 696 hours
Current Hardware: renderBOXX render farm
Actual Time: 63 hours
Time saved: 633 hours

Performance increased by 90%

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Collaboration & Interoperability

In the spring of 1963, Bob Dylan took the stage at New York City's Town Hall to recite the poem, "Last Thoughts on Woody Guthrie." As a preface, Dylan said, "I was asked to write something about Woody, something like, what does Woody Guthrie mean to you in 25 words or less?" Continuing, Dylan joked: "Well, I couldn't do it. I wrote out five pages." In a similar respect, I found it difficult to constrain all the topics I wanted to cover concerning collaboration and interoperability with Autodesk® 3ds Max®.

As a senior production artist, I am well versed in dealing with assets from a number of different sources—real estate developers, architects, and artists to name a few. These assets are created in a variety of different programs, by individuals with varying skill sets. Over the years, I have learned how to make something out of anything. I will limit the scope of this article to the integration of 3D model assets from the most common third-party modeling programs, while also looking at plug-ins and scripts that quickly integrate assets into 3ds Max, including those that help in post-production with rendering and compositing.

MODELERS

3ds Max is a successful modeling platform, but when it comes to personal workflow and budget, or perhaps industry, it can have some limitations or too many features. There are a number of modeling applications that fill these gaps and are used across a variety of industries. I'll give a quick rundown for each program, highlight the strengths and weaknesses for each, and give some suggestions for the best ways I have found to bring these assets into 3ds Max.

SketchUp

SketchUp is a very popular modeling application originally developed by @Last Software and now made by Google. It is well known in the design professions, specifically architecture and planning, but it is not limited to these sectors. Created as "a modeler for everyone," SketchUp certainly doesn't disappoint. The program has "Keep it Simple, Stupid" at its core, allowing a user to go from novice to expert in a very short time. It has a clean interface, great tools, and an oracle of online help and tutorials. SketchUp has tight integration with Google Earth, which allows modelers to geo-locate their models and place them into Google

Earth's 3D building layer with a few simple clicks, as well as make the assets available for download on 3D Warehouse, an online repository of SketchUp models. In addition, there is an importer that ships standard with 3ds Max since the 2011 version. The importer is effective; however, not my choice as the most efficient solution. This is a personal workflow issue that we will cover a bit later in the scripts section.

Autodesk Revit

Autodesk® Revit® is Autodesk's flagship BIM software offering. It allows architects and consultants to build a virtual model of a project, which can then be used to generate all the requisite building drawings, spreadsheets, and even energy analysis. Revit has an AutoCAD® look and feel and has a depth and minutia in the program that is certainly impressive. Exporting models from Revit to 3ds Max is straightforward, with a few main options to consider, such as .fbx and .dwg. Everyone has their favorites; I find that exporting a .dwg as a polymesh combined with the ACAD Legacy .dwg importer in 3ds Max tends to produce the best results.

The strength of Revit certainly comes from what it can produce for designers (construction documents, the plans and sections) from its detailed models, yet this model complexity can become problematic for the novice Revit-to-3ds Max importer. I strongly recommend learning how to filter unimportant information before importing Revit models into 3ds Max. For example, learning to shut off unimportant interior fixtures (toilets, sinks, etc.) can save a huge amount of time if you are exporting a model for an exterior hero shot, not just in export time from Revit, or import time in 3ds Max, but also in file performance in 3ds Max down the road. On that same thread, many native Revit models (furniture, fixtures, etc.) tend to be a bit lacking in surface/polygon detail for polished, high-resolution images, especially interior fixtures. This low detail causes most production artists to remodel the items so that they are workable within a detailed interior scene.

Rhino

Rhino is a NURBS modeling program, so it is generally found in sectors such as industrial design, but is also utilized by architects and other designers who are looking for a set of tools that allows easier free-form, organic 3D modeling. Rhino has good CAD integration, and seems to work best imported into 3ds Max as a .sat file. Spend a few moments in the support/script section of the website at http://www.rhino3d.com/ and you will find a rhinoscript that will export each layer of a Rhino model to the .sat format and name that file based on the file name and the layer name. These .sat files, once exported, can be imported all at once (look for the "add files" button in the .sat importer dialog) and your 3ds Max Layer Manager will build automatically from the file names. A tip for free: watch how the files import with the name relationship to the 3ds Max Layer Manager; you'll find that these files can be a very powerful tool for importing and organizing your Max file for a speedy workflow.

PLUGINS: SCRIPTS

"If you do something in 3D Studio more than 17 times, you should script it." This is the adage of one of Neoscape's founders, and the thought still rings true today. As 3ds Max's user base grows, the native tools and interfaces tend to be Jacks of All Trades and Masters of None. Scripting returns control back to users to create efficient custom workflows and tools, but it is not limited to just that. For the most part, if you can dream it, you can script it.

Before we go too far down the rabbit hole, I wanted to point out some good resources for MaxScripting. There are many sources on the Internet—www.scriptspot.com is the one I frequent almost daily. Both cgsociety.org and area.autodesk.com have forums devoted to scripting as well. There are some great tutorial discs online too, and once you get the rhythm of the basic components, it's pretty easy to pick up the rest, and even to learn from what others scripters have done. Also, it is good to understand that MaxScript generally only exists inside 3ds Max. Unlike other programs, which use more universal languages like Python, MaxScript is completely devoted to just running things inside 3ds Max—so you won't see it elsewhere, and it can be a bit esoteric in methodologies from time to time.

While scripting allows you to do many things, we will cover the scripts that I think are most useful for integrating model assets, including those that really help get some things done efficiently for post-processing/compositing. Most of the scripts discussed below are free online. The ones that I have personally developed are not available, but with a bit of study and online research, you'll be able to create or find ones of your own.

SoulburnScripts: Created by Neil Blevins, SoulburnScripts, are the granddaddy of all script packages. These are a set of his personal scripts which every 3D Production Artist and 3ds Max Enthusiast should have in their toolbox. Memorize them, use every one at least once, and you will be amazed at what they can do. I use at least one of the SoulburnScripts every day; it is probably more accurate to say every hour. There are tons of useful scripts in this pack, some of which I have highlighted below.

