AUGIWorld

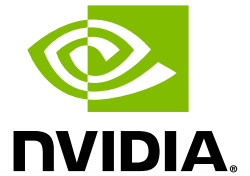The Official Publication of Autodesk User Group International

October 2014

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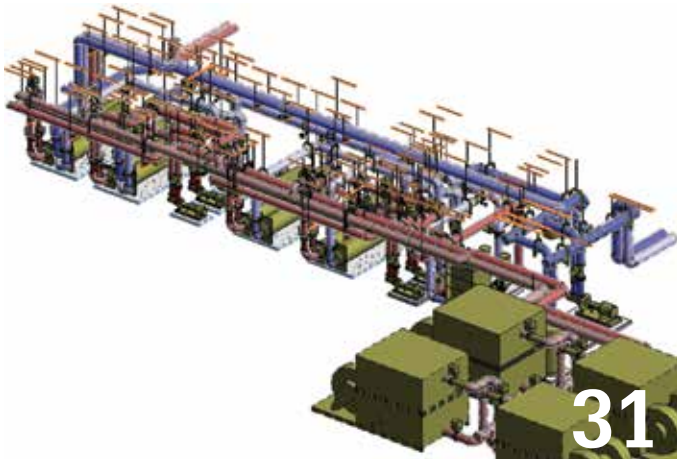
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Letter from the President

ARE YOU READY?

By the time you read this letter, Autodesk University will be looming on the horizon like a large thunderstorm. Those of you living in the United States Midwest know exactly what I'm talking about. And while the simile seems to be threatening, it is apt for several reasons. Let me explain.

Similar to a thunderstorm, it is easy to be caught in the whirlwind of the event. Each year over half of the attendees are new attendees. I would not be surprised if the percentage was near the same this year, or even a bit higher. If this is your first AU you should make plans to attend the Freshman Orientation on Monday at 5PM. This orientation is a recent addition to the event and I have heard some great things about the session.

There has lately been a lot of emphasis on creating an emergency plan for your family for when disaster strikes. AU should not be considered a disaster (laughing). But you do need a plan: your schedule.

Because you are an AUGI member, the first thing you should do is search the catalog for "AUGI" and sign up for the "What's Happening with AUGI" session (session ID 7403) on Wednesday, December 3, at 5:45PM. Immediately following that 30-minute session is the AUGI Reception. Long-time AUGI members who have attended AU in the past know this event as the AUGI Beer Bash. Never fear! The AUGI Reception will still have AUGI-branded glasses on a first-come, first-served basis. They usually go quick so that's all the more reason to attend the "What's Happening with AUGI" session where you will have your chance to get the glass before the reception.

But your emergency planning isn't done yet. The AUGI sessions are only one part of the entire event. I wish I could tell you that determining the rest of your schedule is easy, but that would be a lie. There are always multiple sessions in one or more time slots that you would love to attend. Picking between them is tough. One thing that can help is to go to Autodesk University with some coworkers and they can attend the sessions you cannot make.

Like any good emergency plan, your schedule needs to be flexible. It's a good idea to have a second session picked out in each slot. Why? There can be sessions that just don't meet your needs. The presenter should provide a list of expectations at the beginning of the class so you can leave if another session might fit your needs better. Don't stay in a session you don't need. There are plenty of choices.

See you at AU!

R. Robert Bell
AUGI President

Breaking the Rules

Late with my article. Again. Luckily this isn't my first article so I suspect the editors know by now to give me an earlier deadline so I have some time left past curfew.

It's not that I didn't start this article in time. It's probably the one I worked on the longest. I began working on the first draft three weeks ago, but I got stuck. Failed to make my point, no matter how hard I tried. And as my wife so eloquently pointed out just now, in that case it's probably just a dumb point anyway. As always she is right, so I'm starting over. Already 36 hours past my deadline and the clock is ticking. Let's do this.

I was going to discuss customizing Autodesk® Revit® through standardizing your information structure. And, as I read this, I understand this is really, really boring material. So I guess you all should thank my wife for saving you the burden of having to read all of that, especially since we established the fact that there was not going to be a real point in the entire article, which would have left you all feeling kind of violated.

My wife loves roses, by the way. Email me if you think this article turned out to be a huge improvement and I'll send you the details of the flower delivery service I often use after she saves my butt.

Come to think of it, I'll probably send her some myself, because now I can get off my high horse and talk about the first add-on that I've gotten excited about since Whitefeet Tools...

THE RULES

I have talked about why I chose Revit as my primary tool in BIM a lot. Also told a lot of people that it's not the best design tool, nor is it the best analytics tool. And don't get me started on user friendliness. But it does one thing way better than anything else I've come across: manipulating the information in your model. That is what BIM is all about, in my humble opinion.

But it has some dumb limitations. Don't know why, and I certainly don't know why the Factory refuses to lift them. But I'll give you some examples:

1. Hosted objects know their Host, but they won't tell you.
Every door, window, or any other kind of hosted object you place knows which host it's on. But it is not capable of telling you in the Revit schedule. This is a huge limitation, because if I place a door in a fire rated wall, it should know—and be fire rated, too. Can't do that. So now I have to jump through hoops, create separate views with view filters that light up fire rated walls, and then manually match the door fire rating to the wall it's in.
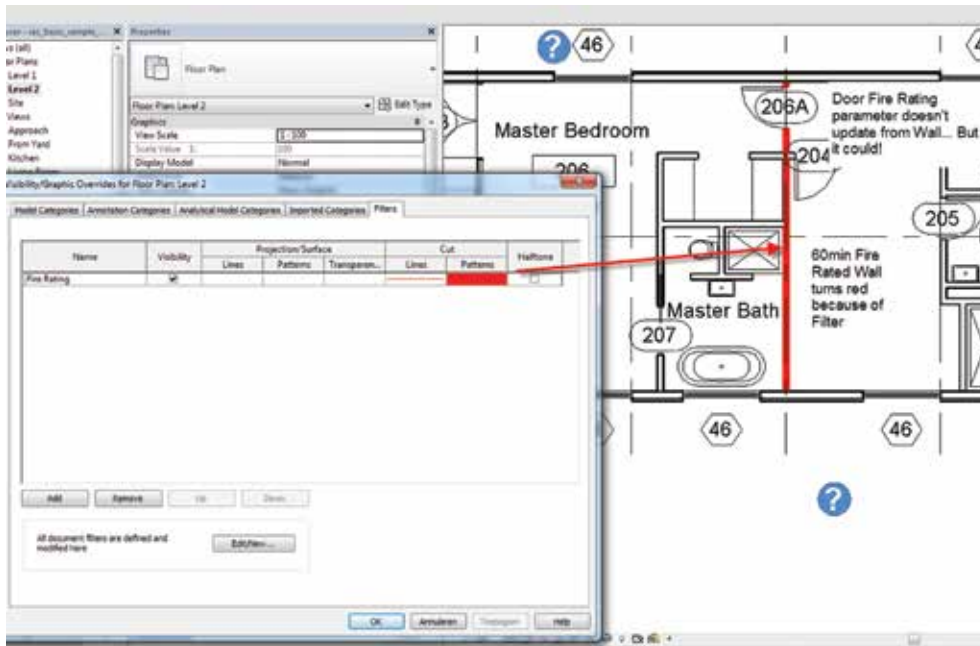
Figure 1: No link between Host and Hosted Object properties

2. Some objects know which room/space they are in, but not all of its properties.

This one really ticks me off. Now you're just playing with my private parts, Factory guys. I know it's there, I can see nine out of ten properties, but not the one I want. Really??

Try this: Create an Air Terminal Schedule. Get the room area in that schedule. You can get all kinds of room properties, but not the area. You can have your (custom) required air flow per square foot (or, in the civilized world, square meter). But not the room area. So you can't check whether you have enough ventilation units installed.
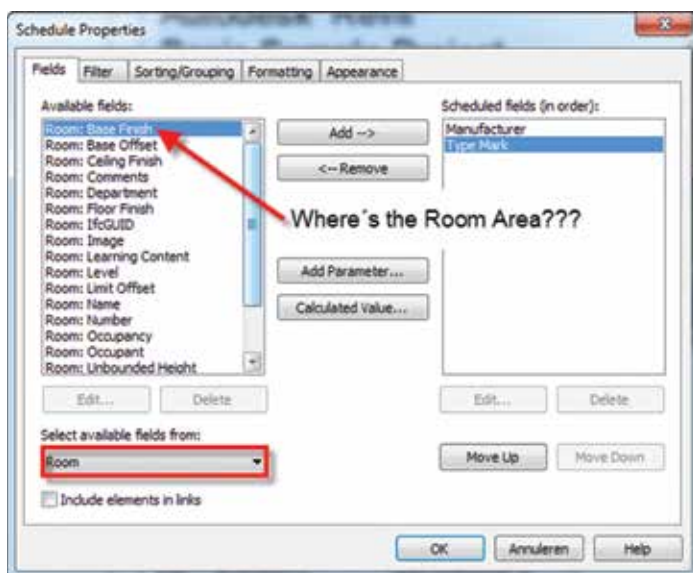
Figure 2: AAAAAARGHHHH!

This list can go on and on, but let's keep it at this and leave the rest to your imagination. I am going to spend the rest of this article telling you about the solution.

A WORTHY SUCCESSOR

One of my all-time favorite tools for Revit is Whitefeet. A simple, yet extremely powerful database manipulation tool. It has some basic features to copy parameter values between objects with a relational connection. Of course, the interface was crooked, and the possibilities for automated sequencing limited. But still, it was the only tool capable of anything like this. This tool has long been without it's equal. Until now…

A few months ago I came across a tool called the BIMiTs Content Admin Kit. This tool, still in an early development stage, was created by Belgian Autodesk reseller called i-Theses. They were actually questioning continuous development of it because they didn't see an immediate use case. Let that be a lesson to us all to keep talking to developers.

WHAT DOES IT DO?

The Content Admin Kit has several tools: a (Shared) Parameter manager, Family Category updater and, most important, the Calculated Parameter manager. The Calculated Parameter manager allows the user to set up a sequence of rules. These rules can simply copy parameter values from one component to another, related component. But they also work with Boolean expressions and conditional statements.
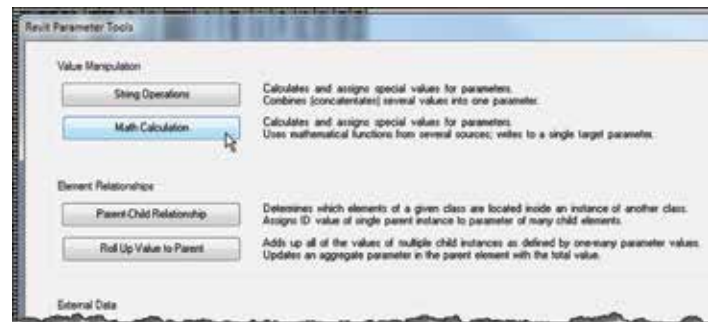
Figure 3: Calculated Parameter manager

Figure 4: Content Admin Kit main functions

Figure 5: Old school schedule that needs manual input for the Element ID parameters

Rules can be applied in a few different ways:
* To all elements of the applicable category in the entire model;
* To all elements of the applicable category in the current active model view;
* To all elements of the applicable category with a certain parameter value;
* To all elements of the applicable category in a certain selection set.

Let's see how this works using some real-life examples.

EXAMPLE 1: COMBINING TEXT PARAMETERS

One of my biggest wish list features is combining text parameters. If only we could combine mark and model values into a single identification value, and then add the room number to easily identify where components are placed. Extremely useful in large projects, especially when going into construction phase.

For this example we will be combining room number, mark value, and model number into a single parameter. In the old days, our schedule would look like Figure 5.

Now this can be done using software such as Ideate BIMLink, i-Theses Datalink, or any other Excel import/export tool. Problem with that workflow is that you need to export to Excel, apply formulas to fill out the project parameters, and then re-import into Revit. To me, that's just too much of a hassle. Now, there's an easier approach, without the need to "go external."

To do this we need to define a rule that copies the Model, Mark, and Room:Number parameter into the Element ID as shown in Figure 6. We're also adding "_" as separators. Then it's simply a matter of hitting "OK" and the tool will perform the required actions.

Figure 6: Combining Mark, Model, and Room:Number into a single parameter
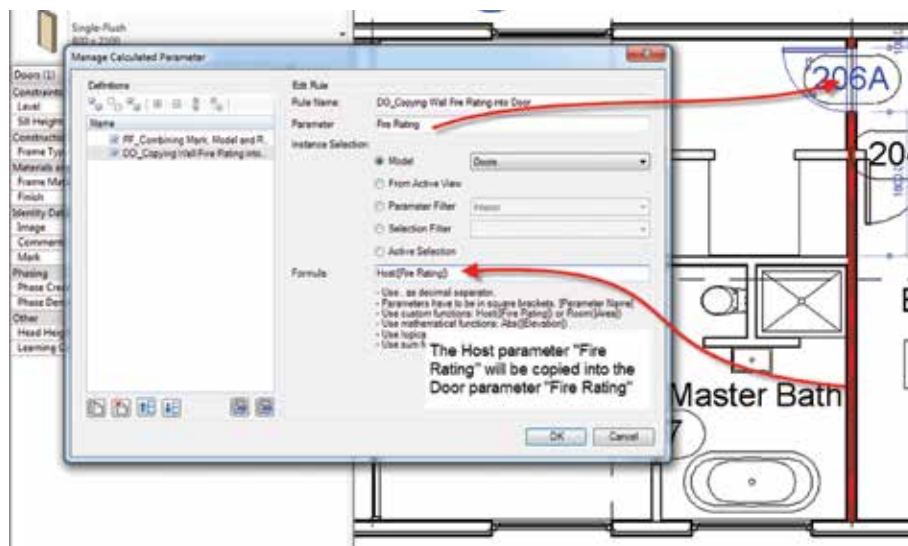
Figure 7: Copying Fire Rating parameter value from Host Wall into Door

EXAMPLE 2: COPYING HOST PROPERTIES INTO HOSTED OBJECTS

Another frustration is the fact that hosted objects cannot respond to parameter values (and changes in those values). In this simple example we will be copying the fire rating parameter values from walls to the doors in the walls. This can be done with a fairly simple rule, as shown in Figure 7.

SOME ADMINISTRATIVE POINTS

The samples above are fairly simple. The Content Admin Kit allows you to create complex sequences of parameter calculations, copying parameter values from hosts to hosted objects, and back again.

However, this does mean your parameter naming conventions have to be pretty strict. Screwing up (either through your own mistake, some manufacturer content, or a project partner messing up) can have some serious implications.

The tools have another great feature: You can create sets of rules that can be exported and imported as desired, which means you can create Rulesets that you save externally and distribute throughout
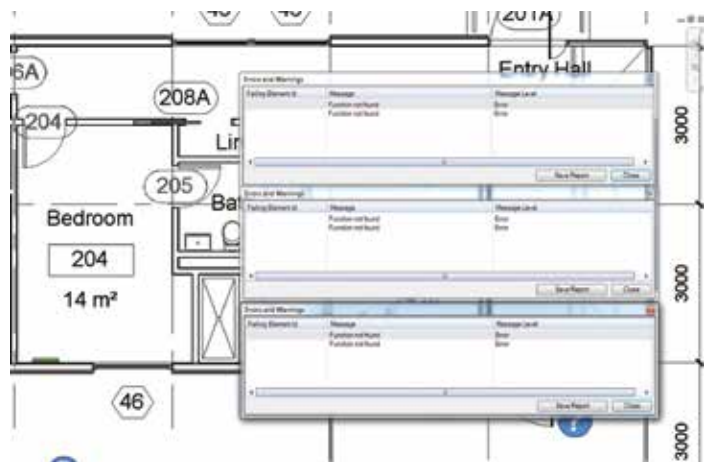
your company. Also, the Rulesets exported and imported back in will fold together so your list of Rules retains a manageable size.

At this point the tool is basically in its first commercially available version. It has some flaws:

- You cannot exclude elements from the rules. In the case of my test file, two Plumbing Fixtures that represented Exterior Tankworks kept giving errors from Example 1, simply because they didn't have a room they were residing in.
- The Errors/Warnings screen doesn't refresh, but gets built with every test run (Figure 8).
- It's not possible to select the elements that are creating warnings from the Errors and Warning screen. This might be frustrating when running large projects.
- There should be a button to test the sequence without closing the interface.

And there are still some features missing. But all in all, this tool really gets me excited. If you want more information, contact the reseller i-Theses, or come to RTC Europe. I will be showing more advanced samples in my class there.

To download a trial version, look here: http://goo.gl/LsFDWL (it's part of the BIMiTs Extensions package).

For more information about functionality and use cases look here: http://goo.gl/9fzOzX

Martijn de Riet is a self-employed BIM Consultant from the Netherlands, working with Revit since version 5.1. Martijn has a bachelor degree in Building Science. After his studies, he started his own engineering firm working for contractors, architects and private clients. Starting in 2007 his company transformed into a full-time BIM consultancy service. At the moment Martijn's clients vary from mid-sized architectural firms to the largest dutch General Contracter and MEP Engineering firms, with a focus on specific corporate solutions, design and implementations of Revit and BIM workflows. Martijn is a member of the Dutch Revit User Group and currently working on creating a Master Template and Component Library. He provides lectures for companies, technical universities, seminars, etc. on a regular basis.

Figure 8: The Errors and Warnings screen gets rebuilt every time

case

How small firms should prepare for the BIM 2016 mandate

THE GOVERNMENT CONSTRUCTION STRATEGY

The Government Construction Strategy is a policy paper issued by the UK Government that sets the target of reducing the cost of government construction projects by 15-20 percent "by the end of the current Parliament." One of the key initiatives is to mandate "fully collaborative 3d BIM [Building Information Modeling] by 2016."

This means that in two years, anyone involved with a government project in the UK will be contractually obligated to use BIM. While the policy only pertains to publicly procured projects, it is expected to catalyze similar requirements from the private sector. So whether or not you do governmental work, collaborative BIM is likely to become a prerequisite for most medium to large projects in the UK within the next couple of years.

COLLABORATIVE BIM

There are many ways to use BIM. At its most basic, BIM can be used inside a firm to produce design documentation. This is sometimes called "Level 1 BIM" or "lonely BIM" because the model is only used internally and not shared with external partners. Communication with partners still happens using traditional drawings sets.

The UK government has mandated a more sophisticated form of BIM called "collaborative BIM," also known as "Level 2 BIM" or "social BIM." In this scenario, the model is developed by multiple companies. The architect, MEP engineer, and other consultants all create a model. These models are then shared so that project participants can check things, such as whether the duct from the MEP engineer clashes with the column designed by the structural engineer. Data extracted from these models are shared in a similar way. Rather than just producing traditional drawings, the architect

might give a fabricator geometric data for a CNC machine or they might generate a COBie spreadsheet of all the assets in the building for the building owner.

COULD THIS HARM SMALL BUSINESSES?

Some in the industry are concerned that small firms might be disadvantaged by the 2016 BIM requirements since small firms are much less likely to be using BIM. The 2014 NBS National BIM Report shows that BIM is used by only 35 percent of small firms with up to five employees. Firms with more than five employees are almost twice as likely to be using BIM, with 61 percent of them having already undertaken the adoption.

The differences of scale make sense historically. Large firms working on large projects have had the most to gain from the benefits BIM offers in terms of systematically organizing and sharing building information. Large firms have also benefited from having dedicated IT staff to guide the transition, as well as the resources to absorb potential disruptions. In contrast, small firms have had less flexibility and less financial incentive to undertake the change.

These differences in scale are becoming less pronounced. Small firms have more reasons than ever to adopt BIM, and many are already racing to undergo the adoption before 2016. Fortunately, this is easier than ever. The pioneering work has already been done by other firms. The best practices are established, many of the contractors and owners are primed to accept BIM, and the technology is mature. It is a perfect time for small firms to make the change.

ADOPTING BIM BEFORE 2016

A common misconception is that your firm can adopt BIM just by purchasing the right software. This is an easy mistake to make. Unfortunately, it's a mistake that leaves a lot of firms in trouble.