PutPivot: PutPivot will place your pivot point in one of the 27 points, which are determined from the object's bounding box. Center (Middle) Bottom is what I use 90 percent of the time for placing correct pivots on setdressing items such as trees, cars, etc. If the pivot of your object is set correctly, you can use a plug-in such as GLUE or "Object Dropper" from SoulburnScripts to "glue" the model to a surface, rather than using the transform dialog or moving it by hand.

ObjectPainter: This script will allow you to "paint" single or multiple objects to a surface (or to many surfaces). It includes the ability to paint the objects as bounding boxes and to add random transformations while painting. The script has two modes: "Paint," which works like a paint brush, placing items on intervals while the cursor moves; and "Place," which places objects per

click. This script is great for creating background/context forests, shrub beds, and the like.

 ObjectReplacer: ObjectReplacer will replace selected objects (or groups) with other objects. This is great for replacing low polygon assets received in files from clients with high polygon, properly textured assets from your production library.

 TransformRandomizer: TransformRandomizer changes the transforms of one or multiple objects through numeric values set in parameters. I use TransformRandomizer daily, especially for adding variety to setdressing such as trees and shrubs. If you have a mass/volume of plants in one area that are all the same model (or proxy), you'll end up with a very consistent-looking render.

Use TransformRandomizer to change the rotation and scale of all the objects independently, which creates massing of items that look like they have tremendous amounts of variety, but are created with one model asset. TranformRandomizer works in conjunction with the object's pivot point, so make sure that is set properly first or you might be surprised with the result! My recommended settings would be: min -45, max 45 for the rotation variation (in the Z), and random scale min 85 max 115 (you can do x, y, z independently with these values or all at once, or some more than others!). The script will execute these parameters every time you click "apply," and the effect is both random (it will do different settings for each item each time, so it could get smaller once, or larger once, depending on the settings) and cumulative. It is best to do small increments in order to find something satisfactory in just a few clicks.

A few others:

 NameManager cleans up names of objects quickly, which is good for 3D party models or model assets from Evermotion or Turbosquid.

 ViewportControl is great for getting to those views that aren't set to hotkeys by default, such as "Right" and "Back."

 ObjectDetacher quickly explodes large meshes into individual objects by elements, which is very handy when trying to glean down geometry, or drill down a curtain wall or some other large geometric object for animation.

PERSONAL SCRIPTS

For the last part of this article, I wanted to share two of my own scripts: the SketchUp Import Awesomizer (SIA) and GBuffer ID Script. SIA was developed and refined through several months of SketchUp model imports and mimics my personal workflow for importing SketchUp models into 3ds Max. The GBuffer ID script utilizes the GBuffer ID, which is present and editable on every object in 3ds Max. This script streamlines the creation of mattes, which will render and output at the same time as the main image pass, thus saving time and energy since they don't need to be created separately. It also speeds up the transition into post production software such as Adobe After Effects or Adobe PhotoShop.

SketchUp Import Awesomizer: Although 3ds Max supports opening/importing SketchUp files with a native .skp importer, this method has its shortfalls. Since the importer brings in the model with the SketchUp layers, components, object names, and materials, the model can be a bit of a hassle to use in 3ds Max because the programs handle the information differently. In addition, the quality of the SketchUp model, or rather, the quality of the import, depends on the quality of the modeler and their personal workflow and habits. The inconsistency in these variables can be quite inconvenient for using SketchUp information directly in 3ds Max, so for my workflow, this script fills that gap.

My preferred workflow is to export the model out of SketchUp as a .3ds file, by materials. Then, I import the file into 3ds Max and use the "layer by material" portion of the SIA script to organize the model into layers by material (these will build in my Layer Manager as well). Once this is sorted, I can begin to sort geom-

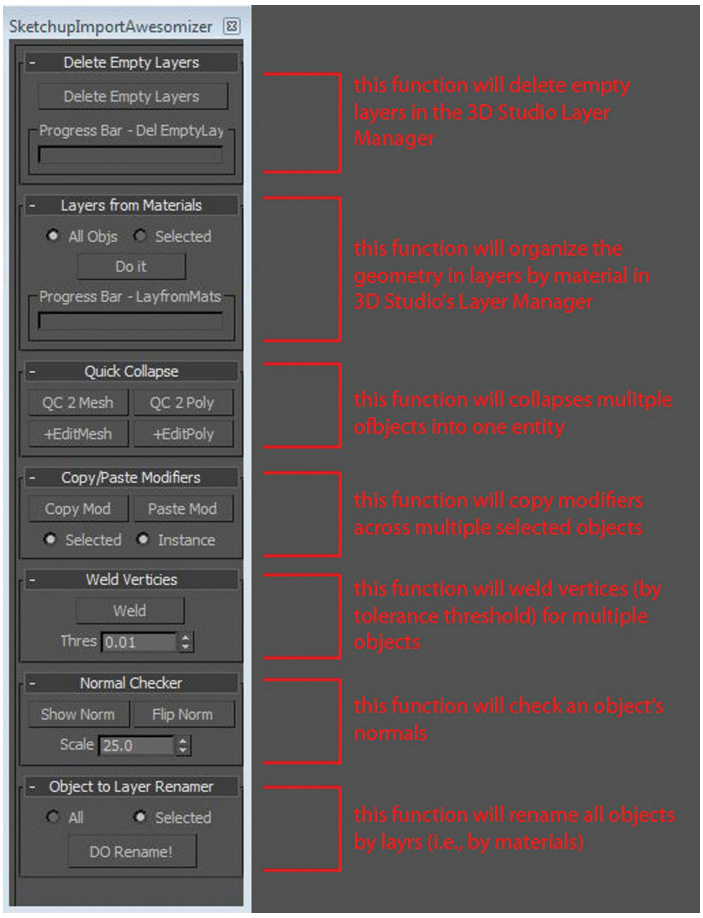


Figure 1: Screengrab of the SketchUp Import Awesomizer Script

etry into more defined layers by collapsing objects into larger meshes and applying UVs and appropriate modifiers where necessary—like shell for glass. What is gained through this process is that the artist in 3ds Max is not bound by the SketchUp modeler's components or layers. Instead, the artist can use the base organizational information of the asset, the materials, to drive the process. One caveat: this script/workflow only works if the model received has materials applied!

GBuffer ID Script: This script is very similar to EffectChannelSet, a script by Track on ScriptSpot. The script sets the GBuffer ID in an object's properties to a numerical value, which is then coordinated with a Multimatte Render Element (if using VRay). Please note VRay's Multimatte Render Element is similar to the Matte Element (if using Default Scanline). When the scene renders, 3ds Max will generate an image file with the GBuffer ID in one of the color channels (R, G, or B) which can then be used in either PhotoShop or After Effects to set mattes. The good thing about this method is that mattes are generated with the main render, and will continue to be updated every time you render (as long as the Render Element is turned on!) Another good thing is that you get three mattes for the price of one luma matte!

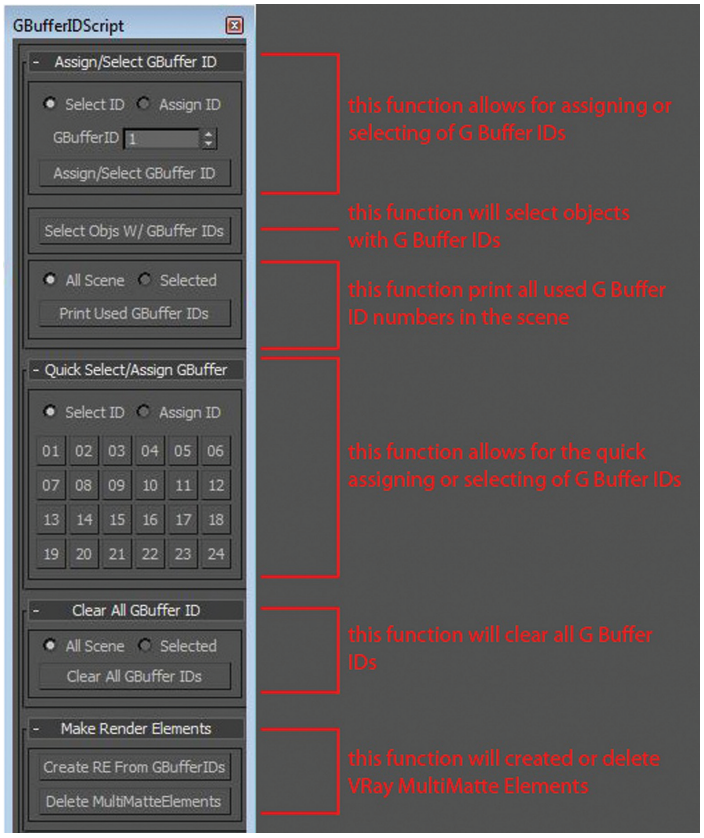


Figure 2: Screengrab of GBuffer ID Script interface.

CONCLUSION

This article has covered popular third-party modeling programs and described techniques to integrate assets created in these programs into 3ds Max. We have also covered some different scripts and techniques to quickly manage, integrate and transform model assets. It is my hope that you will be able to take some of these tips and advice and apply them to your work in a way that helps you work more quickly and efficiently in 3ds Max.

Seth Borne is a Senior Digital Artist working for Neoscape Inc., a Boston-based creative firm specializing in Experimental Media and Visualization. Trained as a landscape architect, he worked as a project landscape designer for Michael Van Valkenburgh Associates Inc. before transitioning to visualization. As an artist, he focuses on architectural visualizations and animations, and dabbles in streamlining production pipelines, custom workflow scripts, and whatever else is required. Seth is a regular contributor to Boston's Autodesk Animation User Group Association (AAUGA), where he has presented topics ranging from Advanced 3ds Max Materials, MaxScripting, and PhotoShop/After Effects Compositing. A portfolio of his work can be found at www.sethborne.com.

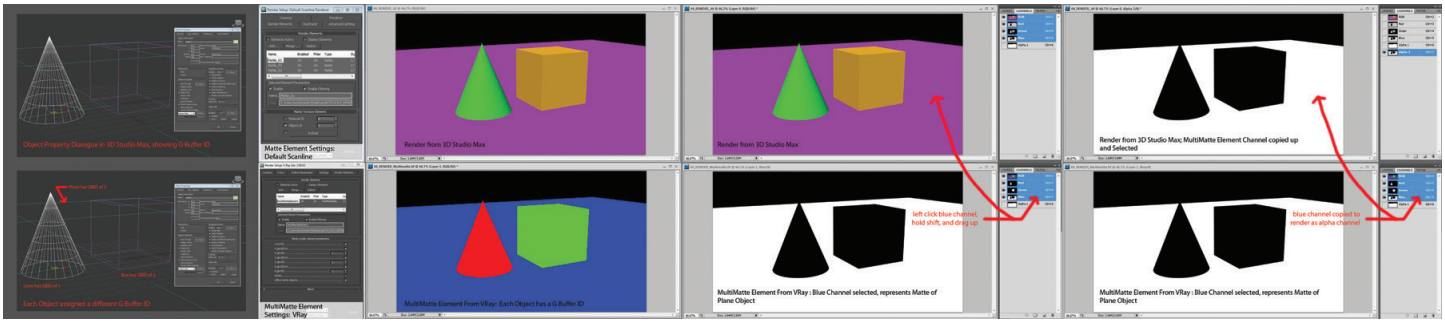


Figure 3: Screengrab of how GBuffer ID works with Adobe PhotoShop.

Up Next: Your Architecture Career, 3.0

The use of building information modeling (BIM) continues to grow among firms worldwide. While there is significant geographic variation, professionals who master BIM skills report higher earnings than their counterparts using CAD.