Many of the difficulties associated with adopting BIM can be avoided if a firm realizes that BIM isn't about the software, it's about change management. Your employees don't just have to learn a new software, they have to learn a new way of delivering projects.

Small firms adopting BIM benefit from a lack of institutional bureaucracy that could hinder adoption. Change may be easier to initiate, but it still requires leadership. For a successful adoption, it is paramount that someone within the firm takes responsibility for the adoption. So identifying the BIM leader is the first step. The leader must be technical, ideally with experience in delivering BIM projects. If this person doesn't exist within your organization, consider hiring them or employing a consultancy.

Once the BIM leader is in place, the next steps are to begin making the switch. At a small firm, it's practical to make the switch in unison. Select a project that everyone can be involved with – preferably one that's not too difficult or time constrained. Staff training should begin as close to the project kickoff as possible to ensure there isn't a significant gap between training and application. Once the first project starts, someone experienced in BIM should guide the project so that modeling mistakes are proactively addressed before they become serious problems down the line.

For the first project, you will probably use BIM just internally to generate design documents. This isn't a particularly ground-breaking application of BIM, but it's a safe place to start. As you grow more confident, you will be well positioned to start working towards the collaborative BIM requirements for 2016.

AN INFRASTRUCTURE FOR ADOPTION

It's important that your infrastructure is designed to support the expected workload. BIM places new demands on your infrastructure. Most obviously, if you want to undertake collaborative BIM, you must have the network to support the exchange of data internally and externally. This will typically involve having a reliable internet connection, robust internal networking, and an internal server. For a small office, the server doesn't have to be especially powerful. At a minimum, we recommend 16GB of memory, a 2.6GHz four-core Intel® Xeon® processor, and a couple of terabytes of storage. HP sells a range of servers targeted at small to medium businesses. The HP ProLiant ML350e is a great choice because it doesn't require any special cooling or housing. You can just set it up in the corner of your office and have it serve the BIM files.

In addition, it is important to have the right desktop computers. BIM places significantly more demands on your hardware when compared to traditional 2d CAD drafting. Look for workstations that have been certified to run your Autodesk software. They should include SSDs for fast file opening, at least 16GB of RAM, a mid-range GPU, and a fast Intel Xeon processor. For more help selecting your workstations, see HP's and CASE's previous AUGI article from April 2014 on hardware configurations for Revit: http://www.augi.com/augiworld/april-2014.

With this infrastructure in place, and a couple of "lonely BIM" projects under your belt, even your small firm can be prepared for the 2016 deadline.

RESOURCES

For more information, access the following sites:

- Organization implementing the government construction strategy (http://www.bimtaskgroup.org/)
- Government construction strategy (https://www.gov.uk/government/publications/government-construction-strategy)
- NBS National Building Report 2014 showing the rate of BIM adoption in the UK (http://www.thenbs.com/pdfs/NBS-National-BIM-Report-2014.pdf)

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BIM

By: Dan Stine

Lighting Design and Analysis in Revit

As the Building Information Modeling (BIM) "movement" continues to evolve—or mature—it is only natural that we now have more advanced features to discuss in the world of lighting design. In this article I will present an add-in for Autodesk® Revit® called ElumTools, developed by Lighting Analysts. First, we will take a high-level look at this tool's capabilities and then look more specifically at a few recent developments since this product hit the market in mid-2011 when I started using the beta version. Finally, I will briefly mention two other related offerings in the BIM daylighting-design arena.

BASIC REQUIREMENTS

The basic requirements for lighting analysis and design in Revit are highlighted in the box below. The Spatial Geometry is based on the Revit model(s). The Surface Reflectances start with the Revit material and can be changed or overridden via ElumTools. Similarly, the Luminaire is based on the Revit light fixture family and may be manipulated to a certain degree in ElumTools.

The execution of an accurate calculation of illuminance (fc or lux) on a surface or work plane requires that the following quantities be defined:

- Spatial geometry
- Surface reflectances
- Luminaire photometry and associated factors
- Luminaire position and aiming

MODEL SETUP

The following steps must be taken in Revit prior to using ElumTools.

- Typically use Spaces or Rooms
  - Best if they extend to the Level above
  - Must at least extend up to ceiling/lighting fixtures
  - FYI: Otherwise, individual elements may be selected without Spaces/Rooms as long as they are not in a linked model

Middle School designed by LHB, Inc.

- Calculate Volumes must be enabled
  - Elements defining perimeter of room must be set to Room Bounding
- Revit Materials can, indirectly, be set up to determine reflectance in ElumTools
- Revit Materials with the word "glass" or "glazing" in the name will automatically be recognized by ElumTools as being transparent, with the following exceptions: "fiber glass," "glass fiber," and "fiberglass."
- Place proper content

SURFACE REFLECTANCE

Reflectance is derived from the shading color of the Revit Material. Check out the 'Materials Mapping' help topic in ElumTools. In particular, the subsection labeled Surface Reflectance.

ElumTools uses the Graphics\Shading setting rather than the Appearance setting for a Revit Material. This is because the current Revit API does not allow third-party developers full access to this information! Even if it did, these properties do not necessarily represent the true physical properties of the material, which is essential for accurate lighting calculations (ergo, ElumTools material mapping dialog). In addition, there is no consistency between materials as far as parameters go. Check out the Appearance parameters for Carpet (1) versus Tile (4).

$$\text{Reflectance} = 0.2125 * R + 0.7154 * G + 0.0721 * B$$

Where R,G and B are expressed as numbers between 0 and 1.0 (when RGB is expressed by numbers between 0 and 255, divide by 255).

For example:
The Shading color for a specific material is set as shown in Figure 1.

Let's calculate the ElumTools reflectance for this Revit material.
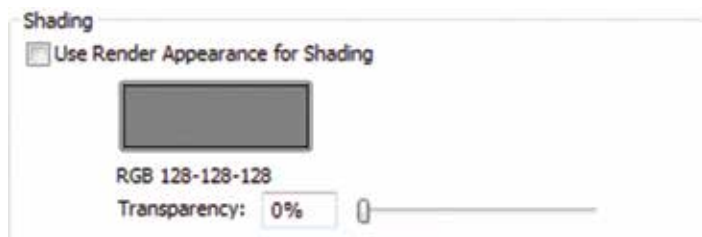
Figure 1: Revit Material's shading setting

First, modify RGB numbers for formula: 128/256 = 0.5020

$$
\begin{aligned}
\text{Reflectance} =\ & 0.2125 * 0.5020 + 0.7154 * 0.5020 + 0.0721 * 0.5020 \\
=\ & 0.1068 + 0.3591 + 0.0362 \\
=\ & 0.5020
\end{aligned}
$$

In the ElumTools Material Mapping dialog we see the reflectance is indeed 0.50 as calculated above.

Using this method, the reflectances can be set in Revit using specific Material settings, even in the linked in architectural model. This may be a challenge in terms of visual color desired and effort to determine correct values for a specific reflectance. It is even more challenging if the architect is not in-house or does not see that value in this effort. *Breaking news on this issue:* The folks at ElumTools are working on an option to use the defaults (such as 80/50/20) for any ceiling/wall/floor, thus significantly simplifying the reflectance workflow. Watch for this in a future release!

SPACES AND VOLUMES

It is important to be aware of the height of your spaces in the Revit model. This is true, irrespective of ElumTools. For example, if you want light fixtures or occupancy sensors on the ceiling to report which room they occur, the space needs to extend up and engage them. In the example below, the Revit ceiling elements are not able to discern which room they are in. Neither can ElumTools find the lighting fixtures or the ceiling itself, which is needed to derive reflectance.
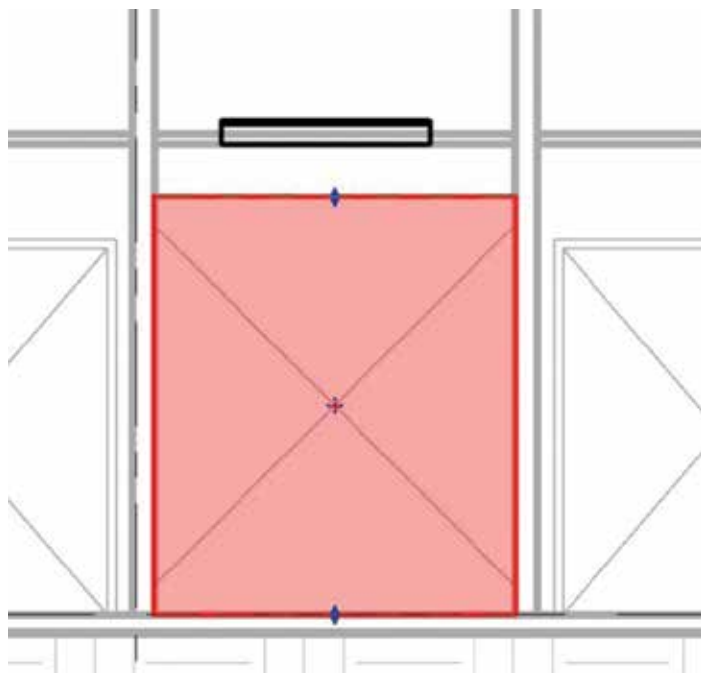
Figure 2: Selected space does not extend to ceiling or light fixtures above

For a more in-depth discussion see my Rooms and Spaces article at www.AECbytes.com.

Best Practice: Set the Upper Limit of the Space to the Level above (assuming it is not an intermediate level such as a mezzanine) and then set the Space's Limit Offset to 0'-0".

ELUMTOOLS WORKFLOW OVERVIEW

The following outline represents a high-level overview of the ElumTools workflow.

- Luminaire Manager
  - Verify light fixtures are valid (no red Xs)
  - Verify photometric file is correct
    Change via button in upper right if needed
  - Adjust Light Loss Factor (LLF) for each fixture
    Duplicate Types may be needed in Revit if multiple LLFs are needed
  - Properly position each light source
  - Apply emergency settings as appropriate
    Each fixture type has a Use Instance Parameters option
- Material Mapping
  - Verify Surface Type and Reflectance for each Material used in the space(s) to be analysed

- Important: The drop-down list at the top allows you to see, and override, materials in linked files
  - The Link column can be set to None, Unidirectional, Bidirectional
  - Common settings can be saved
- Add Calculation Points
  - Select a Space and then specify the point grid spacing and elevation, etc.
  - A points grid can also be added to a planar face. This allows you to study a wall
- Calculate Space
  - This allows you to select one or more spaces to calculate (all previous steps listed must have been performed prior to this)
  - Layout Assistant
    - This feature can be used to automatically place light fixtures in a space based on the desired light levels
- View/Hide Results
  - This toggles the visibility of the results directly in the Revit model (uses Revit's Analysis Display styles)
- Mode Toggle
  - Toggle between General, Emergency, and Daylighting mode
  - Daylighting Parameters
  - Dialog only available when Mode is set to Daylighting
  - Verify Site information
    - Initial settings come from the Revit model
  - Specify Date and Time
  - Select and define Sky Condition

At this point, we will take a closer look at two newer features; Layout Assistant and Daylighting.

LAYOUT ASSISTANT

The Layout Assistant will add light fixtures to an area based on the desired illuminance for a space or room.

Prior to using this feature, the model must have the space element, ceiling, and a single light fixture. The single light fixture is required for ElumTools to connect the dots between the desired family and the host (i.e., ceiling).

When you start the layout assistant tool, you are presented with this dialog. Click one of the "Space" buttons (item #1) to select the space(s) in the model
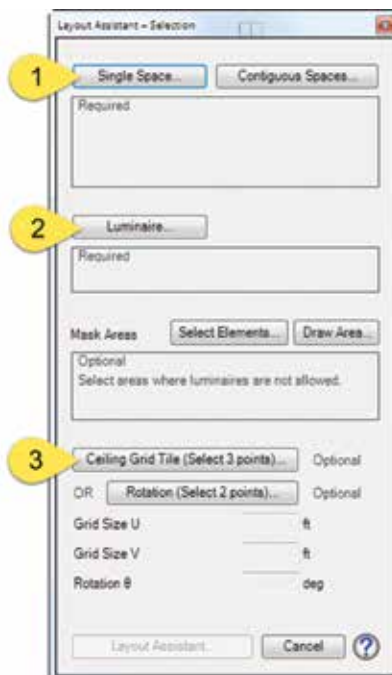
Figure 3 : ElumTools Layout Assistant Selection dialog

under consideration. Next, click the Luminaire button (item #2) to select the light fixture (previously placed on the ceiling in the space). Optionally, you can tell ElumTools where the ceiling grid is (item #3); this will ensure the proposed fixtures align with the ceiling grid. This is optional because it might be better in some cases to reposition the ceiling grid, rather than the lights, for ideal light distribution.

When the selections are complete, you click the Layout Assistant button to move on to the next step.

In the main Layout Assistant dialog (Figure 3) the lighting designer is presented with a plan view of the room—an L-shaped space in this example. The most basic workflow consists of entering the desired foot candle (fc) level (see red arrow). Immediately, ElumTools presents three rough options in the "Estimated" section. Clicking on each of the buttons in the "Estimated" section previews the luminaire layout in the space. In our example, ElumTools indicates 11 fixtures will be required to achieve 70 fc.
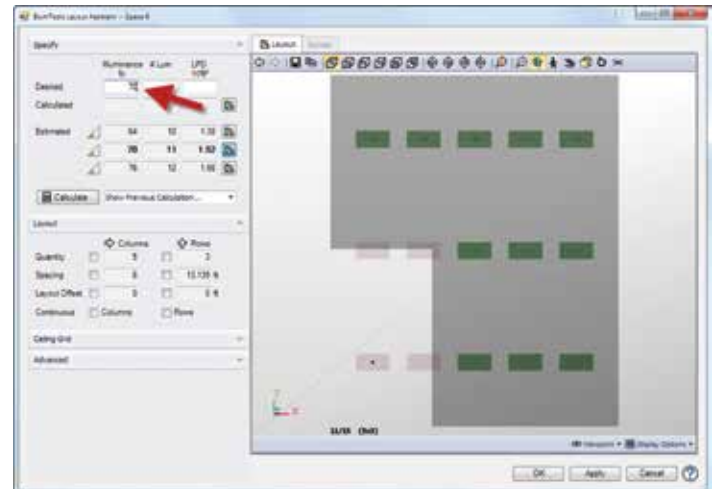
Figure 4: Entering desired illuminance

Once we have selected an estimated option we are happy with, we need to run an analysis to confirm the design. The layout assistant provides convenient access to the full calculation engine
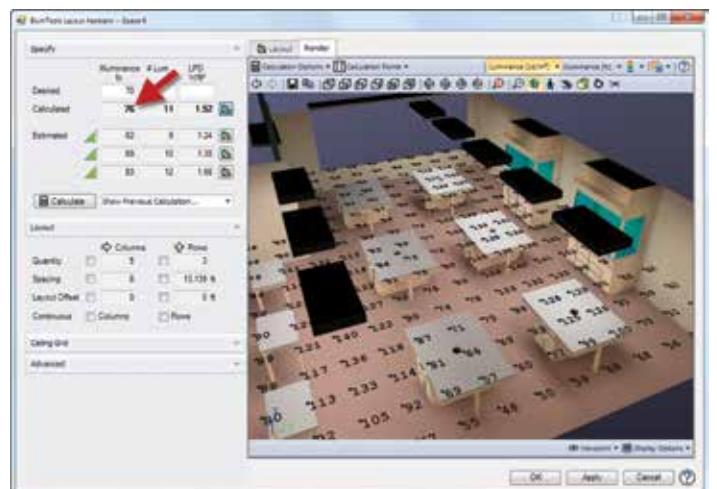
Figure 5 : Calculated illuminance

via the Calculate button. Once a full calculation is complete we can compare the Desired value with the Calculated values as pointed out in Figure 5. Also, notice how the estimated values have updated. Notice the preview window now shows a 3D view of the model with our defined grid points populated with fc levels.

Once you click OK, ElumTools places the fixtures in your model as shown in Figure 5. In this example, either the ceiling grid needs to move or all the fixtures could be selected and aligned with the ceiling grid. Also, notice that the Space Tag was edited to report the Average Iluminance for the space. This was done using the shared parameters provided by ElumTools. The FC value is blank until a calculation is run.
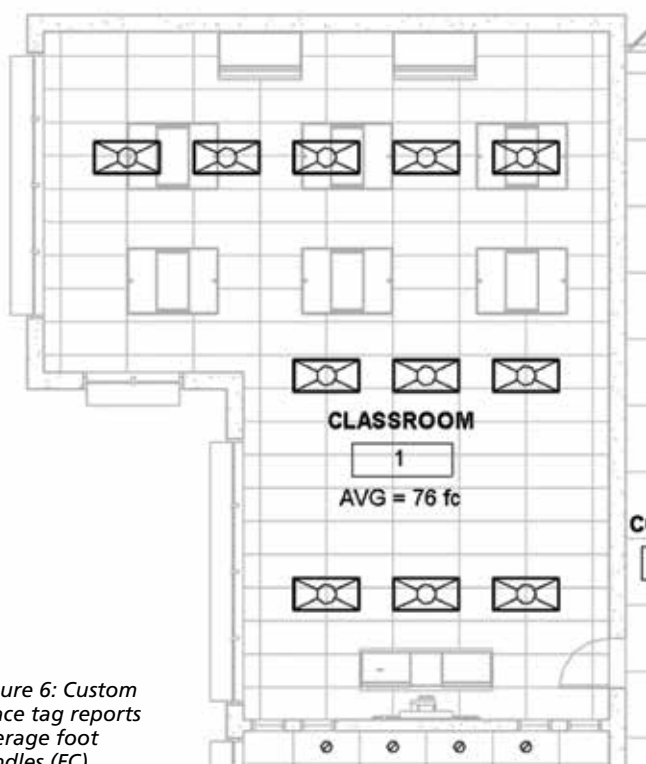
Figure 6: Custom space tag reports average foot candles (FC)

Figure 8: Calculated results displayed in Revit

is presented. The results may be hidden via the Analysis Display option for a given view's properties.

SCHEDULING RESULTS

Because ElumTools pushes all the calculated data for each space back into the Revit model, all this information can also be scheduled. The example shown here combines the space results with information about each luminaire located within it. This is called an Embedded schedule.

DISPLAYING RESULTS IN REVIT

Once one or more spaces have been calculated you may display the light level values in any Revit view by clicking the View/Hide Results button on the ribbon. ElumTools employs the built-in Analysis Display Styles, so some changes can be made (e.g., decimal, min/ max legend, etc.) to the way the information

Figure 7

Lighting Analysis Schedule				
Room: Number Family and Type	Room: Name Luminaire Dirt Depreciation	Illuminance Average Luminaire Lumens	Illuminance Maximum Count	Illuminance Minimum
1	CLASSROOM	76.28 fc	148.19 fc	0.41 fc
Troffer Light - 2x4 Parabolic: 2'x4'(4 Lamp) - 277V	1	8029 lm	11	
2	OFFICE	78.00 fc	125.56 fc	12.80 fc
Downlight - Recessed Can: Fluorescent - 277V	1	836 lm	4	
Troffer Light - 2x4 Parabolic: 2'x4'(4 Lamp) - 277V	1	8029 lm	4	
3	CORRIDOR	0.00 fc	0.00 fc	0.00 fc
4	Room	55.45 fc	73.07 fc	28.34 fc
Zumtobel AERO II 60W/85 LED + 2/35W T16 Dimmable		9713 lm	6	
5	RCPT	78.94 fc	97.57 fc	51.40 fc
Troffer Light - 2x4 Parabolic: 2'x4'(4 Lamp) - 277V	1	8029 lm	4	
6	WORK AREA	51.04 fc	69.87 fc	30.68 fc
Troffer Light - 2x2 Parabolic: 2'x2'(4 Lamp) - 277V	1	3741 lm	2	

Figure 9: Lighting analysis schedule in Revit

One thing to keep in mind with ElumTools data in the Revit model, is that the same parameters are used for Normal and Emergency modes. That is, if you run calcs for a space in "Normal"

BIM

Figure 10: Elumtools Daylighting dialog

mode, and then run calcs for the same space in "Emergency" model, the normal data is overwritten. This will affect Revit tags and schedules. So, per this scenario, once the emergency design results have been confirmed, switch back to normal and run the calculation again to restore the "Normal" dataset.