All the once-flat components of your world are turning three-dimensional, and not just at the movies. If it hasn't already, your career is quickly escaping its two-dimensional flatland as well.

If you think of ink on vellum as Your Career 1.0, computer-aided drafting as 2.0, then the 3D capabilities of building information modeling (BIM) constitute Your Career 3.0. And the uptake of BIM clearly has reached a tipping point.

In 2008, more than one-third of firms polled by the American Institute of Architects indicated they already had obtained BIM software, more than double the share in 2005. A separate report, this one by McGraw-Hill Construction, said that by 2009, just under half of architecture, engineering, and construction (AEC) firms had employed BIM.

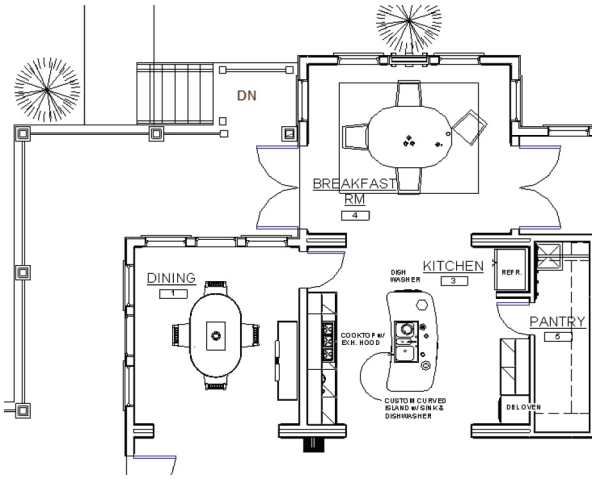
"Among areas that are emerging for the profession, I would certainly put BIM at the top of the list," says Kermit Baker, AIA's chief economist.

And it's clear that the spread of BIM is not just spreading widely across the industry, but reaching deep into the profession. Between 2009 and 2010, the proportion of respondents in the annual AUGI Salary Survey who identify themselves as BIM managers doubled, from 3 percent to 6 percent. And that's up from the 1.6 percent who identified themselves as BIM managers when the AUGI survey first provided this title option in the 2007 survey.

The introduction of a BIM survey question four years ago reflected *AUGIWorld*'s growing appreciation of the importance of BIM as a professional specialization. The 2012 edition may distinguish between BIM and non-BIM designers to reflect the evolution of that position, says Melanie Perry, a St. Louis-based technical writer and editor who has for several years produced the survey.

INFORMATION, PLEASE

BIM itself has evolved over the years. McGraw-Hill's definition, the "process of creating and using digital models for design, construction, and/or operations of projects," is certainly serviceable. When drafting lines were supplanted with digital models infused with AEC information, architecture professionals were able to create more accurate and comprehensive project models. For the first time, all professionals at all stages of a project worked in the same virtual space—the BIM model.



CAD Drawing- drafting lines

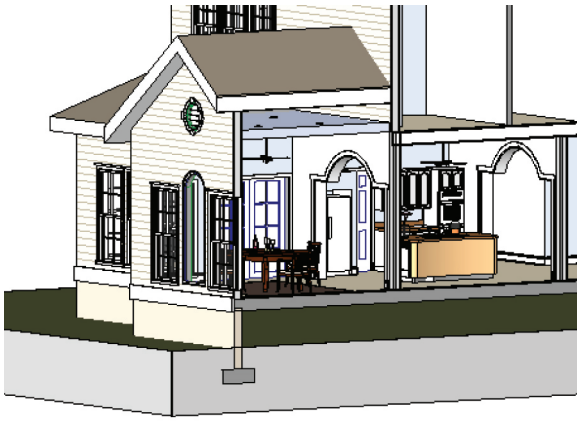
For many professionals, one of the most profound changes brought about by BIM appears to affect not just the output, but the very processes that define the industry. When a single BIM model contains all the specifications for a given project, "everyone is seeing the space the same way," says Rebecca Herr, a 2005 Georgia In-

stitute of Technology graduate who served as a senior designer in the Atlanta, Georgia, USA, headquarters of the international firm Smallwood, Reynolds, Stewart, Stewart (SRSS). "BIM is not just about the architect; it's a collaboration."

IT'S ABOUT TIME, IT'S ABOUT SPACE

Today, information imported into BIM models can include such fine detail as surface finishes and reflected light, with resolutions sufficiently high to produce realistic renderings of the finished product.

The most current BIM models incorporate the fourth dimension, time. Pulling data from the estimate and project logic models, BIM modeling depicts the sequential construction of a project in a simulated three-dimensional graphic. Estimates and design elements can be updated instantaneously, making it possible to respond to and visualize client requests in real time.



BIM Model- object oriented

SHOW ME THE MONEY

According to the most recent AIA survey, compensation at architectural firms remained flat between 2008 and 2011, reflecting in large part a struggling economy, But that same survey noted that almost a third of firms offer higher salaries for staff that have BIM expertise. Your chances for getting a BIM boost in salary were better—43 percent—at a firm with 100 or more employees. With fewer than 10 employees, the likelihood that a firm would offer a BIM premium dropped to 24 percent

The latest available AUGI salary statistics, from 2010, further establish BIM's position as a compensation booster: overall, BIM managers reported an average annual salary of $62,791, while the average annual salary for a CAD manager was $62,014.

The 2011 figures are published in this issue of *AUGIWorld*.

The averages, though, mask significant variation among the 10 regions. In half of the regions surveyed—Pacific, South, Southwest, Australia, and Canada—BIM managers actually made less than their CAD counterparts. The place to be, in either professional mode, was Australia. There, CAD managers reported an annual salary of $79,583 and their BIM colleagues averaged $77,500 annually, making Australia easily the best-paying region in either field.

THE BOTTOM LINE

BIM professionals can command top dollar because their skills boost the bottom line of their firms. In that 2009 McGraw-Hill survey, 63 percent of BIM users said they saw positive ROI on their overall investment in BIM and 72 percent of users who formally measure their ROI on BIM report positive returns. Moreover, advanced BIM skills translate into higher returns: 87 percent of expert users reported a positive ROI with BIM compared to 38 percent of beginners.

The skills and training for BIM are considerable; even mastering a basic component can require weeks of intensive training. In the past, training by your friendly local Autodesk reseller was sufficient to handle basic CAD software, but in the days of BIM, firms have to reach out to the few architecturally trained and very experienced Mentors to guide their staff through multiple BIM projects. The AIA's Mr. Baker notes that, in the current economic slowdown, it is not uncommon for firms to make available BIM workstations where professionals can teach themselves BIM skills in anticipation of a stronger economy. This self-taught method of training, while resourceful, has lead to inadequately trained staff, and often discovered too late to help the firm's latest BIM project.

USEFUL AT ANY STAGE

Right now, many architects think of BIM as best suited for the later, more complex stages of large-scale commercial projects; that was Ms. Herr's initial attitude at SRSS, where she worked on several large-scale efforts, including redevelopment of Atlanta's Buckhead commercial district. For some, the elaborate functionality of BIM may be more than is necessary in a project's early stages, where clients might like to brainstorm and work from rough sketches.

"In the beginning, you do a lot of work by hand. If your initial sketches are too finished or too polished, you might even scare a client a bit," she says.

But even there, BIM can rise to the occasion and provide an appropriate solution. Ms. Herr notes that in the early stages of a project, BIM output can be tweaked to resemble the rough renderings familiar both client and design professional.

WIDESPREAD APPLICABILITY

BIM processes can be incorporated into almost any stage of the design/build process. In addition, BIM is rapidly taking hold in facilities management, lease management, and asset management.

Still, BIM professionals are unlikely to work exclusively with three-dimensional modeling, says St. Louis editor Perry. Instead, managers and designers are more likely to switch back and forth between BIM and CAD as the professional establishes new professional and industry standards. "People who are flexible are going to be the ones who are successful," she says.

The AIA report can be purchased through the association's store at www.aia.org/store.

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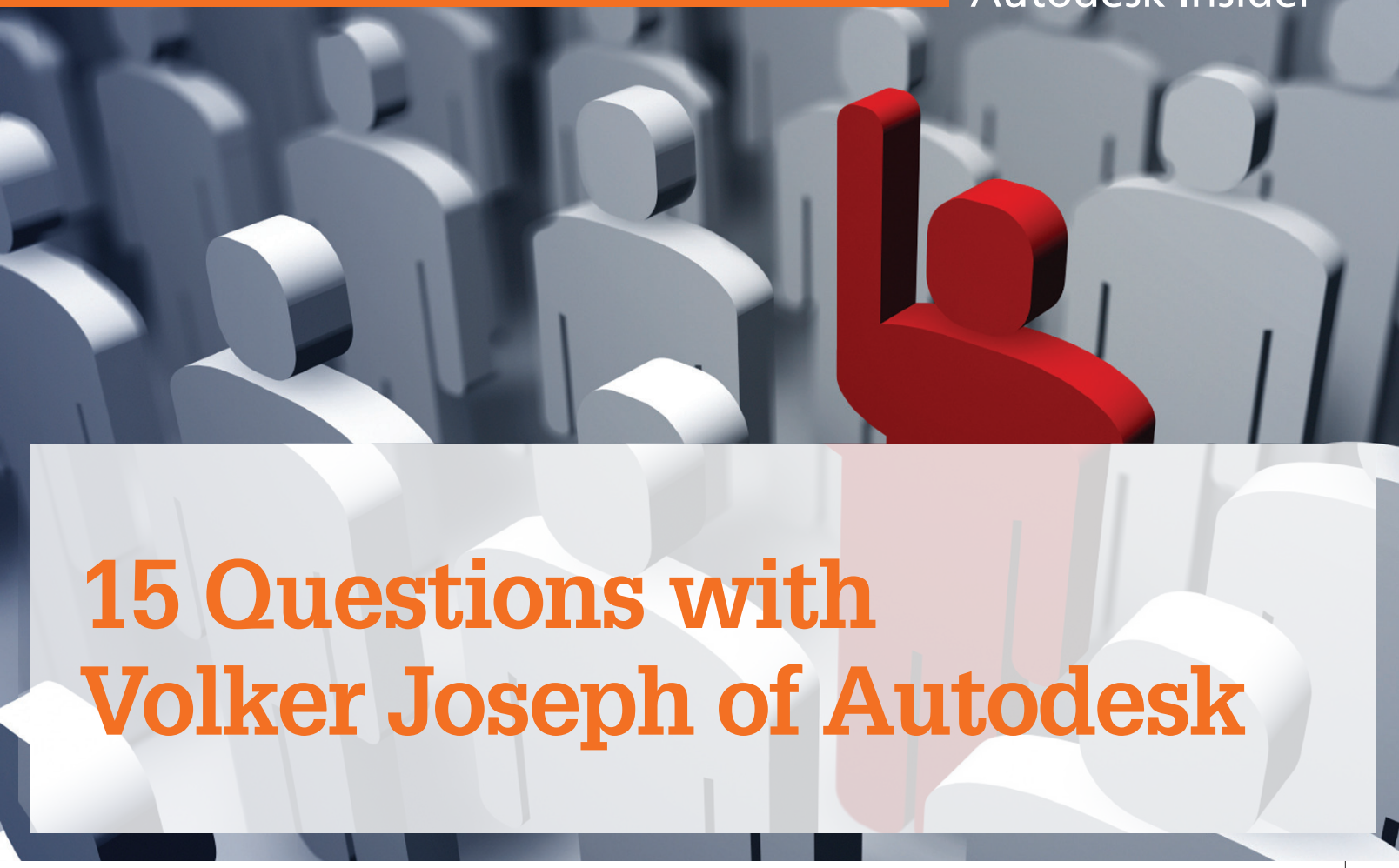


15 Questions with Volker Joseph of Autodesk

What is your role at Autodesk, Volker?