DAYLIGHT DESIGN

The newest feature to ElumTools is the ability to calculate light levels in a space from the sunlight and skylight at a given day and time.

First, the location and true north must be specified using the normal Revit steps; Manage * Location and Manage * Position * Rotate True North (in a view with Orientation set to True North).

Next, similar to artificial lighting workflows, one would need to verify the Material Mapping and add Calculation Points to a Space.

To select the daylight specific options, simply change the mode to Daylighting to reveal the Daylighting Parameters button on the ribbon.

The Daylighting dialog, Figure 10, initially gets its Site Information from the Revit model. However, this can be changed manually here if needed. The date and time must be set for accurate results. Finally, the sky conditions must be selected. There is an IES and/or CIE sky model option (clear, partly cloudy, overcast) and then we have a more accurate option tied directly to our project's micro-climate via weather station data. This latter option, the Perez All-Weather Sky method, uses historical weather data to better approximate the sky conditions for the selected day and time. One simply needs to select Find Closest to quickly list the correct weather station.

Graphically, the results are presented the same as the images shown previously in this article—using the specified point grid with values reported based on light entering the space through exterior glazing.
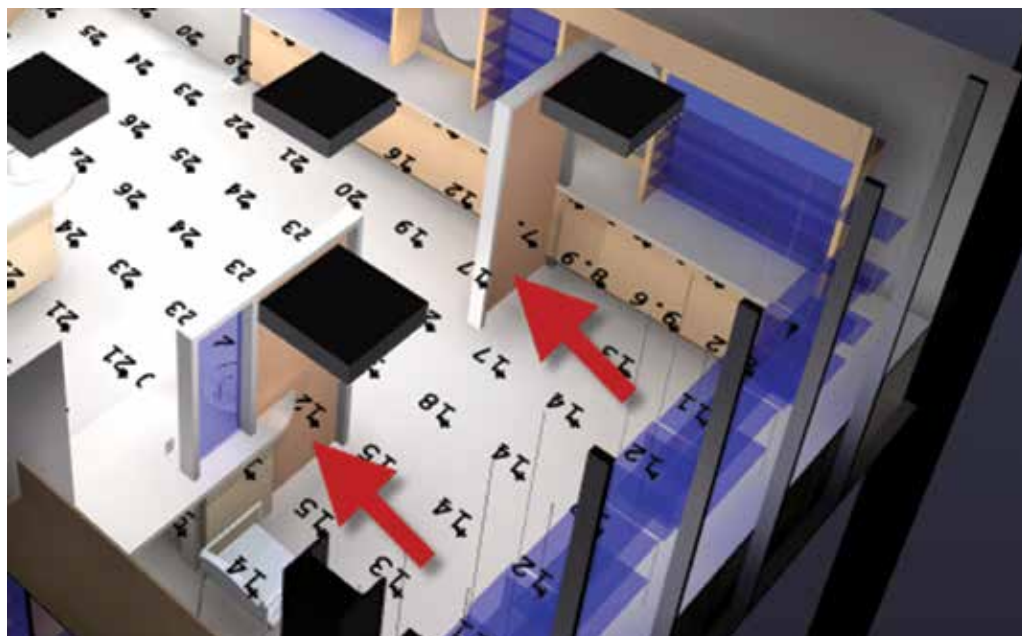
Figure 11: Problem filtering out demolished elements

ENHANCED 2014 GEOMETRY VALIDATION

One last thing worth mentioning—there has been a challenge with existing items, set to be demolished, showing up in the lighting analysis (Figure 12). This, I am told, has to do with some limitations in the Revit API. However, the folks at ElumTools came up with another way to achieve the desired results.

When enabling the "Filter by View Visibility" setting, ElumTools will automatically create a 3D view named ElumTools_WorkingView. Anything not visible in this view will be excluded from the calculations. This can be quite powerful as it accounts for phases, design options, visibility graphics, view filters, etc. If you see undesirable results, you open the ElumTools_WorkingView and hide anything you want. The next time a calculation is run, the items hidden will not appear in the analysis.

AUTODESK DAYLIGHTING CLOUD SERVICE BETA

Autodesk is working on a daylighting solution geared towards LEED IEQc8.1 2009 compliance. The analysis is all done via Autodesk Cloud Services so you have to log
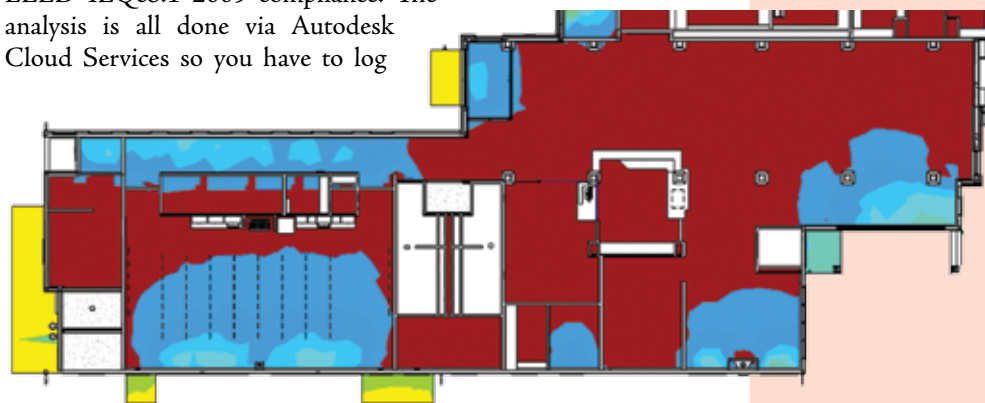
Figure 12: Autodesk daylighting analysis results in Revit

in first. The results are presented graphically in Figure 12 and a room schedule is created in your Revit model.

SEFAIRA

As a building performance design tool, Sefaira now offers daylight and glare analysis in their real-time SketchUp add-in. This feature set is not supported directly in Revit. However, Sefaira does have a Revit add-in to export the geometry to Sefaira.

CONCLUSION

As you can see, the ability to do lighting analysis using third-party software in the Building Information Model has come a long way in recent years. These tools significantly reduce the time necessary to do the analysis. I am sure these tools will continue to evolve and provide even more features and speed for lighting designers.

Dan Stine is a registered architect with 23 years of experience. He currently works at LHB, a 250-person multi-discipline firm in Duluth, Minnesota, as the BIM Administrator, providing training, customization and support for two regional offices. Dan is a member of the Construction Specification Institute (CSI) and the Autodesk Developer Network (ADN) and has taught AutoCAD and Revit Architecture classes at Lake Superior College for the Architectural Technology program. Dan currently teaches BIM to interior design students at North Dakota State University (NDSU). He has presented at Autodesk University, the Revit Technology Conference, and Minnesota University. Author of a number of textbooks, Dan has included a 40-page ElumTools tutorial in two of his 2015 Revit textbooks, Design Integration using Autodesk Revit 2015 *and* Interior Design using Autodesk Revit 2015. *Dan has presented on ElumTools at the last two Revit Technology Conferences in North America and will be presenting some of the new information touched on in this article at this year's conference.*

The ABCs of MEP Construction Modeling, Part 1
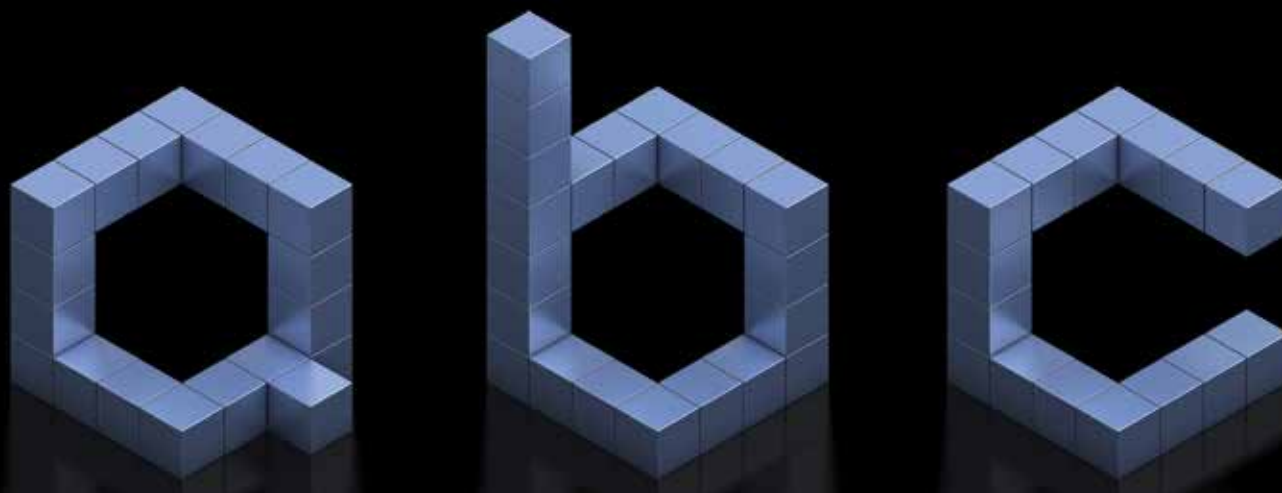
It is clear that BIM in general and Autodesk® Revit® specifically are not just for building design. Leveraging BIM directly in construction is arguably the most cost effective use of the technology, particularly for the mechanical, electrical, and plumbing (MEP) trades. Trade subcontractors for HVAC, plumbing, electrical, and fire protection work are increasingly employing modelers to produce BIM construction models for the purposes of coordination, fabrication optimization, and installation sequencing. Many component manufacturers now provide high-quality Revit content of their product lines, improving the integrity of construction models and thus increasing the value of the BIM process back to the owner for the purposes of commissioning, operations, and maintenance.

However, the process of construction modeling is not to be underestimated in terms of time, effort, expertise required, and expense. Even with the most well-coordinated design models at your disposal, considerable effort is going to be spent by the construction team in creating models adequate for the requirements of coordination, fabrication, and installation.

This first of a two-part article series reviews the real-world work involved in getting started with Trade Contractor Modeling (TCM) with a focus on the MEP trades. Part 2 will show how to use Revit specifically for TCM, providing tips to help make the process smoother.

WHAT? THE DRAWINGS AREN'T PERFECT? WHAT ARE THE CHANCES?

Architects and building engineers are tasked with delivering a documented design that satisfies the client's needs. To that end the goal is to deliver a set of construction documents—the drawings and specifications—to the owners and builders, which provide detailed instructions on what is to be built, the systems to be installed, the materials and products to be used, and the execution methods by which they are to be incorporated within the project.

Ask any contractor to rate the quality of the construction documents on their last project on a scale of 1 to 100, and you could easily get answers in the single digits (if not in negative numbers). One factor is the disparate legal, financial, and industry focus considerations between the design and construction industries. As a result, designers don't care about what the contractor has to go through, and vice versa. This is something that BIM in general and new contractual models such as Integrated Project Delivery (IPD) are attempting to solve, but we aren't all there yet.

In more typical project delivery scenarios, some of the major reasons for "bad drawings" are: 1) Incomplete work, resulting in part from too little time to fully flesh out the documents; 2) Inaccurate work, resulting in part from too little time to fully Q/A the documents; and 3) Incompatible work, in part due to a concerted effort to limit professional liability.

A MAN'S GOT TO KNOW HIS LIMITATIONS

Limiting your professional liability surface area essentially means you relieve yourself of responsibilities that should be taken on by someone else. In most cases, this is the contractor in charge of installing that part of the work.

For example, the following excerpt is from "Section 23 00 00 – Mechanical General Provisions" from an actual project specification, emphasis in bold:

"E. Intent of Drawings and Specifications:

1. The intent of the drawings and specifications is to establish **minimum acceptable** quality standards for materials, equipment and workmanship, and to provide operable mechanical systems complete in every respect.

2. **The drawings are diagrammatic, intending to show general arrangement, capacity and location of system components, and are not intended to be rigid in detail. Final placement of equipment, other system components, and coordination of all related trades shall be the contractor's responsibility.**

3. Due to the small scale of the drawings, and to unforeseen job conditions, **all required offsets and fittings may not be shown but shall be provided at no additional cost.**

4. In the event of a conflict, the Owner's Representative shall render an interpretation in accordance with the General Conditions."

In other words, the mechanical engineer is responsible for designing an HVAC air system that provides a particular level of performance, e.g., to deliver 400 CFM to a specific diffuser. But that engineer is ultimately not responsible for coordinating the ductwork to that diffuser with the structure or even with other MEP trades. And, sadly, too many of them may not even care. This is why we get drawings with pipes running through steel beams or electrical conduit running through ductwork.

However, even with a very well-coordinated set of construction documents, the critical phase of construction coordination happens outside of design, and thus it ultimately rests on the shoulders of the construction manager and trade contractors. Constructability reviews, requests for information (RFIs), shop drawing production, and product submittals are all part of this phase, and in today's BIM environment this requires concerted construction modeling efforts that go way beyond design modeling.

While many of the trades will participate in coordination over time, the model-based coordination process falls largely on the shoulders of the MEP trade subcontractors and, increasingly, the trade subcontractor construction modeler. This person accurately models his particular trade's systems in detail, breaking down the designed elements into the specific fabricated parts, often using specialized (read: not Revit) software. This allows the contractor's shop standards, required clearances, and fabrication/constructability to be factored in to provide a proper model for coordination, shop drawing production, and installation.

THE PLAYERS

The construction modeling process starts with the construction manager, who is usually responsible for performing all coordination. Along with the project manager and other support staff in the job trailer, they will have an MEP engineer/coordinator on site to oversee installations of the MEP systems, ensure the documents and specifications are followed, conduct QA/QC walkthroughs with the owner's representatives, and work on the commissioning of all MEP systems.

Many construction firms have dedicated BIM coordinators on staff to collate and perform clash detection of the trade subcontractor models. This person is often responsible for creating the project's BIM Execution Plan and Coordination Specification. This section of the Project Specifications lays out things such as required level of modeling development (LOD), subcontractor responsibility matrix, and BIM coordination schedule.

The BIM coordinator gathers and combines the trade contractors' models into Navisworks and/or other applications, running clash tests and issuing clash reports, performing model-based quantity takeoffs for estimating, creating 4D simulations, and perhaps advanced visualizations for owner requirements.

A trade subcontractor's bid will include fees for construction modeling and coordination based on the construction documents as well as construction manager's BIM Execution Plan. They either have BIM capabilities in house or may subcontract out the modeling work. The CM may also self-perform or subcontract the creation of the architectural and structural construction models, which are then provided to the trade subcontractors as backgrounds for their trade models.

Thus, the MEP trade construction modeler will be a key person in the process, working very tightly with the CM's project manager, BIM coordinator, and the MEP coordinator. They will need to regularly upload the ongoing trade model content for coordination, and participate in all coordination meetings.

Revit MEP 2015

REVIEW THE CONSTRUCTION DOCUMENTS

The first thing the trade contractor modeler needs to do is to perform a thorough review of all the construction documents, even those out of the trade's scope, to fully understand what may impact their trade's modeling process.

A thorough familiarization of all floor plans, elevations, sections, framing plans, and all major construction details is required to understand what is happening throughout the building, particularly above the ceiling. This critical space is usually where all of the fun happens, MEP-wise, so it's important to understand where you have room and where you do not. It is true: even in the best BIM design environments, sometimes the HVAC, plumbing, and electrical engineers do not quite coordinate their work as well as perhaps one would like, and end up with things that try to exist in the exact same place at the same time. While the structural and MEP engineers may be on different planets, it's your job to ensure their designs work on this one.

The specifications are just as important as the drawings. They often include crucial information left out (or simply incorrect) in the drawings. They may call out things such as the mounting heights for electrical panelboards, the thickness and size of housekeeping pads, requirements for hangers and suspension systems, and so on. Keep on the lookout for discrepancies between the drawings and specifications, and notify the construction manager of any immediately.

In particular, MEP construction modelers should review the insulation schedules for duct and piping. Insulation is typically not shown even in the best MEP models, but plays a major role in coordination.

Insulation schedules can get complex, based on service type and location. A concealed supply air system above an unconditioned space may require 3" of insulation. The return air ducts may require 2". If a supply duct needs to cross over a return, the schedule demands that an additional 10" of above-ceiling vertical space be dedicated to insulation.

With the universal demand for Sistine Chapel ceiling heights by today's architects and Hobbit-like floor to floor heights by building owners, losing an additional 10" of prime vertical real estate above the ceiling and below the structure is often difficult if not impossible.

MAP OUT SYSTEMS AND MARK UP THE DOCUMENTS

As part of the detailed documentation review process for MEP coordination, the next step I recommend is to map out the various systems one by one. I first establish a standard coloring system for all my MEP systems. Duct systems may be color coded as supply, return, exhaust, outside, and relief air, and/or by the AHU or VAV from which they are served. For piping, color code the separate systems for domestic cold water, domestic hot water/recirculation, sanitary waste, vent, storm sewer, hydronic chilled and hot water, steam, condensate, fire protection, and so on. Conduit usually is not specifically routed on plans, so I color code them by conduit trade size on the electrical single line diagrams.

I used to mark up full sets of drawings using a dozen or so colored highlighters. Today I create my detailed markups directly in the project PDF sheet sets. I typically have a separate PDF each for the civil, architectural, structural, and MEP drawings, and on smaller jobs I'll combine all sheets into a single project PDF. Right now my tools of choice for PDF markup work are Acrobat Pro for assembling multiple sheets into one file and for general page management, and PDF-Xchange Editor, a free application with easy-to-use markup tools and great navigation functionality.

Tracing out each system using simple PDF polyline markup tools enables you to easily cue off of color, reverse-engineer the designer's intent and best understand the building as a living, breathing thing. I use solid fills to highlight equipment, and cloud areas to identify issues. Text boxes with leaders call out issues or RFI information. I always take the marked up PDFs with me into coordination meetings and often directly annotate them during our discussions.

Navigating large PDFs is usually difficult and very tedious with most applications. I first run through the task of creating bookmarks for each sheet. Next I'll create links between the pages to make it easier to bounce around as needed. Floor plans typically get large text boxes with links to the enlarged plans, details, and schedules, all of which have similar text and links that point back to the plans. Anything you can do to make flying through the documents to a specific page or detail easier is time well spent.

3.10 DUCT INSULATION SCHEDULE, GENERAL

SYSTEM TYPE	DUCT TYPE	DUCT LOCATION			INSULATION	
					TYPE	THICKNESS
SUPPLY AIR	Round	Indoor	Conditioned	Concealed	M.F. Blanket	3"
				Exposed	Elastomeric	2"
			Unconditioned	Concealed	M.F. Blanket	3"
				Exposed	Elastomeric	2"
	Rect.	Indoor	Conditioned	Concealed	M.F. Blanket	3"
				Exposed	M.F. Board	2.5"
			Unconditioned	Concealed	M.F. Blanket	3"
				Exposed	M.F. Board	2.5"
RETURN AIR	Round	Indoor	Conditioned	Concealed	na	na
				Exposed	na	na
			Unconditioned	Concealed	M.F. Blanket	2"
				Exposed	Elastomeric	1.5"
	Rect.	Indoor	Conditioned	Concealed	na	na
				Exposed	na	na
			Unconditioned	Concealed	M.F. Blanket	2"
				Exposed	M.F. Board	1.5"
OUTSIDE AIR	Round	Indoor	Conditioned	Concealed	M.F. Blanket	2"
				Exposed	Elastomeric	2"
			Unconditioned	Concealed	M.F. Blanket / Elastomeric	3" / 2"
				Exposed	Elastomeric	2"
	Rect.	Indoor	Conditioned	Concealed	M.F. Blanket	1.5"
				Exposed	M.F. Board	1.5"
			Unconditioned	Concealed	M.F. Blanket / Elastomeric	3" / 2"
				Exposed	M.F. Board	1.5"

Figure 1: A typical duct insulation schedule

Figure 2: Plumbing drawing marked up with color-coded systems and links to other sheets

good while and have started issuing questions and RFIs back to the CM. They, in turn, usually forward them to the architect's representative, who routes them through the design team and sends the answers back to the CM, back to the trade subcontractors, and ultimately back to you.