I am a member of the AutoCAD Product Management team. My role as Senior Product Manager is multifold. I look after all operational and release readiness needs for AutoCAD®, AutoCAD® Architecture, AutoCAD® MEP, AutoCAD® Mechanical and AutoCAD LT® software products. The second responsibility, which is no less important, is to manage the Autodesk Feedback Community and look after Autodesk's beta needs.

How long have you been with Autodesk doing this, and have you held other positions?

I have been with Autodesk for 11 years now. My career at Autodesk started with the Product Support organization as support analyst. After seven great years I was provided with a new opportunity and I joined the Autodesk team that supports DWF™ technology to manage beta programs and customer success initiatives. Yet more doors opened during 2009 when I was entrusted with the management and transition of the Autodesk beta programs. This was followed by my integration into the AutoCAD Product Management team and the handover of all operations and release readiness activities into my care.

Tell us a little about your background and how you came to be doing what you do now?

I consider myself very fortunate to have landed a job at Autodesk in 1999 and I am still seeing it the same way today. Prior to joining Autodesk, I had a more or less successful stint as HTML and database contractor. Good enough to freelance for a few years in the Caribbean. Prior to that I did what many young folks in their 20s do—jump from employer to employer in the hope of finding the ultimate place to work. Guess what? I am confident that I have found it!

What does a typical day look like at your desk?

My role does allow for some flexibility and I can work from the office or from home. It is common that I have a few meetings every day, followed by emails and phone calls. Many of the emails and phone calls are from Autodesk employees, but there are always a few customer inquiries in the mix.

Describe the challenges that you and those you work with face.

Be sure that release readiness processes are tuned to the best of our ability to support timely product release goals. The management of the Autodesk Feedback Community is a very different challenge. It takes a lot of hands on customer interaction with thousands of beta customers during any given beta cycle. Challenging, but fun!

Can you say how many people work with you, or perhaps how the work you do is shared?

It would be difficult to count all of the individuals I deal with. My work and relevant information is usually shared via email or other forms of written communication.

Do you or your team get involved in planning for future releases of the software?

There are several teams and key individuals who contribute to future release content. The AutoCAD Product Management Team is definitely a contributor in the overall process. Many of my team members look after specific features and functionality and we are all contributing in one way or another to the next release.

How do you interact with the product teams, developers, and quality assurance teams?

My role requires me to interact with all internal groups on a regular basis. There are not only product teams, developers, and quality assurance teams. There are also operations, creative, marketing, finance, and legal teams. And that does not even count all of the teams involved to make sure our products cycles are completed successfully.

Any tricks you use to help check how successful your efforts are?

As far as release readiness is concerned—all products were successfully launched, on schedule. As far as the Autodesk Feedback Community is concerned—all major beta release milestones were met and, moreso, testers had a good experience and were able to share their feedback with us.

What can AUGI members do to help?

It would be great if we could further enhance the collaboration between AUGI and the Autodesk Feedback Community. I also look forward to helping with the implementation of the new AUGI Wish List. This will enhance the experience for customers and Autodesk staffers alike.

It would be great if we could further enhance the collaboration between AUGI and the Autodesk Feedback Community.

How much time do you get to do external research apart from responding to users directly?

External research kicks in whenever I do not have an answer in hand for customers. This applies to internal as well as external inquiries. Research is something that I do on a daily basis.

What sort of things do you do for distraction, hobbies, travel?

Whenever time allows I spend time with my wife and our chocolate Labrador. We are also expecting our first child in the summer, which adds yet another layer of complexity. I also love to cook for family and friends alike—no matter the size of the group.

What would we be most surprised to know about you?

My career with Autodesk started in the United Kingdom. Also, I am a student after hours and attend an online college. My goal is to have a master's degree in hand soon. I worked as a chef before entering the world of information technology.

Can our readers contact you with any follow-up questions?

I love to hear from anybody who has an interest to speak with me. Feel free to email at volker.joseph@autodesk.com with any question that comes to mind.

BUILT – BIM to FM© *What Owners Want*

Owners want functional digital assets that increase efficiency and productivity over the life cycle of the facility. Antiquated Design-Bid-Build oriented procurement methods ensure that owners don't get what they want.

This article addresses what owners want—vis-a-vis BIM—and how they can get it. Once owners recognize the value of BIM, they want it all and they want it now. Few, however, know what IT is, how to request IT, or how to achieve IT.

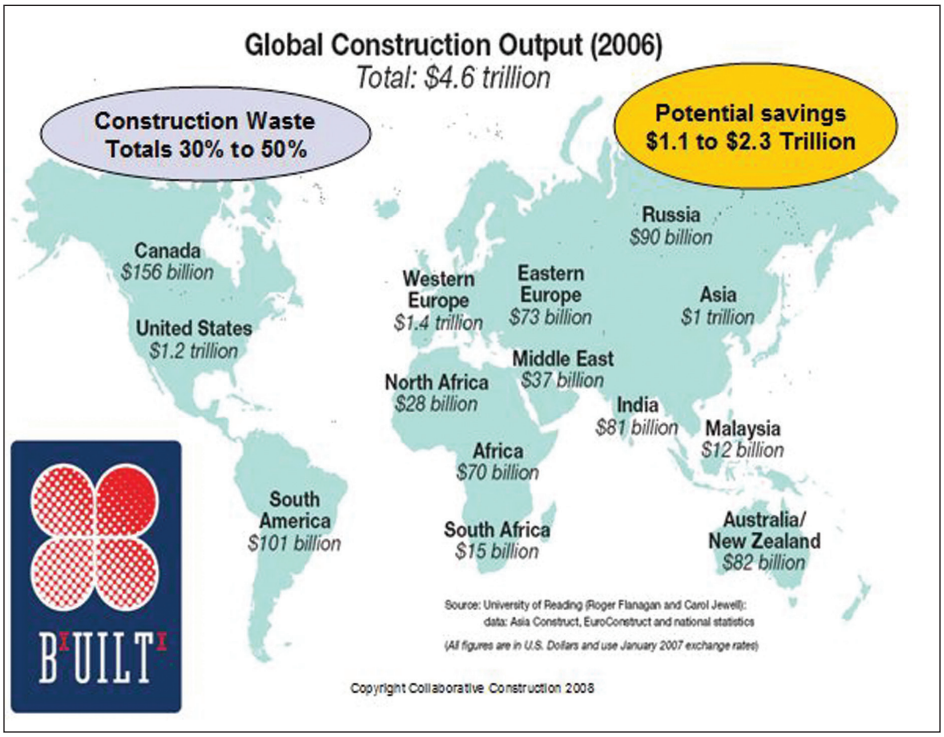
IT is a functional digital asset that accurately reflects the data gathered on behalf of the owner during planning, design and construction in a format compatible with the owner's facilities management (FM) software.