Thus, the next step is to review the complete running set of subcontractor questions and answers, RFIs, and any supplemental drawings (field sketches) issued by the design team. These critical documents often reveal mistakes in the construction documents, clarify dimensional questions, present problematic site conditions, and issue formal revisions. Because these can number in the hundreds for even a small project, make the appropriate allowances for review time. Note that as a trade contractor modeler, you may be responsible for initiating RFIs as well. Close communication with the project manager, MEP coordinator, and BIM coordinator is essential at all times.

For clarification purposes, the design team may at some point revise and resubmit the full set of construction documents for construction, which incorporate all RFIs up to a certain point. It is usually these revised documents that are the basis of the trade contractor's fee. Based on the quality of the construction documents, some contractors fully expect to make a good deal of profit resulting from RFIs or change orders during coordination and construction.

Supplemental drawings and clarification sketches that revise existing drawings always get inserted into the PDF, highlighting the changes with clouds and callouts. Paper drawings immediately get scanned and inserted as well. Addenda will be inserted into the specifications PDF(s), striking out text that is made obsolete. This markup and maintenance strategy creates a living PDF, which negates the need to print off the very expensive set of paper documents.

While I personally would rather use DWFs and Design Review instead of PDF, the DWF format has some functional limitations that PDF does not. Furthermore, I've had Design Review 2013 act decidedly odd with large 100MB+ DWF files. Until Autodesk sorts out its DWF strategy, I'm sticking with PDF for now.

QUESTIONS AND ANSWERS AND RFIS, AW JEEZE

Depending on the project, the construction modeling process may often be delayed until the last possible minute, particularly if the work is being subcontracted out to a third party. By the time you actually start your review and modeling process, the trade subcontractors may have had the construction documents in their hands for a

Figure 3: The reality of construction

Once the construction documents and RFIs are reviewed and marked up, we need to look at what models may have been provided by the design team.
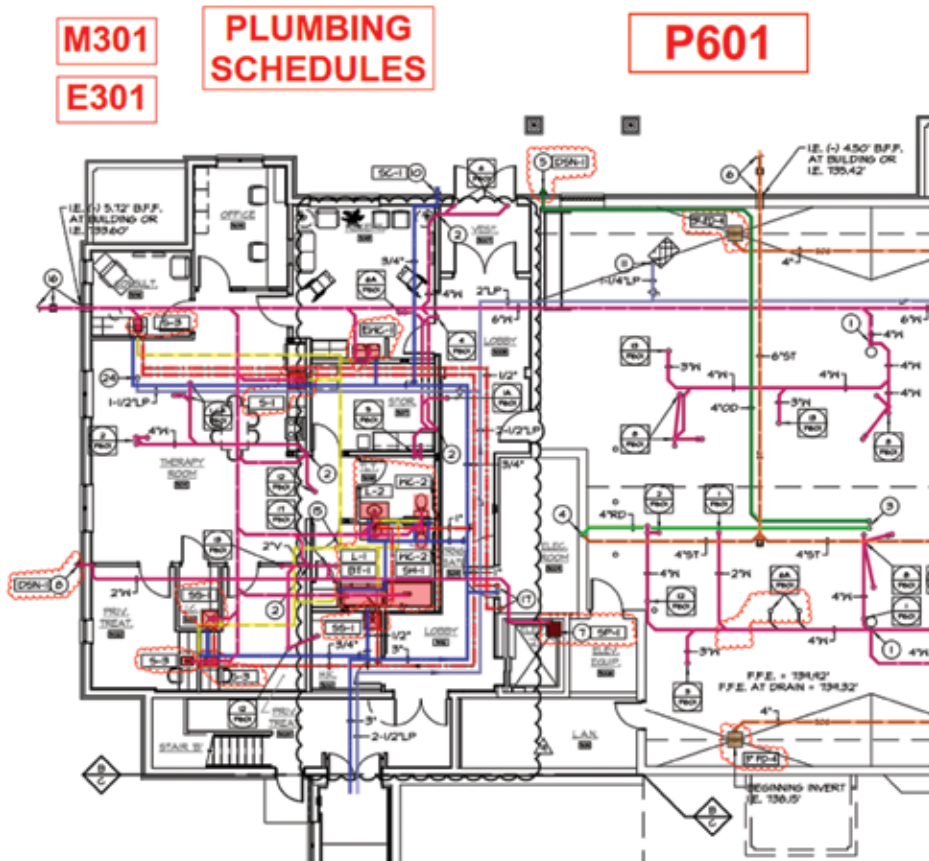
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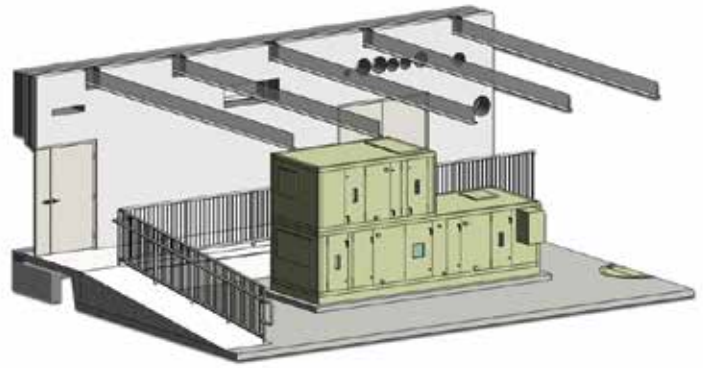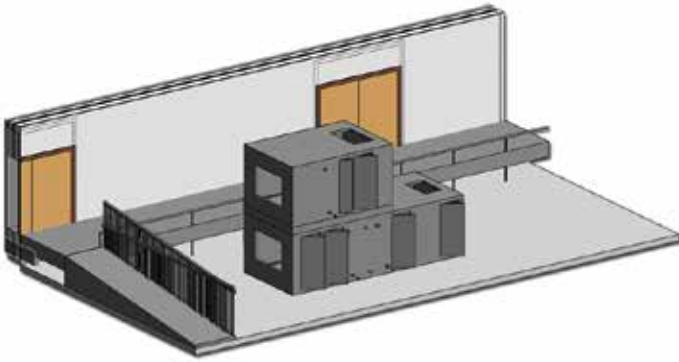
Figure 4: Design model (left) and construction model (right)

DESIGN MODELS ARE NOT CONSTRUCTION DOCUMENTS

The main roles of BIM in architecture and engineering are: 1) to facilitate a better design, primarily through improved visualization, iteration, and analysis; and 2) to accelerate the documentation process, through purpose-built tools such as automated view creation, intelligent tags, always-accurate schedules, and streamlined sheet setup. When the construction documents are delivered, the design team may (or may not) provide their design models to the CM as a basis to start construction modeling.

However, one should understand that even the best design models are not construction documents, and should not be relied upon for accuracy. The level of usability of a typical design model for construction is a huge variable. Designers are most concerned with what is on paper first, and the road to CDs is paved with good, bad, and indifferent intentions. The sins of the design team can be readily seen when reviewing their models for consideration— sometimes you can just tell when it hit 5 o'clock.

While design information reuse through to construction should be something a BIM process delivers on, it is typically not a linear walk from design model to construction model. As odd as it may sound, time is needed to work through design models to ensure they actually represent what is in the construction documents, which always automatically trump whatever is in the model.

There are many reasons why the design model may not match the construction documents. Skill allocation is still a huge issue; a design firm may not have internally moved to a 100 percent Revit implementation, so may use an out-of-band design process using both Revit and CAD. People may simply not understand best practices in Revit or have time crunches for proper modeling, so you may see liberal use of Masking Regions to hide large areas on the floor plans, which are then detailed in "dumb" linework on top.

In one real-world example of a project I've worked on, the structural engineer used a combination of Revit and AutoCAD®. The structural model was used to generate only floor plans; sections, details, and even the column schedules were produced in AutoCAD. Even then, much of the textual information in the plans was input as dumb text, not tags that report actual information.

Column grids were traced from inaccurate CAD plans and were crooked or incorrectly spaced. Foundation walls were modeled as 14", but detailed in CAD as 16". Most of the modeled columns were the wrong size. Top of steel elevations were incorrect. The list of wrongdoings was almost endless. This separation of intelligent model data from the drawings meant the ability to use the design model for construction was severely limited without a lot of rework.

The problem of poor design models isn't going away any time soon. Combined with the specifics required in construction modeling, many trade contractor modelers will simply dismiss design models outright and remodel their project work from scratch. By accurately modeling to the CDs first, issues with the design and documentation can be readily discovered and communicated. After shop drawings and product submittals are factored in to the construction models, you now can build to the model as you have the additional detail required for coordination, shop drawing production, fabrication, and installation optimization.

In Part 2 of this article, we pick up the discussion on initializing the start of your construction modeling process with shop drawings and submittals. We'll focus on using Revit for MEP construction modeling that brings the intended design much closer to reality, and I'll provide some tips and tricks for smoothing out your construction modeling efforts.

Matt Stachoni is the Senior AEC and BIM Applications Technical Specialist for CADapult Ltd, an Autodesk Silver Reseller in Newark, Delaware. He has been using Autodesk applications since 1987 and today actively participates in project construction modeling, coordination, and BIM training and implementation for architects, engineers, and construction professionals. He can be reached at matt@stachoni.com.

Revit Structure 2015

by: Kaushal Diwan and Adam Muñoz

Help Me, Help You

"Customization…? Really…? I just want to use this product out-of-the-box the way Autodesk sold it to me." Let's face it, if you're getting into Autodesk® Revit® Structure, you are customizing it one way or another. You're in the trenches, putting out fires, helping with overall team collaboration, and meeting deadlines by doing things you never knew you could. You don't mess around!

If you've been aboard this "Revit Train" you know how it has changed since it first got on the tracks around 10 years ago. Aside from the technical improvements to the software and its compatibility with other virtual building tools, the true changes are how it forced people to interact with these tools and how they collaborate with each other. Chances are you will either fall in the boat of a "designer" (Adam) or a "general contractor" (Kaushal).

"THE ARCHITECT SAYS YOU DON'T NEED DIMENSIONS ON THE DRAWING WHEN YOU CAN SIMPLY QUERY THE COMPUTER MODEL"

Figure 1

Since no design or general contractor firm operates the same way as their competition, the importance of collaboration and the process of sharing technical information drives us to customize our interactive needs. We will be sharing a few thoughts on customization and what we feel are some of the most important driving forces behind our current virtual building passion as a designer and builder. Allow us to provide a glimpse of what this designer and contractor interaction looks like (or should look like).

IMPORTANCE OF PRE-PLANNING

(Kaushal's email to Adam)
"Hi Adam, I just found out that we will be working together on the local higher education project. As you know, we were recently selected by the owner as the preferred builder and realize that significant production on the 3D model has already commenced. With our role as the general contractor, I would really like to capture all the current BIM progress and understand where we are in design so we can implement the BIM Execution Plan that I have been working on. Please let me know your thoughts and let's get on the same page with utilizing BIM on this project."

(Adam, thinking)
Great! We just hired this construction company and they already want to start directing us how they want us to model things. I wonder how many things I will have to redo for this diva?

(Adam responding to Kaushal's email)
"Hi Kaushal, thank you for reaching out to me. Yes we do have a 3D Revit Structural model already started with significant progress. What were your thoughts on aligning our expectations for the BIM Execution Plan?"

We're all guilty of it and you know that! Although it may seem innocent in the initial email exchange above (and aside from just pure exchange of contact information), there are hidden reasons behind why this interaction takes place. Builders almost always have this impression that the 3D model they will get from the designer won't be useful and that rework will be involved. Designers, on the other hand, will almost always have the impression that they will be forced to increase the level of development (LOD)* in the model so that they are not showing too much detail when it comes time to print the sheets for formal agency review.

BREAK IT DOWN

Now we've just talked about a whole bunch of very important things here. Not sure if you realized, but we've just touched on constructability, level of development, rework (which may possibly result in fee erosion), and opportunities for prefabrication.

One of the primary responsibilities for a designer is to ensure they are able to produce an aesthetically appealing design that meets the client's spatial and program requirements while also meeting code compliance. Within that responsibility, the hesitation to increase LOD on modeled objects usually comes from the responsibility to meet formal agency approval requirements. Which means that when a job captain hits "print," the 2D drawings will look appropriate and have a better chance for approval. (It has to look a certain way so the outcome of the formal agency review has minimal chance of receiving the dreaded stamp "Revise and Resubmit." Dumbing down an intelligent 3D design to a unintelligent/flat 2D design just doesn't make sense to me. But yeah, we can easily go on that tangent for hours. Unfortunately not today, though ☺.)

The other main concern for a designer is that before the contractor was brought on board, they had a negotiated fee for the services they were going to provide to the client. When being asked by the contractor to deviate from that initial plan (on which the initial fee was based) this rework will result in fee erosion that the designer may not be able to recover. (Fee erosion in the sense that you can't bill for added rework so now the balance comes out of your fee.)

SWITCHING TO THE BUILDER SIDE NOW

When a builder begins the new job (depending on at what stage of design they are brought in), their interest in the 3D model relies truly on its reusability for the primary purpose of construction. A few things that go through a builder's mind are systems coordination, constructability, quantity analysis, and the possibility for prefabrication to name a few.

The main concern here is that prior to the procurement of a steel trade partner, builders want to know that if they pull a quantity schedule out of Revit Structure that the tonnage of steel is reflected appropriately. In other words, did the designer model this properly and utilize the correct steel families? When a quantity schedule is created, are the quantities correct and accurately reflected in the construction cost estimate to the owner?
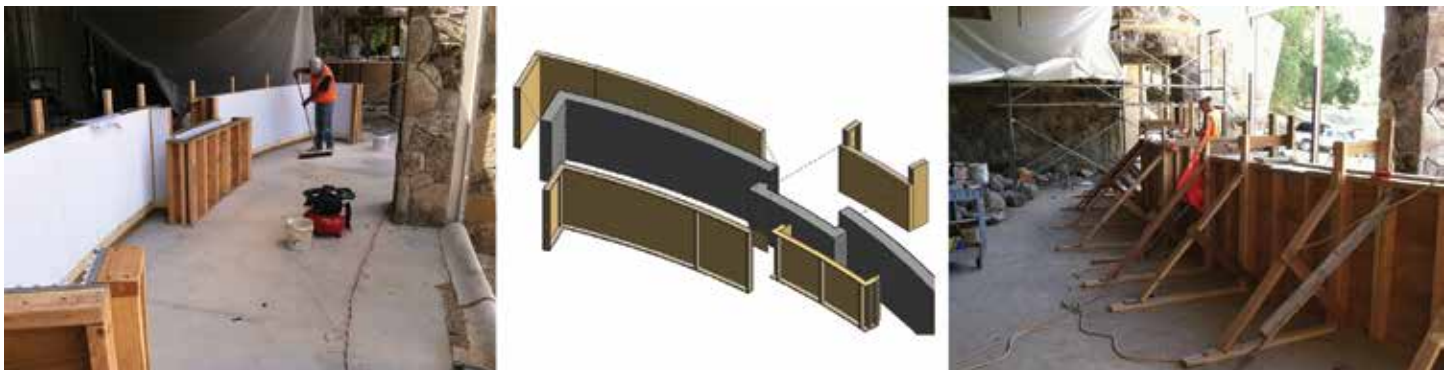

Figure 2: Sequencing, Means & Methods, and Shop Drawings with Revit Structure. Could we embed more into our concrete families?
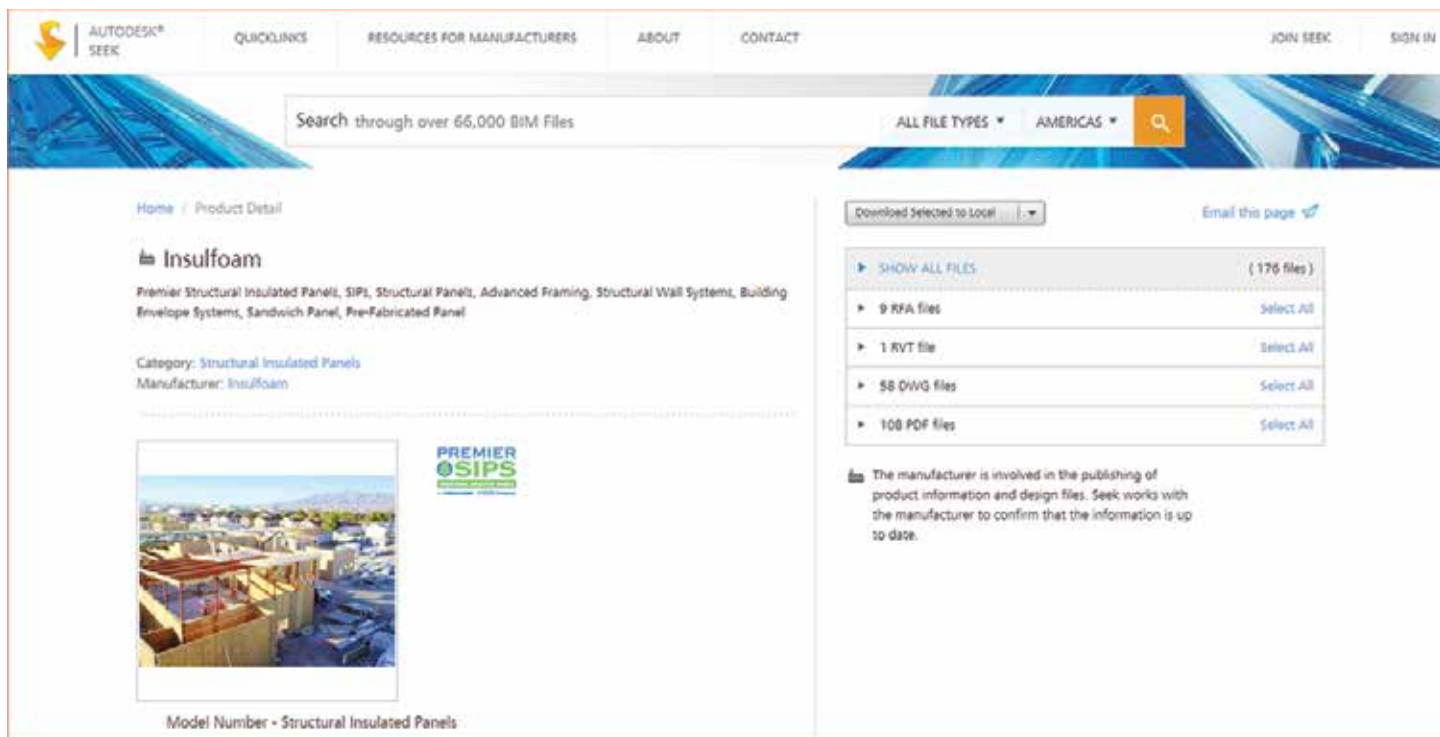
Revit Structure 2015

Figure 3: So you're telling me my local SIPS representative has Revit Structure Families available? Yah they do! Go check out Autodesk Seek and download some Revit Structure Families! http://seek.autodesk.com/manufacturer/Insulfoam

3D models these days can be used for a wide variety of things and be customized for industry standards, preconstruction and constructability coordination, customized families for modeling efficiency or specialty equipment, and facility management on the building operations side. For example, utilizing the simple function of "visibility graphics" settings in Revit Structure may alleviate initial fears of designers and contractors when it comes to managing what actually gets printed for formal agency review. Settings can be customized to only show what is required for agency review and hide the non-essential (contractor specific) information. As a suggestion, utilizing a LOD matrix to define 3D model development during the various stages and utilizing a BIM Execution Plan to align expectations between all parties is a best practice to ensure everyone is on the same page and able to meet each other's individual needs.

So what have we learned, boys and girls? Let's pre-plan this puppy so that the sooner we have these conversations, the sooner we can address each of our needs and concerns.