Too few owners realize that planners, designers, constructors, and commissioning agents can deliver digital assets and fewer still know how to request delivery of such assets in a functional format. Those who do are often disappointed, as delivered assets seldom meet expectations.

FUNCTIONAL DIGITAL ASSETS—DAVIDS

Functional digital assets enable Decisions based on Accessible, Valuable, and Informative Data Systems (DAVIDS). Timely intelligent decisions add value to an enterprise. Decision makers with timely access to valuable and informative data make better decisions. Functional digital assets empower leaders to make quicker, more well-informed decisions. This increases success.

Decisions drive our lives, and good judgment is the hallmark of excellent leadership. Excellent leaders want accurate information more quickly. Providing leaders—on an enterprise level—with access to valuable and informative data is common in the military and manufacturing arenas. Even there, however, tapping facilities or infrastructure- based knowledge while making decisions is not the norm. In the AEC industry, many are just beginning to

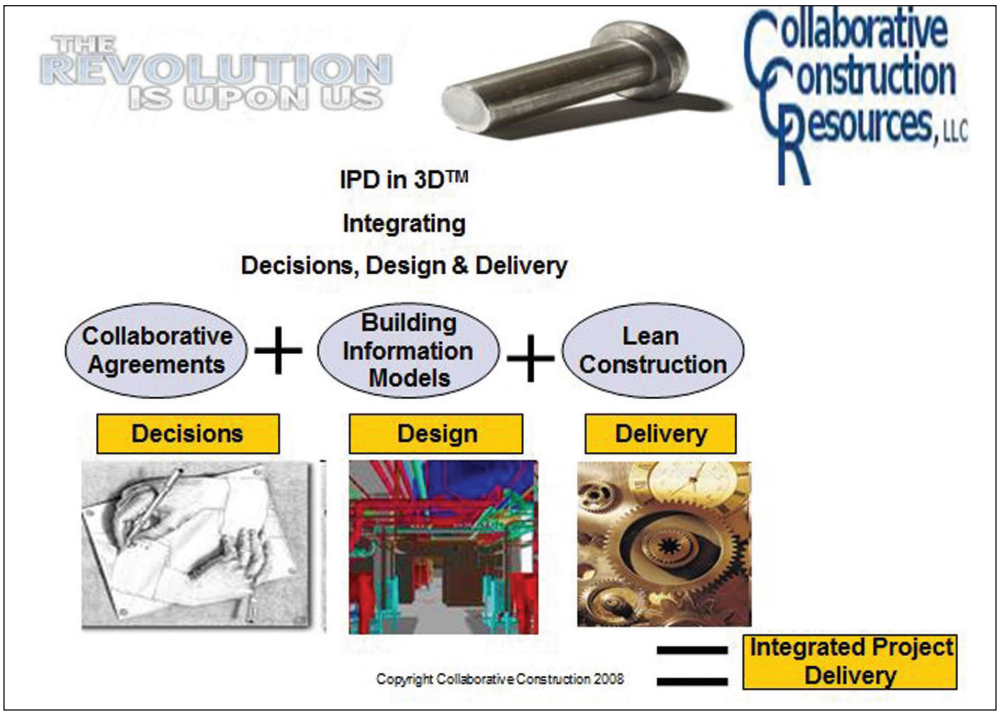


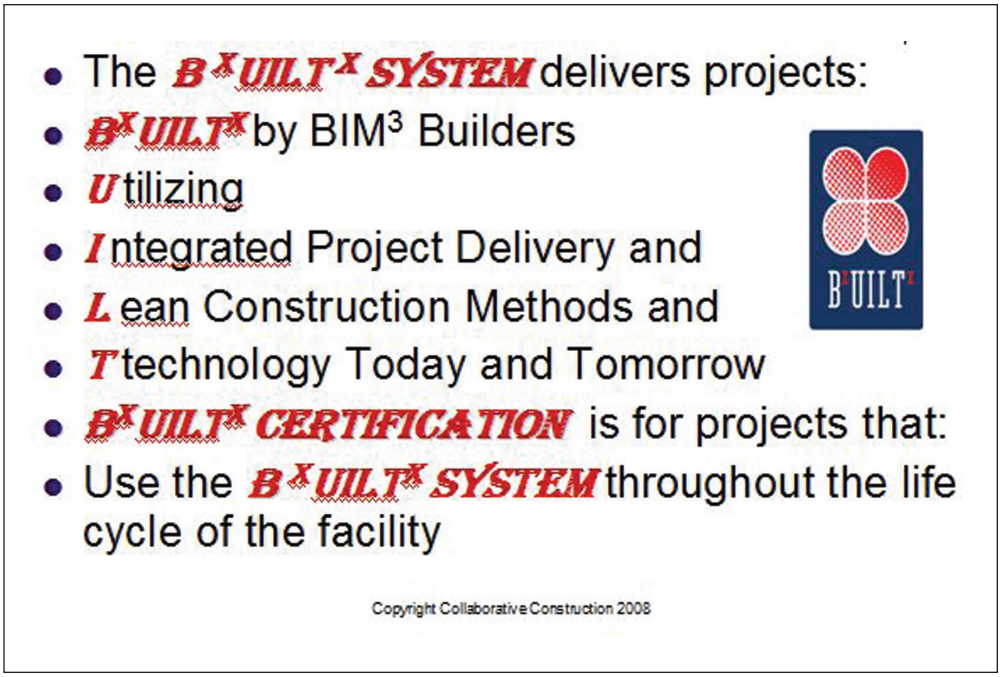
recognize the value of functional digital assets and the power those assets have to improve decisions and add value to an enterprise.

Value is a key component from every owner's perspective. Owners plan, design, construct, operate, and maintain facilities for a business purpose. Adding value to services or products validates new facilities. Facilities-centric information aligns operational and maintenance goals with the business purpose of the enterprise.

Informative data is data that conveys valuable information to the user. Timely access to such data prompts intelligent, fact-based decisions, which increase efficiency and profits.

Increasing efficiency in the AEC industry puts $1.1 to $2.3 trillion in potential savings in play worldwide, creating an industry in and of itself. Separately, operations, energy, and maintenance costs represent several trillion dollars more from which additional savings can be extracted over the life cycle of a facility. IPD, BIM, and lean processes deliver functional digital assets, which empower decisions that drive increases in efficiency and savings on the trillions of dollars spent over the life cycle of facilities and infrastructure worldwide.





PROCURING FUNCTIONAL DIGITAL ASSETS—BUILT

IPD creates functional digital assets suited to this task, but achieving IPD is hard and the task is complicated by antiquated project procurement methods. Design-Bid-Build, in particular, inhibits the collaborative and cooperative behaviors required to produce functional digital assets. The BUILT System™, pioneered by Collaborative Construction as part of its IPD in 3D™ program, provides a process whereby integrated project delivery (IPD), building information modeling (BIM), and lean construction methods can be deployed effectively and intelligently.

IPD in 3DT refers not only to integrated project deliver and the three-dimensional virtual design and construction software tools that support IPD, but also refers to the 3Ds associated with IPD: Decisions, Design, and Delivery. Those three concepts—aka integrated project delivery (IPD)—require integrated or collaborative agreements, building information modeling, and lean processes for support. The interrelated nature of these concepts is reflected in the graphic above.

The BUILT System extends the IPD in 3D concept beyond projects and enables users to deploy fully integrated business models in support of IPD, BIM, and lean processes. An effective BUILT System ensures owners receive functional digital assets that empower DAVIDS—Decision makers with Access to Valuable and Informative Data Systems—within the organization.

BUILT is an acronym that refers to facilities and infrastructure—i.e., Buildings—Built by BIM Users Utilizing IPD, and Lean processes and Technologies Today and Tomorrow.

> Knowledge, innovation, networks, and godly decisions made with access to valuable and informative data systems will enable those who master these tools to overcome immense barriers.

In the BUILT System all stakeholders are BIM users. Planners, designers, and owners use BIM in the planning and design phase to lay the foundation for the creation of functional digital assets. Planners and designers authoritatively collect data related to potential building sites, facility programs, and other aspects of the facility and relevant infrastructure. Owners involve end users in the programming phase to ensure compatibility between the facility as planned and designed and the business purposes reflected in the end users activities.

Contractors, construction managers, trade contractors, specialty designers, suppliers, and others use BIM in the BUILT System as well. Each of these stakeholders access functional digital assets relevant to their particular business purpose throughout the planning, design, and construction of a facility and any associated infrastructure.

Users of the BUILT System are encouraged to think outside the box and identify unique BIM users. Additional potential users of BIM data include lenders, sureties, insurers, and others with a stake in the financial health of the project. Ultimately, the use of BIM on a project delivered under the BUILT System will be limited only by the imaginations of the users of the BIM and the capacity of the internet to connect users to functional digital assets in real time.

RFPS & RFQS ON BUILT PROJECTS

Procurement of planning, design, and construction services under the BUILT System differs greatly from the procurement of such services in a Design-Bid-Build environment, or even in a Design-Build setting. Owners who wish to procure services from integrated teams must formulate their requests for services differently and must request those services from planners, designers, and constructors with a very different skill set than those reflected in the Design-Bid-Build environment.

An owner seeking to procure services under the BUILT System is seeking planning, design and construction services from an integrated team. Accordingly, requests for proposals must be directed at integrated teams, not individual planners, constructors, or designers. Typically, when such an RFP hits the streets it creates confusion and angst among stakeholders in the local AEC community because it represents a substantive change in the normal way of doing business.

The biggest change is the requirement that planners, designers, and contractors—along with key trade contractors and suppliers—join forces early on in the process to form integrated teams capable of delivering IPD. These RFPs also mandate the use of BIM and entail the use of an integrated form of agreement among the integrated team members. An RFP that calls for bids from integrated teams fundamentally alters the way those teams are formed, what those teams will deliver, and the structure of the teams' legal relationship.

Private owners have a great deal of control over the process and are essentially free to pick the A Team. Public owners are shackled, to a large degree, by public procurement laws and regulations that control the process where by governmental entities procure planning, design, and construction services.

Collaborative workshops at which concepts central to the BUILT System are introduced to the AEC community increase the BIM IQ of all stakeholders. Members of the AEC community interested in pursuing BUILT-oriented projects learn, through such workshops, how IPD, BIM, and lean process support the BUILT System and what skills are required to successfully deliver a BUILT project.

Collaborative Construction offers collaborative workshops designed to build such skills and also provides IPD facilitation services to integrated teams in the throes of crafting, negotiating, and implementing integrated or collaborative agreements on specific projects.

CONCLUSION

Knowledge, innovation, networks, and godly decisions made with access to valuable and informative data systems will enable those who master these tools to overcome immense barriers. The challenges faced by the AEC industry are vast, but our ideas are bigger and better.

James L. Salmon, Esq. is president of Collaborative Construction Resources, LLC and the creator of the IPD in 3D Program and the BUILT System. James is an attorney, mediator, IPD facilitator, and collaborative consultant who helps stakeholders in the AEC industry implement the BUILT System and negotiate and implement effective integrated agreements. You can reach James at JamesLSalmon@gmail.com.

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