DATA MANAGEMENT

But I thought that only managers customize Revit Structure. So if we're all customizing Revit Structure together, shouldn't we all help each other in managing it? Jay Zallan shares some good points on BIM Process Management in his July 2014 *AUGIWorld* article, "BIM Management Preamble." As he explains, it's important that all team members know and keep the end goals in mind. Jay also stresses the importance of the BIM Kickoff meetings in which the team goes over the project's BIM requirements. Usually by this time it may be too late for your input, but look into these

supporting documents for your company. Begin to understand and maybe assist with its development. As your team gains experience and learns more about the various BIM services (documenting the knowledge and sharing with the organization) your virtual building requirements checklist can be customized to include additional services. This document ensures that design and contractor teams contribute to an LOD (at an agreed upon time/date/phase so as not to impact the construction schedule. Hence, the importance of BIM Execution Plans).

It is important to note that with any data (not just BIM data), the best practice in data management is proper stewardship and quality of the data; more important than just the raw data quantity. I am not sure who said this, but think of the saying, "Garbage in, garbage out." If you don't manage how you are customizing your Revit Structure data and how it's bringing value by affecting the "big picture" of construction, you are setting yourself up for rework, then lost time, then fee erosion, blah, blah, blah… You get the picture.

The quick lesson here is that we need to manage the quality of our data and our stewardship. I'll let Jay's July 2014 article do all the talking on this one.

"Hold up! Wait for me, guys! I don't really have the time to "customize." I mean, with my day job of getting $%# done, I now have to think about how this affects the contractor?"

LET ME SAY THIS… WHY REINVENT THE WHEEL?

Have you asked any of your project team members for help? If

you are on some non-negotiated/hard-bid job where everyone is out for themselves, chances are that you may not get the help. But on the flip side, there is also a good chance that you are on a project that is very collaborative (design-build or integrated project delivery) where you have the chance to share ideas and customized techniques to truly invent something really cool and unique. Sometimes proprietary information on projects with strict non-disclosure agreements keeps us from sharing information. But most of the time, this is not the case and just raising your hand and asking specific questions will lead to the right dialog to break down collaboration-resistant silos.

Some of the things that can help with managing your capacity may be as simple as adopting a standard that fits your needs or creating standards within your own organization and customizing your workflows. A great article in *AUGIWorld* October 2011 by Ibrahim Hakki titled "Codeless Revit Customization" explains "you don't need to be a programmer to customize Revit Structure." The author provides a great overview of "out-of-the-box" items that can be customized for any team (view templates, pre-created schedules, and so on.). It may be difficult to proactively prepare for every design scenario and customize Revit Structure for it. On the other hand, you can't give up and not pre-plan altogether either.

Aside from your standard AIA or Associate General Contractors of America (AGC) standards, you will realize from working on similar projects that utilizing similar materials (wood, concrete, steel, and masonry) typical details will start to emerge. Think of ways to capture those "typical" scenarios and also realize how those details sit with your local agency approvers. Meaning, if you know for sure that a certain detail works and is buildable, and also that it usually receives little to no redline comments from your local approving authority, that detail is a good candidate for your organization's library. Architects, engineers, subcontractors, and manufacturers all have preferences on how things should be done

It is important to note that with any data (not just BIM data), the best practice in data management is proper stewardship and quality of the data; more important than just the raw data quantity.

and understanding how it comes together on a specific project will help reduce the capacity issue of producing something new each and every time.

Another big sore spot on this topic is software compatibility. Why can't everyone just use Revit (Architecture, Structure, MEP)? Why can't the mechanical, plumbing, electrical, and fire protection (MEPF) guys just use Revit MEP and make this whole thing simple? Everyone has their own software in a project because they have a specific need downstream. Take the mechanical guys, for example. The primary reason they design/model in AutoCAD is because their fabrication system relies on it. Try to truly understand when exactly they need to be in CAD or Revit MEP and how you can help them with their requirement of tying back into their fabrication system. Because at the end of the day, they will be prefabricating from whatever 3D models they produce. Lastly, to help with your capacity challenge if you are able to figure out this workflow and see how you can "live link" others models versus "incrementally updating" them, you will be
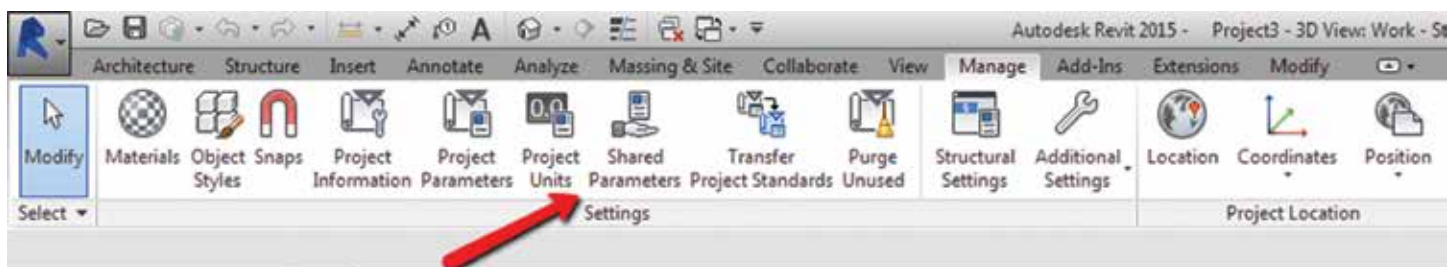

Figure 4: One thing we can look into is the benefit of driving our BIM with "Shared Parameters," which utilize Excel. Look into these supporting documents for your company. And because you can have more than one shared parameter text file in a project, brainstorm possible design guidelines (and maybe start your own)
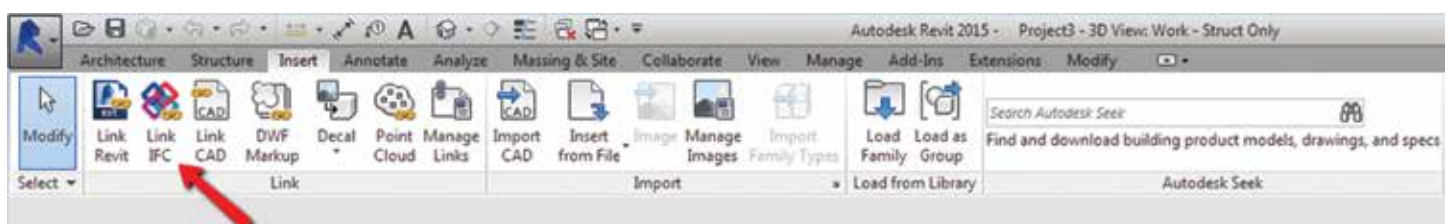

Figure 5: The new IFC Link tool to link an IFC file directly to Revit Structure

Revit Structure 2015

able to better communicate with each other. In other words, use Revit "links" to add to our model and not "import" geometry. (No more sending emails and waiting two days for a response.) Revit Structure 2015 now allows you to link in IFC files. (This could help with generating those concrete shop drawings with up-to-date last minute changes from the steel subcontractor that could possibly affect your work.)

Also realize that your 3D model's life will not stop when the design is complete. Just because you hit 100 percent construction documents and hit "print" doesn't mean that you are done and that the 3D model is useless from that point on.

YOUR 3D MODEL WILL BE REVIEWED BY EVERYONE!

OSHPD (Office of Statewide Health Planning and Development, a safety review department for healthcare construction in California (http://www.oshpd.ca.gov), has been requesting an engineer's structural analysis model for years and reviewing the design decisions. Retailers such as Target are realizing the benefits of utilizing Revit Structure and virtual building as a whole in inventive ways to help with all sorts of creative data analysis. 3D models combined with embedded formulas and shared parameters help with pushing those limits.

Once again, boys and girls, what did we learn here? Your capacity challenge may not be as bad if you just ask the right questions. Adapting to standards or figuring out similarities in your day-to-day workflows will help reduce starting from scratch every time you start a new job.

PAY IT FORWARD

Pay it forward when it comes to virtual building and knowledge. Often lessons learned on past projects are not shared or easily available such that in a knowledge-sharing scenario, folks with the most passion have no time to collaborate effectively, or are confined to a cubicle. Get outside the walls of your office or cubicle and go to more job walks, and talk to the trade partners who do this day in and day out. You may have the creative design, but those are guys who put it into place. And if your typical details constantly get changed because it can't be built, guess what. It's time to change it and the trade partners can help with that.

So help me, help you. What does that really mean? Seriously? Are you really asking that question after all that we covered here? (Just kidding!)

What it really means is that we need to help each other and open the doors of collaboration between the design and construction teams. Using customized means and methods, if someone is taking care of this for you, then thank them! Keeping in-house family libraries up-to-date with the latest and greatest out-of-the-box families can be a chore depending on the size and complexity of customization (and probably many other factors that I do not wish upon anyone). This will absorb someone's time for sure. But after realizing the efficiencies and similarities in these processes you can start to automate and streamline daily workflows.

* The Level of Development (LOD) matrix (as developed by AIA or the Associated General Contractors BIMForum) is typically used to monitor model progression throughout the project design lifecycle. It's not uncommon on projects to be asked by a contractor, "What LOD do you want my model?" or "Do we have a BIM Execution Plan." These are all very important and necessary things on complex construction projects.

Kaushal Diwan is a BIM Manager and leader in implementing BIM at DPR Construction in Sacramento, California. Kaushal also leads DPR's corporate BIM training program and supports project teams across the nation. Kaushal is passionate about establishing a highly efficient BIM approach within multidisciplinary networks and is the founder of the Sacramento BIM Network, a group of Sacramento BIM professionals focused on information exchange in the construction industry. He is actively involved in national and local BIM groups and has been a popular speaker at Autodesk University, local colleges and universities, and within the Sacramento Architecture, Engineering and Construction (AEC) Community. To learn more, please visit www.dpr.com. Kaushal can be reached at kaushald@ dpr.com.

Adam Muñoz is a Senior Structural Drafter at Lionakis in Sacramento, California. With more than 180 employees, Lionakis is a multi-disciplined firm specializing in architectural, structural engineering, planning, interior design, graphic design, and sustainability services. Building on more than a century of diverse project experience, Lionakis excels at providing BIM solutions for educational, civic, commercial, and healthcare clients. In the past decade alone, Lionakis has opened offices in San Francisco, Newport Beach, Modesto, and Honolulu to better serve the western United States. To learn more, please visit www.lionakis. com Adam Muñoz can be reached at adam.munoz@lionakis.com

Design, Coordinate, Fabricate

Prefabrication is one of the main factors for subcontractors to adopt a BIM workflow. The old saying "measure twice, cut once" is a great example of why contractors are coordinating real LOD 400 content. The assurance that the content you put in your model for design, coordination, and prefabrication is also going to install in the field without second guessing is remarkable.

Improving productivity is reported as the top driver for using prefabrication/modularization by construction managers, general contractors, and design-builders. (McGraw Hill 2012).

As you can see in Figure 1, contractors are using the same Revit MEP model from design to construction. Instead of going from one platform to another, contractors use the design data from the beginning of the project to the end. The saying over the years has changed to "design, coordinate, fabricate."

PLUMBING PREFABRICATION

Al Beckes from J&S Mechanical Contractors worked directly with Neil Spencer from Van Boerum & Frank Associates, Inc. on the Eccles Performing Arts Center. The engineer had very specific mat footings (Figure 2) for this project. The reason for the s-traps on all the floor receptacles was that the design engineer wanted to address the challenges posed by a job-wide structural mat-footing that was several feet thick. The mat-footing depth is such that the design option is to either make an s-trap or be forced to exceed the maximum tailpiece length. In the end, the city reviewers chose to allow the s-trap on a combination waste and vent system rather than to exceed the maximum tailpiece length.

The design decision was made quickly to use floor drains and ensure the s-traps would fit in the specified determined pocket. Since both Al and the engineer were using the same software platform, Autodesk® Revit® MEP, they could collaborate real time in the same model.
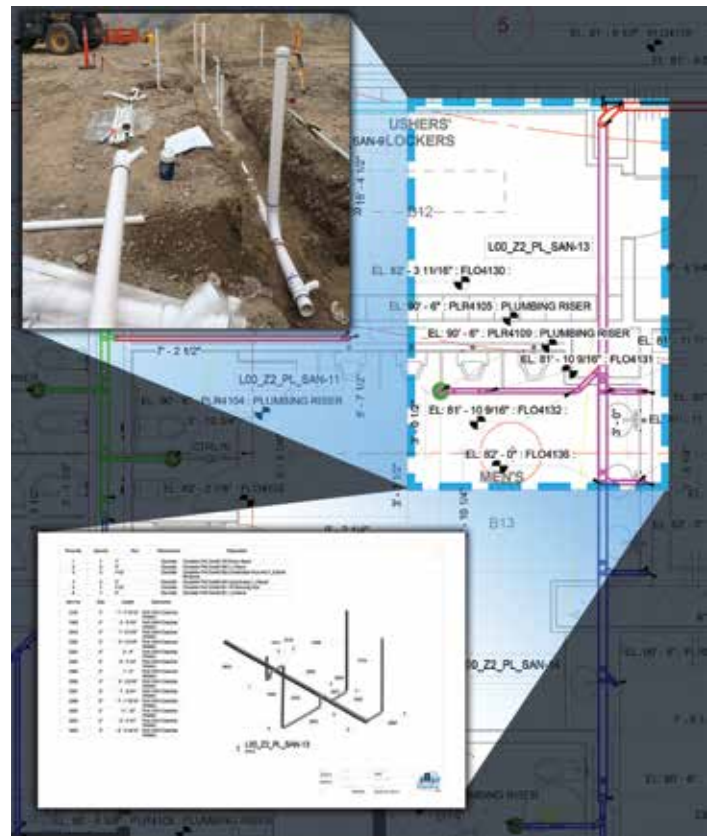

Figure 1

No need to spend additional time exporting out of Revit to AutoCAD®. Al could use the original Revit design from the engineer while using SysQue® to add the LOD 400 level content that was required to ensure the model could be fabricated and installed correctly.

Al utilized Trimble MEP on this project to locate all risers and elevations for his underground plumbing. Al reports that he will continue to use this process for hanger layout above ceiling for each

Revit MEP 2015

floor. This process allows the field to put away the tape measures and keep the same accuracy and precision that comes from the LOD 400 model.

"J&S Mechanical Contractors is now fully transitioned to Revit. I always kept Revit at a distance after using AutoCAD for so long, and only using and cussing Revit when I had to. We've taken the plunge on our two most recent projects, and though still cussing, it is less and less and I am liking Revit more and more. I sent out our first runs of fabrication in Revit using SysQue (the reason we made the jump to Revit) and I can definitely see our move saving us time as the field is now up to speed with Trimble and using it for layout of our prefabricated underground. In short (I never thought I'd say this), Revit rocks. Also, one thing I've learned is to quit trying to make Revit AutoCAD. The best thing I ever did was to quit dealing in equivalencies and start thinking in Revit rather than trying to translate it into AutoCAD." (Al Beckes, August 27, 2014). Add fellow Revit Users as LinkedIn connections http://lnkd.in/dDjWAw4

PIPING PREFABRICATION

Ryan Joyce, BIM Services Director at PACE Collaborative, says, "The detailed data content available in SysQue far exceeded our expectations. SysQue allows us to quickly model mechanical piping and plumbing to LOD 400 directly in native Revit MEP, and the spooling documentation even includes pipe cut lengths in isometric sheet views. It saves us so much time and money by using SysQue. Each Revit family from Building-Data contains a link to the manufacturers' PDF cut sheet. All of our
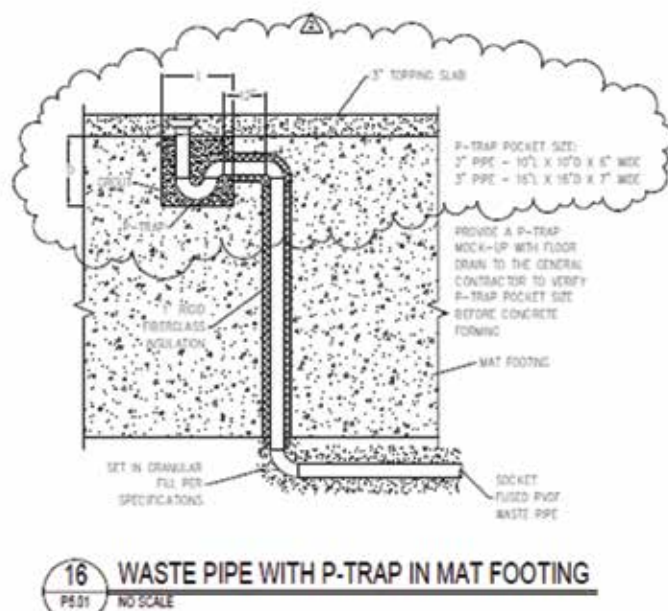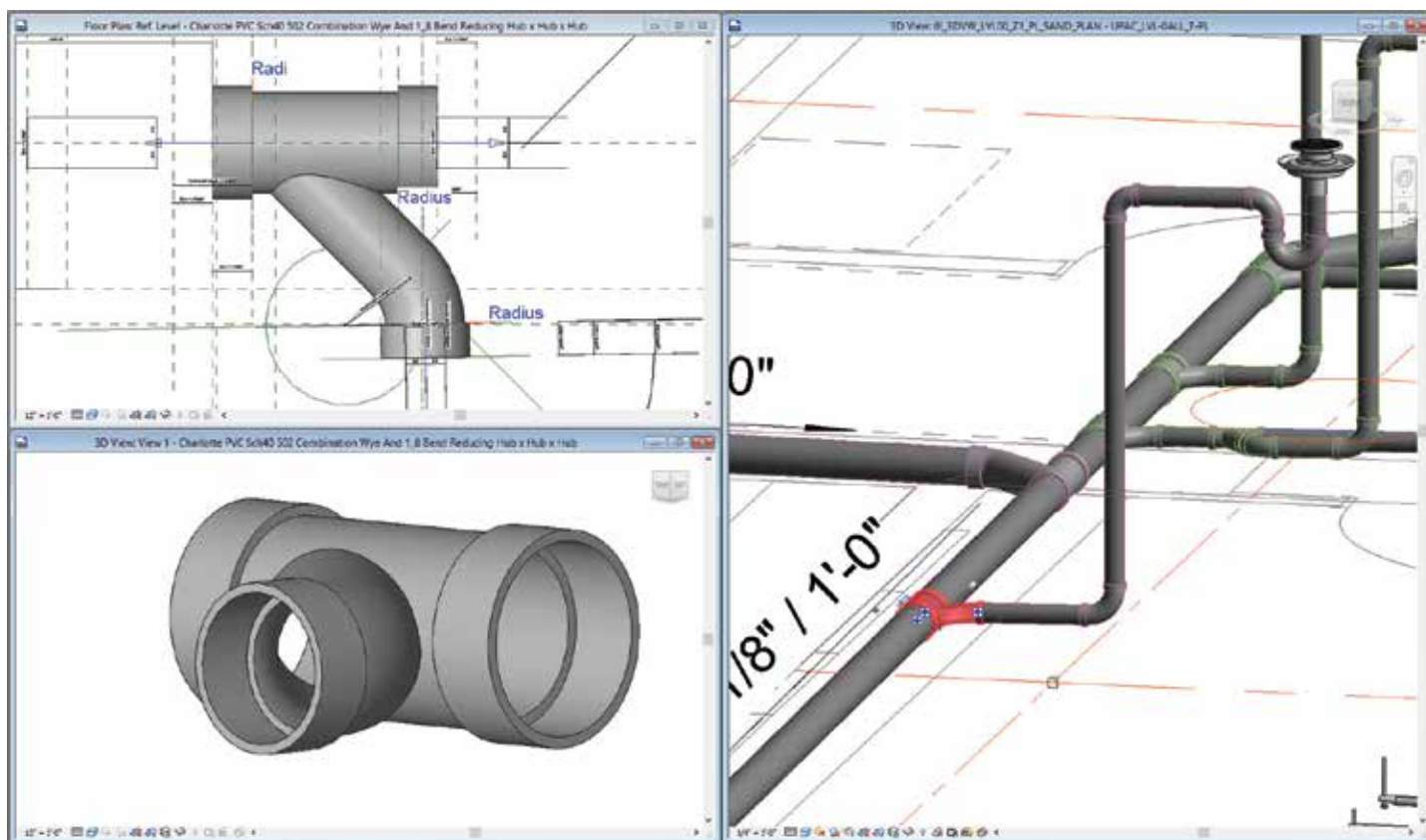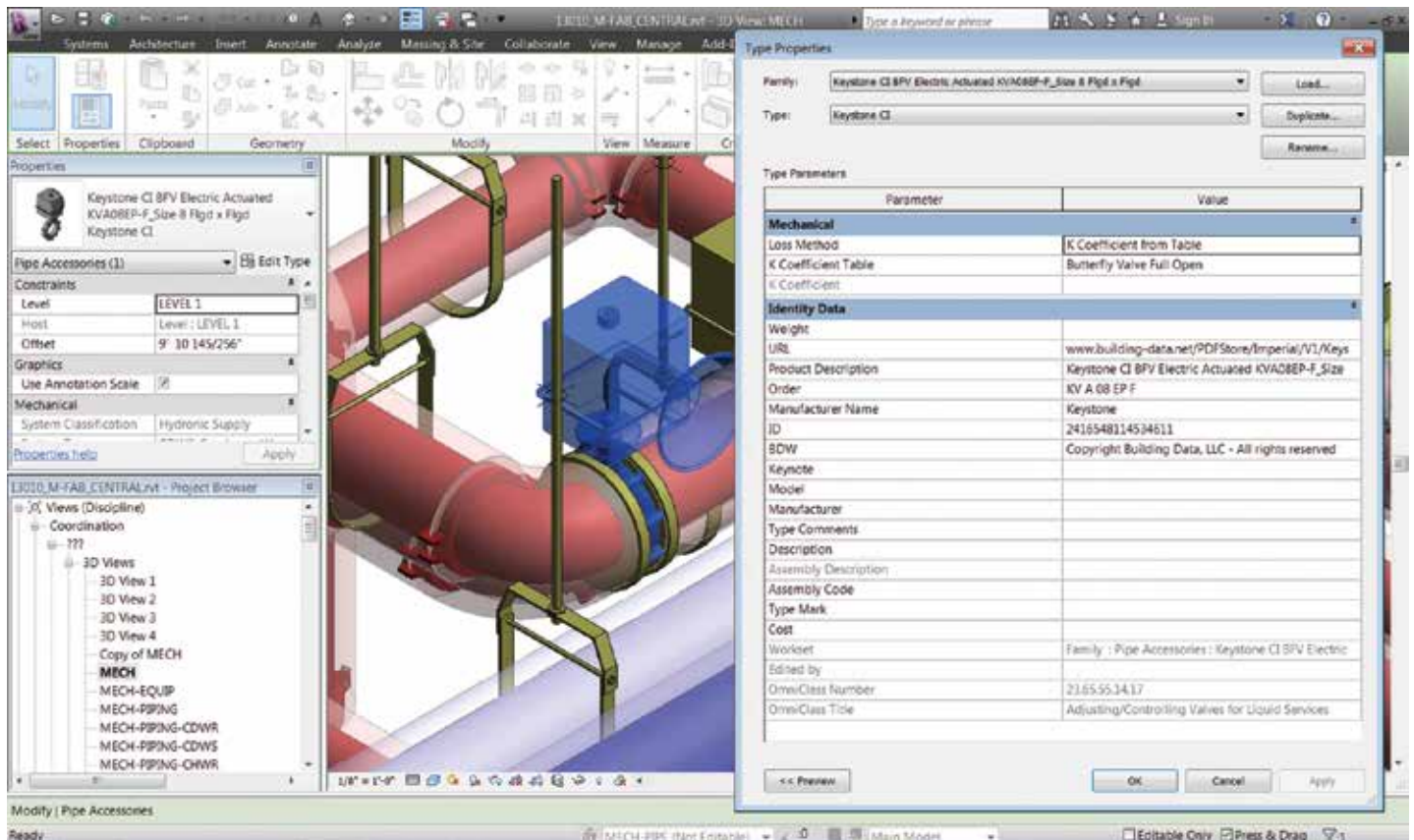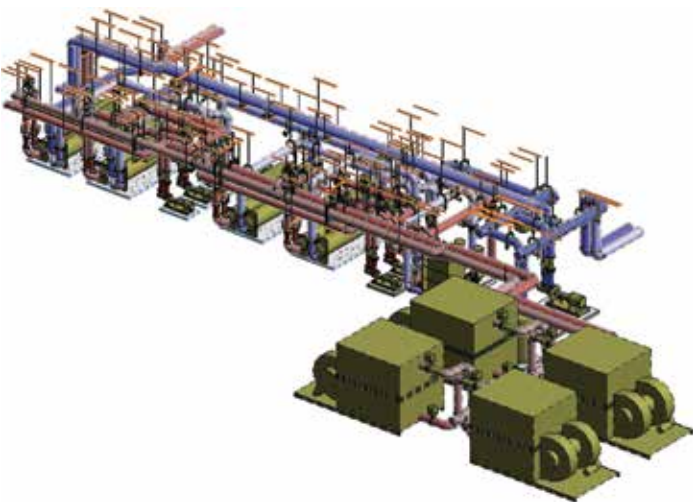

Figure 3

Figure 2

Figure 4

Figure 5

models' mechanical pipe valves and fittings now include bills of material within the family, with material costs and labor rates per each size, and item bubbles identifying each component to support shop prefabrication. It's incredible."

Kenneth Eastman has more than 15 years of construction/engineering experience. He was a CAD Manager for a large MEP contractor in San Francisco where prefabrication was the key objective on all MEP construction projects. Kenneth has trained users on Revit and SysQue in Australia, Dubai, Malaysia, UK, and the USA. Kenneth truly believes that when it comes to prefabrication, an hour spent in the office saves four hours in the field. He currently is the SysQue Product Manager. Kenneth can be reached at keastman@sysque.com

Project: Utility Building Renovation on Wallops Island for the Army Corp of Engineers
General Contractor: MEB Contractors
Architect: Ivy Architectural Innovations
3,800 sq ft central plant with 4 cooling towers, 4 chillers, 10 base mounted end suction pumps, 2 inline centrifugal pumps, and 1 heat exchanger.

Viva La Revolution! Start Your Own Country with Content Pack Creation

Have you ever dreamed of starting your own country? Perhaps your aspirations are a bit more humble and you would be content to deploy multiple AutoCAD® profiles within your company. In either case, this article will explain the basic anatomy of a content kit for use in Autodesk deployments. We will be looking at AutoCAD® Civil 3D® 2015 as our example; however, the same principal can be used for base AutoCAD and related vertical applications.

This article will explain using content kit XML files to set AutoCAD profile paths. This article is targeted to CAD administrators who are already very familiar with creating Autodesk product deployments and are comfortable with making Windows registry changes.

WHY A CONTENT PACK?

If you have installed an AutoCAD-based product in the past, you may be familiar with the following portion of the setup (Figure 1).
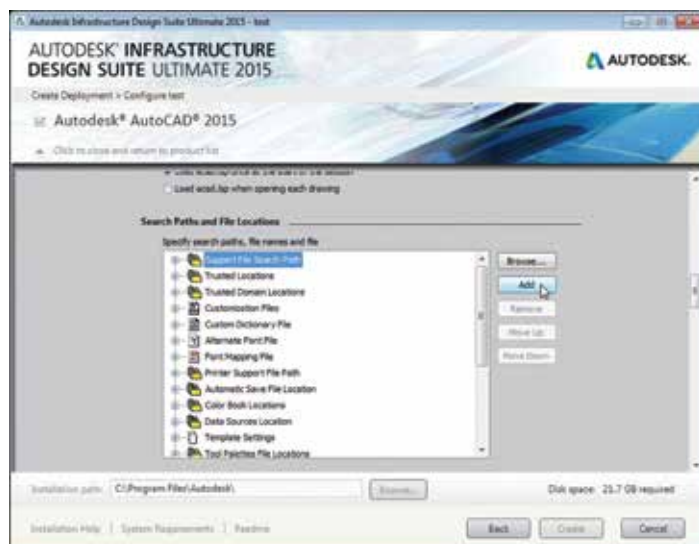
Figure 1

In some cases, you can modify the search paths and file locations upon install. These are the paths that will become part of the AutoCAD profile upon installation. This method has several drawbacks, however. The first drawback is that you can only set up one configuration at a time. If you have multiple departments at your company that use different templates or tool palettes, for example, this interface does not allow for alternate profiles. Another drawback is that the Search Paths and File Locations interface is hidden in the Civil 3D 2015 installation.

USING A CONTENT PACK

Content packs are added to a deployment in the individual product configurations.

Products that can use Content Packs are:
- AutoCAD® Architecture
- AutoCAD® MEP
- AutoCAD® Civil 3D®
- AutoCAD® Map
- AutoCAD® Plant 3D
- Autodesk® Revit® Architecture
- Autodesk® Revit® Structure
- Autodesk® Revit® MEP

Figure 2

Figure 3

Figure 4

Figure 5

Notepad ++ is a more general editor that color codes the different components, but otherwise behaves like Windows Notepad. I like this tool for comparing my content pack with the out-of-the-box examples, because it does not hide any of the formatting.
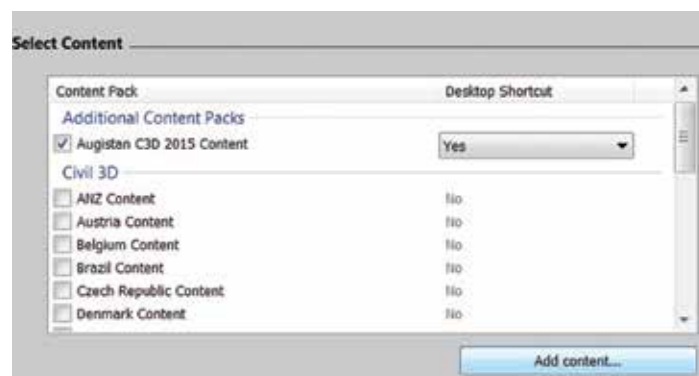
The best starting point for your own content XML files is to examine some existing ones. After you have downloaded and extracted the files for your install, you can find the out-of-the-box localization files in C:\Autodesk\ Autodesk_IDSU_2015_ English_Win_64bit_dlm\ Content\en\.

To add content to a deployment, you will click Add Content and browse to the XML file. If you have created your own content pack and the name of the pack does not appear in the above dialog after you select it, the culprit is an error in the XML file. Check for unclosed tags, missing nodes, or a non-coded "less than" symbol in the body of the XML (more detail on this later in the article).

ANATOMY OF A CONTENT PACK

A full content pack comprises several pieces. The main piece is an XML file, which sets the name of the profiles you are adding, and sets search paths, file locations, and can set any option found in the AutoCAD Options dialog. The content pack XML generates the AutoCAD profiles and registry settings found in each profile. You can create multiple profiles with one XML file; however, it is simpler to make a new content XML file for each profile (see Figure 3).

An optional component of a content kit is the folder containing content. This could be custom templates, plot styles, color tables, tool palettes, or any other files you would like copied to a user's local machine. Content must be in the form of compressed CAB files. If your shared content is stored on a network location, then it is better to omit the CAB files. Creation of CAB files is beyond the scope of this article, but be sure to check out my blog (http://civil3detcetera.blogspot.com/) for future articles where I will be discussing CAB creation in more detail.

CREATING YOUR CONTENT XML FILE

When working with any XML file, I recommend using a special editor to aid your work. My favorite tools are XML Notepad and Notepad ++. XML Notepad is great for validating the format of your files and for adding multiple lines of profile data. If you run into problems adding the content pack to the deployment, try opening it in XML Notepad. If XML Notepad can't parse the file, it will tell you the exact location and nature of your error.

CONTENT PACK IN DETAIL

Open C3D_CONTENT_ANZ.XML, for example. This is the content file for Australia and New Zealand. Let's examine each line and what the lines mean. Note that line numbers appear because the file is being shown in Notepad ++. Line numbers may vary depending on the editor you use.

Lines 1 and 2 are the same for all XML content files and can be copied directly to your file from any of the examples. Lines 3 through 9 are part of the Identification node. The Name element (line 4) is what you will see in the installation interface when you add content to the deployment. Line 5 is a description that is only used in the XML file (and not seen anywhere outside the file). The group in line 6 indicates the type of data you are adding. If you have a CAB file, lines 7 and 8 tell the installer where the data is located. If you are not using a CAB file, these can be omitted (see Figure 4).

Line 10 is the inheritance. This line is extremely important for making sure your content pack picks up settings from the default Civil 3D content. This indicates which content packs are related. The order in which you add these makes a difference, because duplicate settings will get superseded by the content pack listed last, which in turn will be superseded by any settings in the XML file you are editing. This makes sure that the CAB files for the inherited content packs get extracted.

Lines 11-14 list application defaults. The settings here show that the AutoCAD profile called <<C3D_ANZ>> will be loaded by default. Note that because XML uses the "less than" sign for its own purposes, the &LT code is used to explicitly denote the < symbol (see Figure 5).

Lines 15-18 are the shortcut definitions. These lines are optional in your content file. There are two entries for this in the ANZ example because the install will create the desktop shortcut and

AutoCAD 2015

the start menu shortcut (see Figure 6).

Now for the main reason you are reading this article: the registry settings! An AutoCAD profile is really just a list of Windows registry entries. Lines 19-27 in the ANZ define the profile and describe how it differs from the out-of-the-box profiles. Any profile registry setting can be added here. A good file to examine for examples of all of the registry settings can be found in the …content\en folder under C3D_Profile.xml. The inheritance listed here is the profile inheritance (not to be confused with the content pack inheritance listed in line 10). These define the registry entries that will be included with your profile. For example, say you want to change the default Automatic Save File Location on install. If you load the ACAD_Profile and don't redefine it, you will get the default location of the user-specific temp folder. If you add an entry in these registry settings, your profile will override the AutoCAD ones. The line in the XML file will look like this:

< P r o f i l e E n t r y N a m e = " T e m p D i r e c t o r y " Subkey="General Configuration" Type="REG_SZ">D:\TEMP</ProfileEntry>
(see Figure 7).

Figure 6

Figure 7

Figure 8

Figure 9

Finally, the Files portion of the XML file specifically references the compressed CAB files that contain data. Not all CAB files are created equally, so this portion is best left untouched. In your own files, you can remove everything in the Files node, or turn it into a comment by adding !- - just after the less than symbol (see line 20 of the ANZ file for an example of a comment).

Be sure to keep the </DocumentRoot> tag because this signals the end of the file (see Figure 8).

RESULTS AND CONCLUSION

After you deploy your product with a custom content pack, you will see your profile listed in the AutoCAD options area. Before pushing out the deployment to your users, check that your desired changes appear in the AutoCAD options dialog box.

For more examples of custom content pack XML files and a discussion about creating CAB files, visit my blog (http://civil3detcetera.blogspot.com/).

Louisa "Lou" Holland is a civil engineer and support specialist for Autodesk serving enterprise priority customers. When she is not saving the world from evil, she can be found hanging out with her 2 dogs in San Francisco, CA. Lou can be found on Twitter as @LouisaHolland and on her personal blog http://civil3detcetera.blogspot.com/

And Here's How to…
Effectively Use Associative Dimensions

Have you ever had a dimension automatically update when you use Move to move one of the objects that was dimensioned … even if the dimension layer is Off or Frozen!? That'll mess with your head.

THE VARIABLE DIMASSOC

Set the DIMASSOC variable to <1>, then add a dimension. Move the objects, and the dimension <u>does not</u> update.
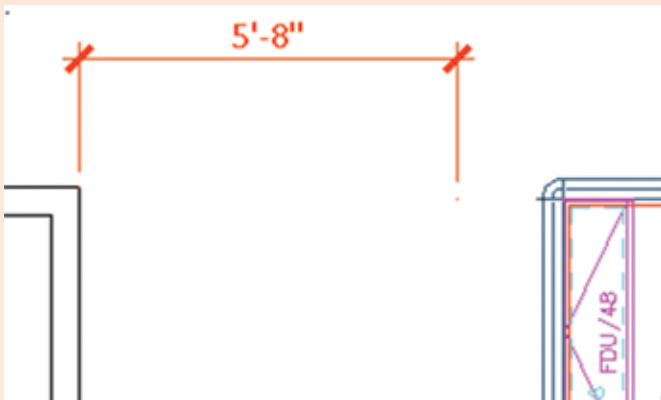
Figure 1

Set the DIMASSOC variable to <2>, then add a dimension. Move the objects, and the dimension <u>does</u> update.
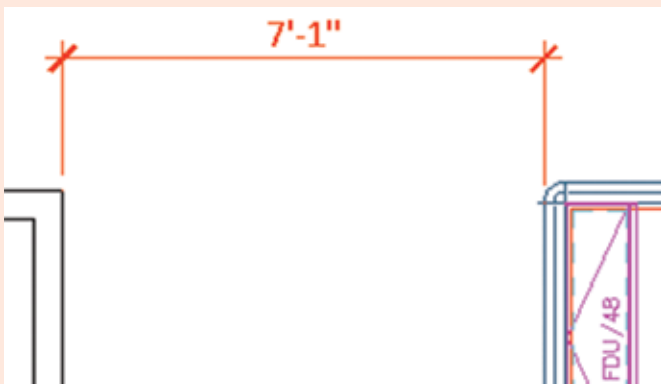
Figure 2

DISABLING THE DIMASSOC ASSOCIATIVITY

Q: "How do you disable the 'follow' feature incurred when you have Dimassoc set to <2>?"

Curiously, you cannot change the Associative condition of the selected dimension in the Properties dialog box (notice in the illustration that the Associative option is grayed out).

A: DIMDISASSOCIATE, then select the offending dimension.
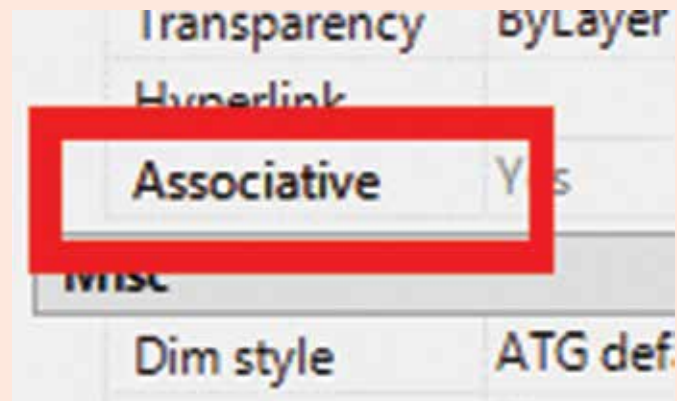
Figure 3

[And yes, those of you making the mental leap have discovered there is also a DIMREASSOCIATE; just follow the prompts.]

Michael E. Beall (B. Arch.) won the AU 2013 Speaker Award for Hands-on Labs and will be presenting the updated version of that Lab at AU2014! An Autodesk Authorized Author, he is the owner of CAD Trainer Guy, LLC in Shelbyville, KY and has been presenting onsite CAD training around the planet since 1982. Contact him anytime at michael.beall@cadtrainerguy. com, on LinkedIn at http://www.linkedin. com/in/cadtrainerguy/ or give him a call at 502.500.2267.

Customizing Leads to Productivity in Grading Projects

Did you know that we, as humans, move around seven gigatons of earth each year? That is a lot of dirt, and it takes a lot of money to move such massive volumes. Being able to move dirt virtually is very valuable and helps ensure that the project will work within budget before ever breaking ground. Whether you are doing a residential or commercial site plan, designing a subway, or constructing a large dam, AutoCAD® Civil 3D® makes grading virtually easy.

AutoCAD Civil 3D is a powerful grading tool. The dynamic 3D model that it creates provides a way to see the final project and estimate earth volumes quickly and accurately. I have some bad news and some good news around this subject. The bad news is, the software does need to be set up to make the grading visualization easier. The good news is, set up is quick and easy. In this article, I share with you how I like to customize AutoCAD Civil 3D to make grading easier.

WORKING WITH SLOPE ARROWS

Slope arrows provide visual clues indicating which direction water will run on a site. Creating a surface style with slope arrows turned on makes it very clear whether or not the site will drain in the intended direction. In Figure 1, it is clear that

AutoCAD Civil 3D 2015

Figure 1: Surface with Slope Arrows turned on
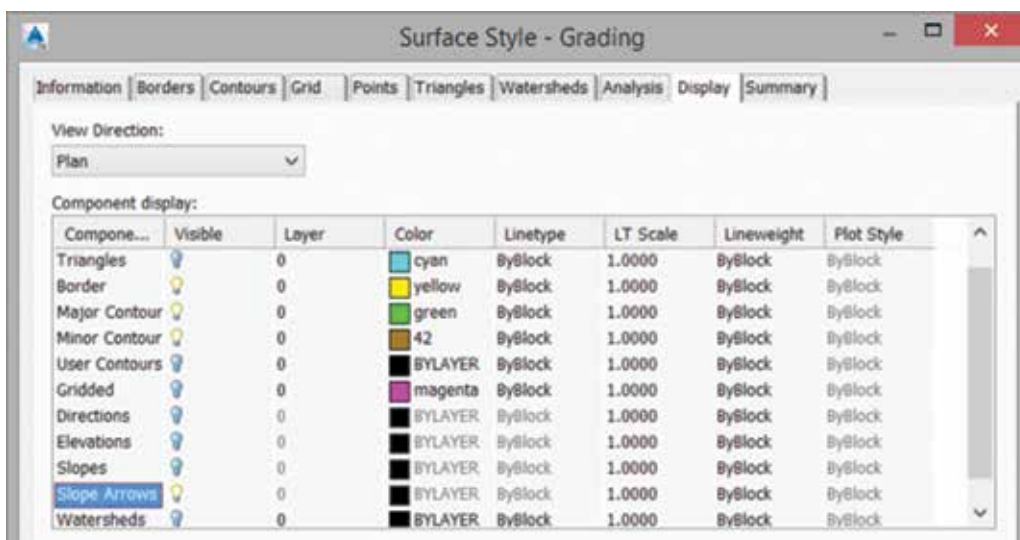
Figure 2 – Grading Surface Style
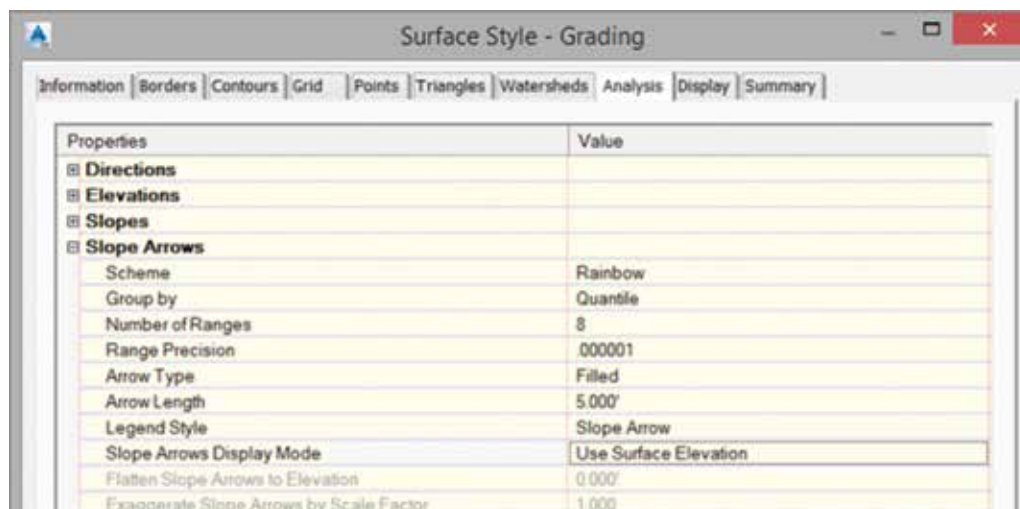
Figure 3: Analysis tab of the Surface Style dialog box

the water will drain away from the building footprint, to the front and back of lot five.

To create the surface style required, go to the setting tab of the Toolspace. Expand the Surfaces category, right-click on Surface Styles, and select New. In the Information tab, type a name that is relevant for your needs. I typically name this style "Grading" to help me remember to use it when I am creating my grading plan. On the Display tab, turn on all the components you would like to see displayed in the model. I recommend turning on at least the major and minor contours and the slope arrows, as shown in Figure 2.

Note that the layer next to the Slope Arrows component is grayed out. This means that you cannot change the layer to which they default. You also cannot change the color of the arrows on the Display tab. You can, however, change the color scheme for the arrows on the Analysis tab of the Surface Style dialog box, as shown in Figure 3.

Once the style is set up, it is just a matter of using it. Of course, you do not want to use it at all times. For instance, you are not likely going to want to print the plan with all those arrows displayed. That is why it is important to have multiple surface styles created. Then select the style to be used in the surface properties for various tasks.

If selecting the surface and clicking the Surface Properties on the contextual ribbon is too much of a hassle, there is a faster way to change the style being used by a surface. If you are fortunate enough to have two monitors, then keeping the Properties palette open on the second screen can make switching between object styles extremely quick and easy. If you do not have two monitors, then you may want to use Quick Properties instead of the Properties palette. Either way, when you select the surface in the model, the current style name appears in the Style field of the Properties palette and Quick Properties, as shown in Figure 4. Simply click inside the Style field and select an available style from the drop-down list to switch between styles.
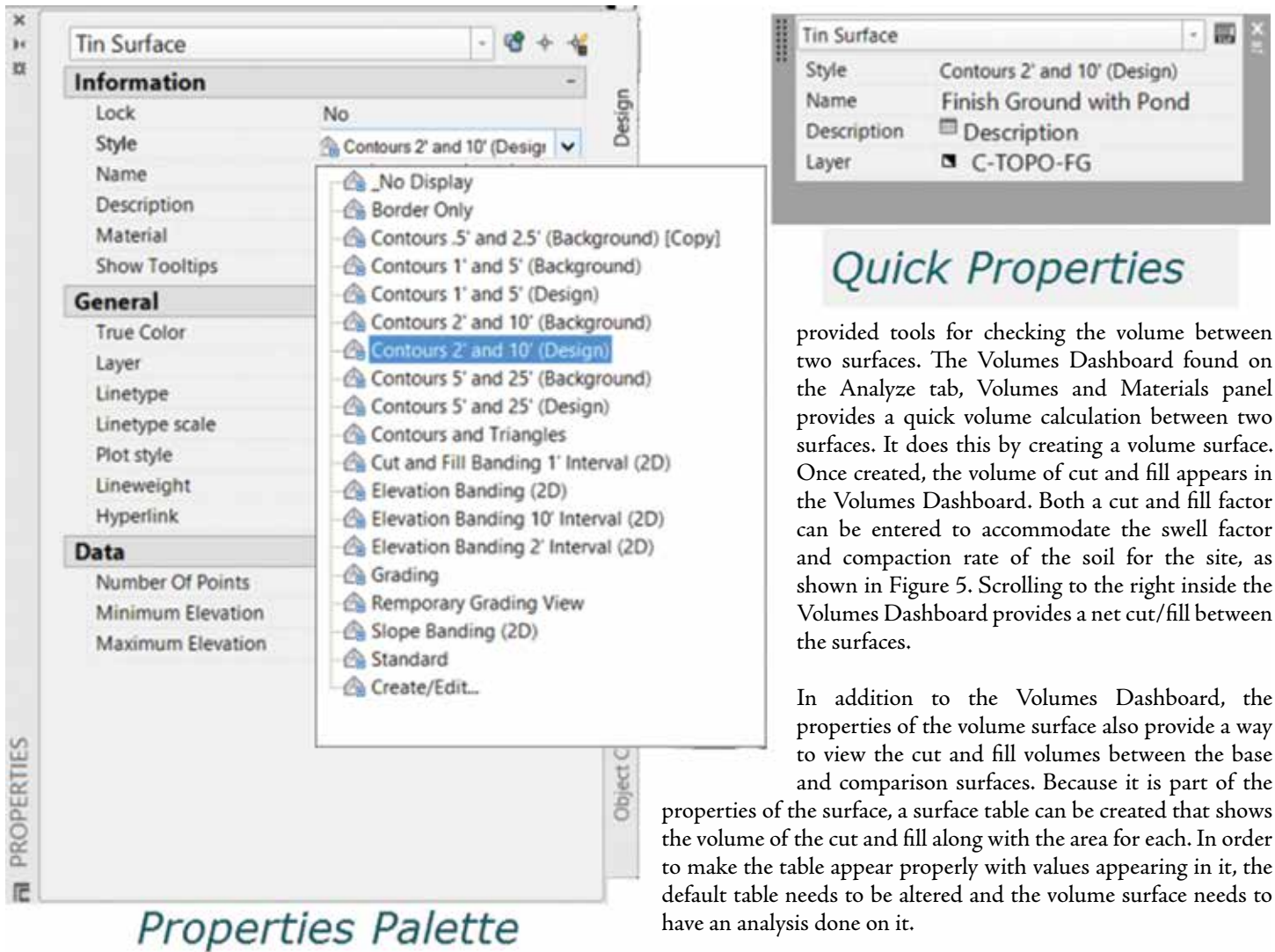
Figure 4: Properties palette and Quick Properties

TAKE ADVANTAGE OF VOLUME SURFACES

Balancing cut and fill quantities plays a key role in keeping a project within budget. Although grading groups have the option to balance cut and fill, it is more likely that the entire project site needs to be balanced, not just one area. That is why Autodesk has

provided tools for checking the volume between two surfaces. The Volumes Dashboard found on the Analyze tab, Volumes and Materials panel provides a quick volume calculation between two surfaces. It does this by creating a volume surface. Once created, the volume of cut and fill appears in the Volumes Dashboard. Both a cut and fill factor can be entered to accommodate the swell factor and compaction rate of the soil for the site, as shown in Figure 5. Scrolling to the right inside the Volumes Dashboard provides a net cut/fill between the surfaces.

In addition to the Volumes Dashboard, the properties of the volume surface also provide a way to view the cut and fill volumes between the base and comparison surfaces. Because it is part of the properties of the surface, a surface table can be created that shows the volume of the cut and fill along with the area for each. In order to make the table appear properly with values appearing in it, the default table needs to be altered and the volume surface needs to have an analysis done on it.

SETTING UP THE VOLUME SURFACE TABLE

A volume surface basically calculates the difference in elevation between two surfaces. Therefore, it is easier to start with the default Elevation Table that ships with the software to set up the volume surface table. In the Settings tab of the Toolspace, expand the Surface category, Table Styles, Elevation. Right-click on the Elevations table style and select Copy.
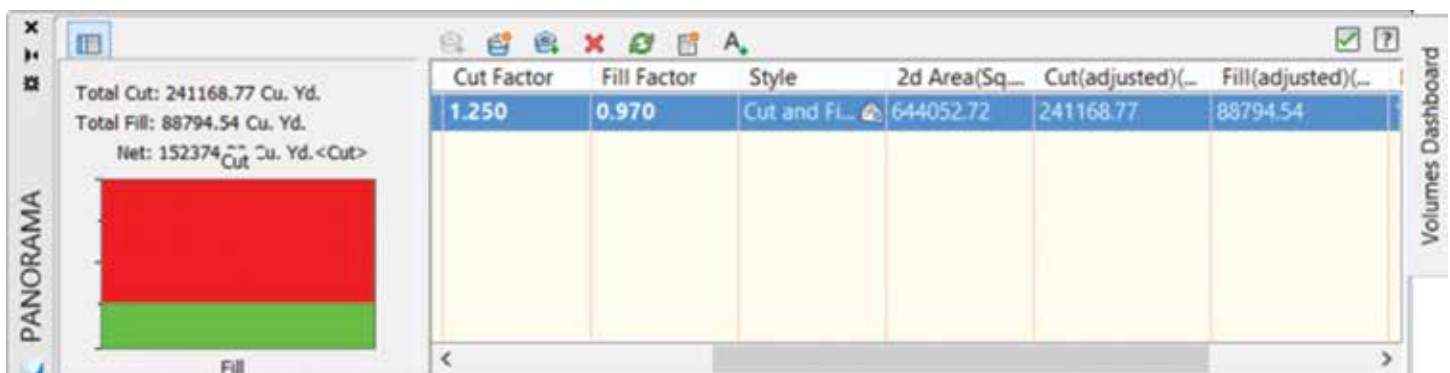
Figure 5: Volumes dashboard
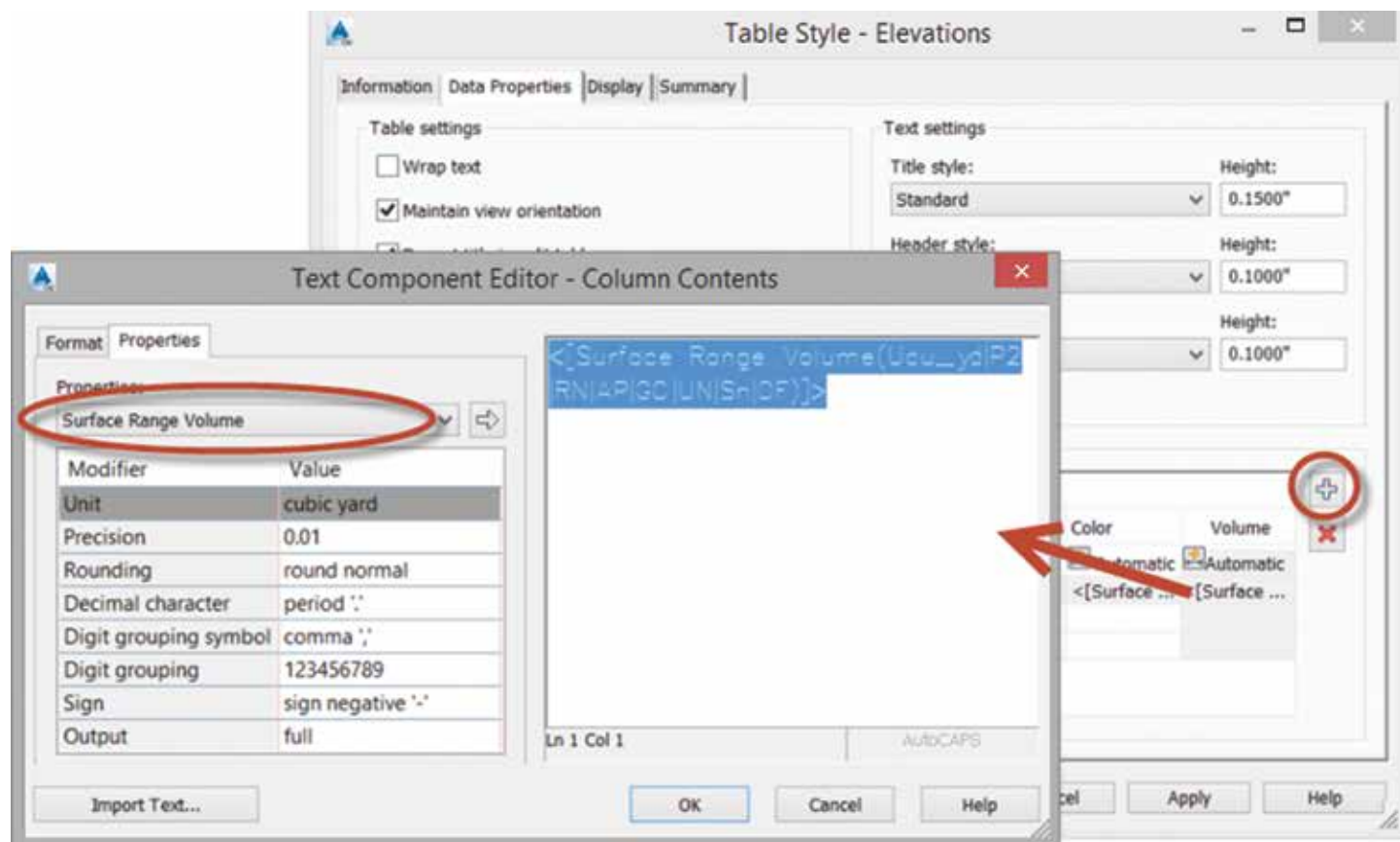
Figure 6: Table contents

1. On the Information tab, type Cut-Fill Volumes in the name field.
2. In the Data Properties tab, click the plus symbol to add a new column to the table.
3. In the new column, double-click the header to add a column title.
4. In the new column, double-click the Column Value field to add the Surface Range Volume property to the table, as shown in Figure 6.

POPULATING THE VOLUME SURFACE TABLE

Once the table style is created, you can create a table for the surface. However, the table values will be empty until you complete an elevation analysis on the volume surface. We will start by adding a table to the model. It does not matter which you do first as long as the table is dynamic.

How to Create the Right Table:
1. On the Annotate tab, Labels & Tables panel, click Add Tables and select Add Surface Legend Table.
2. Press <Enter> to select a surface from the Select a Surface dialog box.
3. In the Select a Surface dialog box, select the volume surface created earlier and click OK.
4. In the command line, select Elevations.

5. In the command line, select Dynamic.
6. In the model, click to place the upper left corner of the table.

How to Populate the Surface Volume Table Values:
1. In the Prospector tab of the Toolspace, expand the Surfaces category.
2. Right-click on the Volume Surface you just created the table for and select Surface Properties.
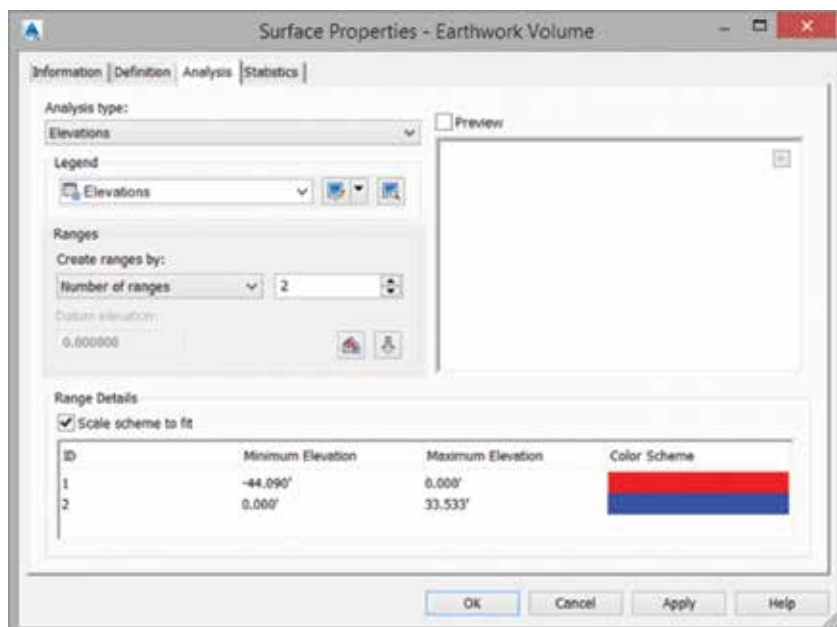
Figure 7: Surface analysis
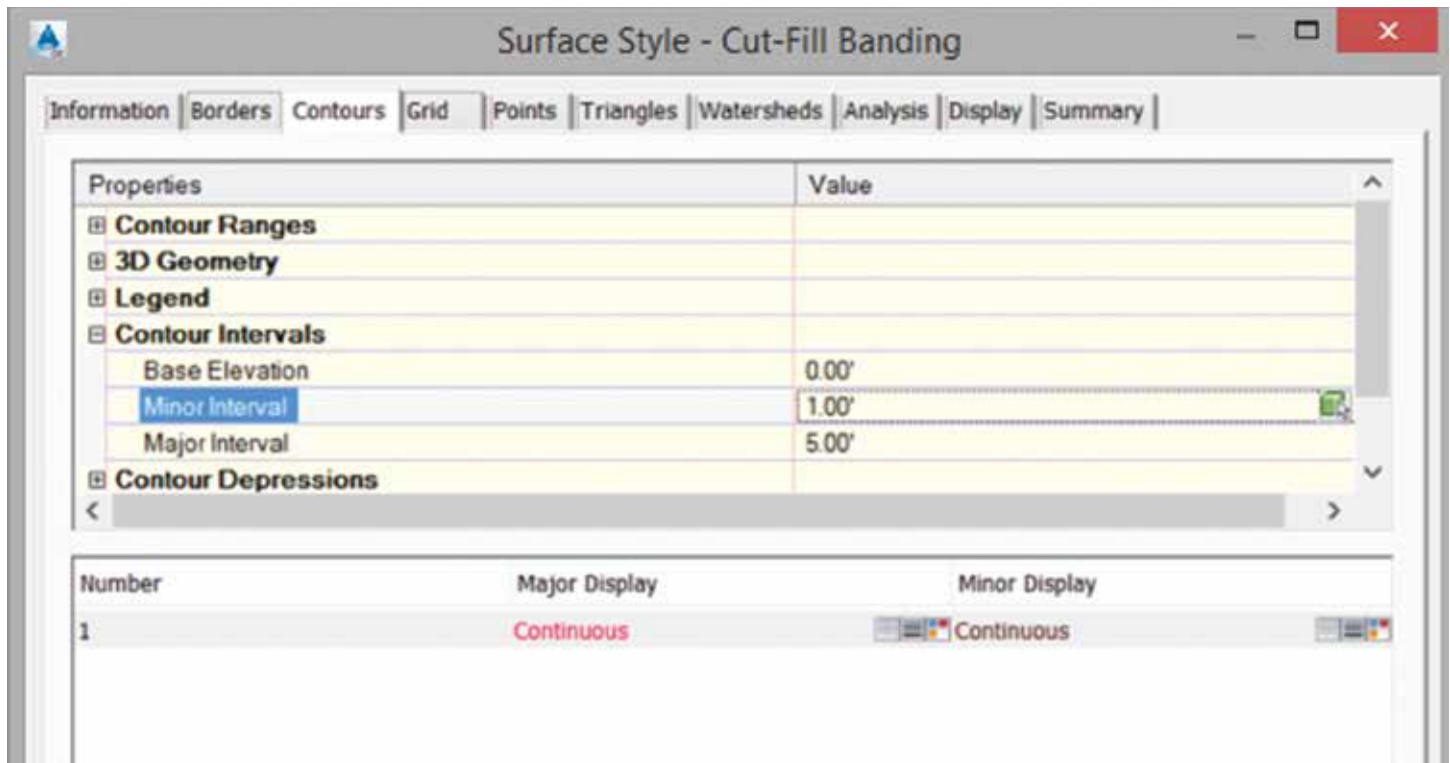
Figure 8: Set contour intervals

3. In the Surface Properties dialog box, on the Analysis tab, set the Analysis type to Elevations and set the Number of ranges to 2. Then run the analysis.
4. Set the Maximum Elevation for the first range to 0 and set the color to Red for Cut areas.
5. Set the Minimum Elevation for the second range to 0 and set the color to Blue for Fill areas, as shown in Figure 7.
6. When you click OK, the Volume Surface Table should automatically update.

Note: More ranges can be set up as needed to show where higher volumes of cut/fill are happening on the site.

DISPLAYING CUT/FILL CONTOURS

In order to clearly differentiate the cut areas from the fill areas, a surface style must be created and applied to the surface after an analysis is done. The templates that ship with the software already have a surface style—Cut and Fill Banding 1 Interval (2D)—that can be used. However, most companies are using their own templates and may have purged this style out when they created the company standard. If this is the case for you, it is easy to recreate the style.

In the Settings tab of the Toolspace, expand the Surface category, right-click on Surface Styles, and select New.
1. In the Surface Style dialog box on the Information tab, type a relevant name (such as Cut-Fill Banding, for example).
2. On the Display tab, make sure that Elevations are turned on. You can also turn on the major and minor contours if you wish to see where various areas have more cut or fill depths.

3. If you turned on the contours in the Display tab, then also set the Contour Intervals on the Contours tab, as shown in Figure 8.
4. If contours are being displayed, you can now label the contours. The label text that appears is actually the depth of the earth between the base and comparison surfaces.

Using slope arrows and volume surfaces in conjunction with each other as you create grading plans can help you verify quickly and easily that the project is draining properly. It also helps you ensure that the project stays within budget by allowing you to see exactly how much cut and fill is happening across the entire site. Until next time, good luck and happy grading!

Michelle Rasmussen started in the Air Force working in the Civil Engineering unit as a surveyor, designer, and construction manager in the early '90s. She has worked for both municipalities and consulting engineering firms as an engineering/GIS technician where she completed transportation studies, environmental impact studies, and drafted subdivision and site plans. She has been training people on Autodesk products since 2000 and is currently an author for ASCENT where she writes books for Autodesk infrastructure software products such as AutoCAD Civil 3D, Autodesk InfraWorks, and AutoCAD Map 3D.

PRODUCT FOCUS

Inventor iLogic Notes for Assembly Drawings

It has been some time since I was regularly programming. My background was C++ and I was moving to C# when, well, I started writing. It appears as though there is only enough time to either research engineering software or research software API.

I have been on a project that demanded a lot of drawings, and after I got through revising about 20 drawings, I decided that digging into iLogic would be a sound investment. What follows is a collection of my notes and references relating to the iLogic Assembly document functions that I used to automate drawing creation.

INTRODUCTION

It is very important to understand the Autodesk Inventor® assembly document structure and hierarchy. Each component in an assembly is a document. Each document is simply a reference
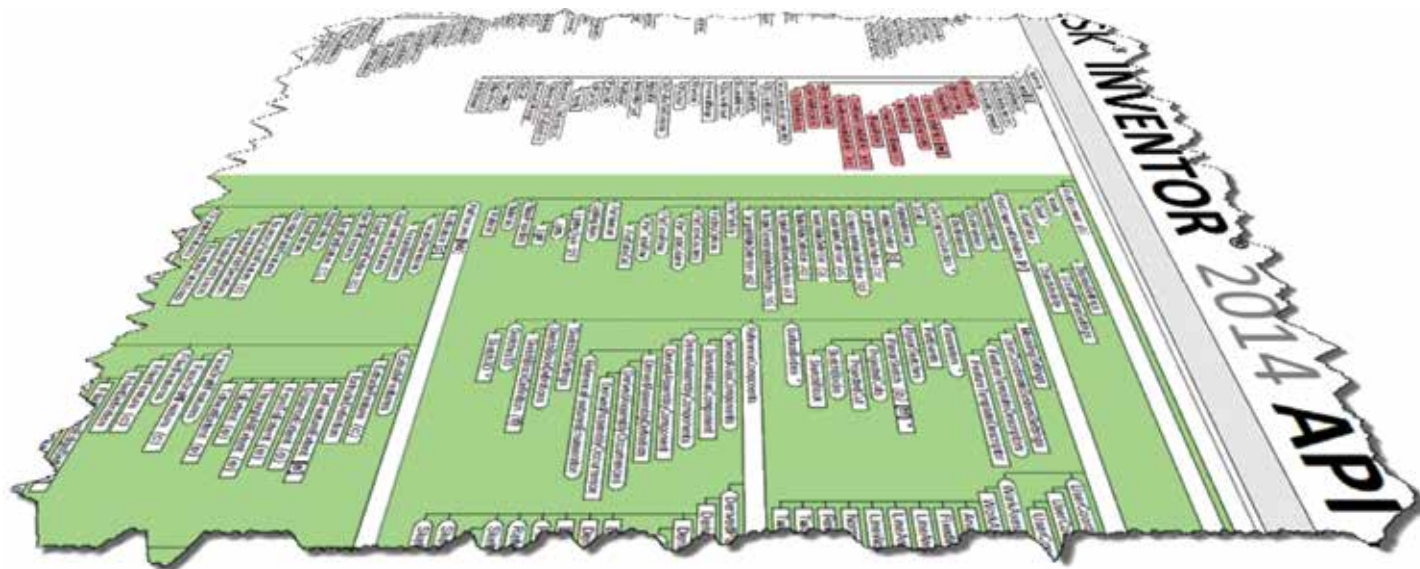
to a file that is, or will be upon saving, stored on a file server or local drive.

However, documents can be interpreted in numerous ways. In our case, documents represent parts, assemblies, spreadsheets, drawings, etc. Inventor has class objects that have intelligence built in to deal with how an assembly document, for example, will behave.

We will look briefly at raw document references, and then take a bit of time stepping into the assembly document container hierarchy.

For the scope of this discussion, I will limit that object hierarchy as follows:

Document -> AssemblyDocument -> AssemblyComponentDefinition -> ComponentOccurances -> ComponentOccurance
and
ComponentOccurancesEnumerator

JUST GIVE ME EVERYTHING
First, we can get all file references by calling for 'AllReferencedDocuments'. This function is basically a document dump.

Base Object Class: Document
Type: Function Call
Object Function: AllReferencedDocuments
Returns: Document object

This function does a jam-up job of returning all FILE instances within any document object. Only one instance per file is returned, regardless of how many times a part is used in an assembly.

This function is not reserved to assembly files and will work on any document class-based object. This makes it a great, universal front-end build for code that needs to work in a broad range of Inventor documents.

Caution should be used to provide significant bounds checking as to what type of document is being returned, as AllReferencedDocuments will return anything at all— spreadsheets, part files, you name it.

Example (working with only the part files in a document):
' Get the active assembly document.
Dim oAsmDoc As AssemblyDocument
oAsmDoc = ThisApplication.ActiveDocument

' Iterate through all of the documents referenced by the assembly.
Dim oDoc As Document
For Each oDoc In oAsmDoc.AllReferencedDocuments

' Verify that the document is a part.
If oDoc.DocumentType = kPartDocumentObject Then
Dim oPartDoc As PartDocument
oPartDoc = oDoc

'------------------
'Do something with the part document here
'------------------

End If
Next
…

This is great when you want everything, but I need to see some structure, and having some refinement would be nice.

ASSEMBLY COMPONENTS
This is what cleaned up my code tremendously. I am dividing into parts so that it is (hopefully) easier to digest.

Assembly component occurrences are all components in an assembly, which contain occurrences, or each component. This section will discuss the use of these, and the functionality associated with extracting each portion.

Assembly Component Definition
The complete component container is similar to the CAD bills of material (BOM), except that the actual BOM definition data is contained separately inside this structure.

Base Object Class: AssemblyDocument
Type: Standard Object
Object Definition: AssemblyComponentDefinition
Retrurned By: AssemblyDocument.ComponentDefinition Function

Inventor 2015

Access to the assembly component structure is performed through this object. We need to define the 'AssemblyComponentDefinition' object and load it with data from a call to the assembly document's 'ComponentDefinition' function.

Example:
' Get the active assembly.
Dim oAsmDoc As AssemblyDocument
oAsmDoc = ThisApplication.ActiveDocument

' Get the assembly component definition.
Dim oAsmCompDef As AssemblyComponentDefinition
oAsmCompDef = oAsmDoc.ComponentDefinition
…

Now that the Assembly Component Definition is filled, it is time to do some digging.

Component Occurrences
As you might expect, these are the containers in which each component document is present.

If a part definition occurs 10 times in an assembly, there are 10 component occurrences, and all 10 will show up in this container. The benefit here is that skeleton and reference files are not part of the 'Assembly Component Definition' structure, so they don't get in the way here.

Base Object Class: AssemblyComponentDefinition
Type: Collection Object
Object Definition: ComponentOccurrence
Referenced at: AssemblyComponentDefinition.Occurences

The occurrences collection is the whole enchilada of component occurrences, which you can access directly.

Now we can define a 'ComponentOccurence' object, and use it to inspect each 'ComponentOccurrence' that exists in our 'AssemblyComponentDefinition'.

In this example, I used a "For Each" function to pull each component.

Example:
' Iterate through all of the Part Occurrences
Dim oOccurrence As ComponentOccurrence
For Each oOccurrence In oAsmCompDef.Occurrences

' Set Reference to Occurrence Name
Dim oOccName As String
oOccName = oOccurrence.Name

' Show each name in a dialog
MessageBox.Show(oOccName, "Document Name")
Next
…

This is a great way to quickly run through the assembly and get every component. What follows is more functionality to be used when you want to be specific about what you are getting.

Occurrence Enumeration
This object goes hand in hand with the next function. While its complete functionality is still not quite understood by me, this object acts as a container to catch a collection of component occurrences, and disseminate them by type into an intelligent object with appropriate functions.

Base Object Class: ComponentOccurances
Type: Collection Object
Object Definition: ComponentOccurrencesEnumerator
Referenced At: itself as dimensioned object

In the last example, we bypassed the need for this and iterated through our assembly component definition's collection of components directly, like a book, one page at a time. However when we want the assembly component definition to hand us a big list of components, we need somewhere to put them. The Inventor API has provided this container for that purpose.

We need to define the 'ComponentOccurrenceEnumerator' object for the next section.

Example:
' Define the Component Occurrence Enumerator
Dim oLeafOccs As ComponentOccurrencesEnumerator

All Leaf Occurrences
Leaf occurrences are part files in an assembly, the end of any branching in the structure.

Base Object Class: AssemblyComponentDefinition
Type: Function
Function Call: Occurences.AllLeafOccurrences
Returns: ComponentOccurrence

This function returns the very same component occurrences we iterated through previously; however, this function only returns a collection of those components that represent the end of assembly branches, part or 'leaf' objects.

While we were able to peruse the assembly component definition's components like reading a book, in this function the assembly component definition object will dump an appendix in our lap.

Here, we will fill our component occurrence enumerator by a call to the component definition's 'AllLeafOccurrences' function. Then we define another component occurrence to represent and investigate each leaf occurrences that is in our filled enumerator.

Example :
' Create the Enumerator to catch all the leaf occurrences of the assembly.
Dim oLeafOccs As ComponentOccurrencesEnumerator
oLeafOccs = oAsmCompDef.Occurrences.AllLeafOccurrences

```
' Iterate through the occurrences and print the name.
Dim oOcc As ComponentOccurrence
For Each oOcc In oLeafOccs
MessageBox.Show(oOcc.Name, "Occurance Name")
```

All Referenced Occurrences

The Inventor API will also permit users to extract all occurrences of specific Inventor documents.

Base Object Class: AssemblyComponentDefinition
Type: Function
Function Call: AssemblyComponentDefinition.Occurences.
AllReferencedOccurrences(Document)

Returns: ComponentOccurrences

This function will return all instances of the specified document at any level within a component definition.

This example takes a file name, and returns all occurrences of it that exist. It uses a call to opened documents expecting that if it exists, Inventor has it opened. Some good bounds checking could be applied to catch any error associated with an unopened file.

Example:
```
' Get the active assembly.
Dim oAsmDoc As AssemblyDocument
oAsmDoc = ThisApplication.ActiveDocument

' Get the definition of the assembly.
Dim oAsmCompDef As AssemblyComponentDefinition
oAsmCompDef = oAsmDoc.ComponentDefinition

' Get the document to find occurrences for.
Dim sDocName as String
sDocName = "C:\designandmotion.ipt"
Dim oDoc As Document
oDoc = ThisApplication.Documents.ItemByName(sDocName)

' Get the occurrences that represent this document.
Dim oOccs As ComponentOccurrencesEnumerator
oOccs = oAsmCompDef.Occurrences.
AllReferencedOccurrences(oDoc)

' Iterate through the Occurrences
Dim oOcc As ComponentOccurrence
For Each oOcc In oOccs


' -----------------------------

' Do Something here with the Occurrence
' -----------------------------

    Next
…
```

CLOSING THOUGHTS

I used this code to automate the production of drawings, running out as many as 20 at a time right out of an assembly drawing file. I added substantial enhancements so that each drawing contained views, parts lists, as well as automating various key iProperties values.

I hope this helps you get a jump start on iLogic assembly code as it did for me. If you'd like more information on Inventor, iLogic, or even how we built the drawing generator, stop by Design & Motion (http://designandmotion.net).

References:

Special thanks to the Mod The Machine team and their article "Accessing Assembly Components" from 2009:
http://modthemachine.typepad.com/my_weblog/2009/03/accessing-assembly-components.html

The Autodesk Inventor 2014 API chart:
http://images.autodesk.com/adsk/files/Inventor2014Model.pdf

Mod the Machine Article "Understanding File References" from 2008:
http://modthemachine.typepad.com/my_weblog/2008/11/understanding-file-references.html

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CAD Manager

by: Mark Kiker

Customized Leadership

One size does not fit all. You have heard that over and over. You know its true when you try to buy clothing that is labeled "one size fits all," which means that this size fits some. You may try it on and see that it is too tight, too loose, too short, too long, or whatever it might be. It obviously does not fit you.

Leadership is the same way. There is not a predefined "one way" to lead all people. Trying to do that will result in conflict and frustration at best and outright rebellion and heated words at worst. I know. I have fallen into that trap. I have seen tough times come because I try and lead everyone the same way.

A leader has to bend and shape his or her leadership so people can be encouraged, engaged, energized, and mobilized in a way that works for each of them individually. It is not easy, but it does pay off.

But you cannot change everything for everyone all the time. That is called anarchy. Some things have to be firm and in place. You cannot be flexible in everything just as you cannot be unchanging in everything. A leader has to recognize and change as needed and when it is appropriate. And it is hard to know when to customize your leadership. Get it right and things click. Get it wrong and things get rough. Just as customizing your software can make you a better performer, customized leadership can make your team work better.

THINGS TO "NOT CHANGE MUCH"

Notice I did not say "never change." There are many things that should not be allowed to slip. Even small slips, if left uncorrected, can soon spawn more slips and slides that deteriorate the entire efforts of all.

Expectations of Quality. Some say never sacrifice quality for any reason. I wholeheartedly agree for things such as healthcare, safety, child protection, data security, and many more. Holding the line and setting the bar high is needed in many, many areas. Leaders set the pace and often allow a slip in quality to happen without realizing it. Keeping a focus on quality will improve every area of your team's efforts.

Insert

Expectations for Level of Effort. Make the level of effort match the need for quality and completeness. Like a BIM model, sometimes level of effort needs to be dialed back a bit because the return on infinite detailing is small. Keep the focus on what is needed to achieve the goal. Expect more and you will get more, I have been told. Expect your team to put out a high level of effort on every task they approach.

Expectations of Professionalism. Respect, honesty, trust, graciousness, helpfulness, humility, and sharing of knowledge are a few things that should be on your list of expectations. Everyone deserves to be treated professionally. Every person that you and your team interacts with should be treated as someone who deserves the best you have to offer at all times.

Expectations of Customer Service. Excellent service and extra efforts from those you lead should be something that they all strive for. Service focus that goes beyond just what is expected and moves toward exceptional support and contributions. Providing more information, explanation, support, assistance, and provisioning approached with vigor, under budget, and delivered as agreed. Go the extra mile.

Expectations on Deliverables. Leaders should put forth the expectation that all deadlines will be met or exceeded with the expected delivery or even more. On time, under budget, and high quality as agreed. If a deadline and quality expectation is defined and agreed to, strive to exceed those expectations on every task or project.

THINGS THAT SHOULD BE CUSTOMIZED

Customizing your leadership to fit the person or situation has been suggested by many authors. It is what the best leaders do. They adapt and shape their leadership based on the people they lead and the project, task, or environment they are in.

What do they adapt?

Methods of Communication. I have seen this in action and it works great. When I am trying to interact with people, I try to adapt my communications to fit the audience. I will use different wording and tools. I have some that will reply to emails. Others that instantly get back to me via texting. And still others that respond well from their desks using Instant Messaging tools.

You should look at how you communicate and the tools you use. Change it up a little and try different methods and wording to see what might work for some groups and use others for the next team. See what works and move toward that method.

Methods of Production. Setting the goals and targets that need to be hit along with the deadlines really does make a leader into someone to follow, but there may be times when the "how" of getting things done needs to be left to team members. They may know something you do not. They may have processes that will get the job done better than what you are thinking. They may have shortcuts and tricks that seem outlandish but produce the outcome you desire. Let people be creative in how they get things done.

Methods of Interaction. Just like communication, your methods of interacting need to bend and shape to the need. Some like meetings; others hate them. Some will respond to thinking independently and then presenting to the team. Some might want to run everything past you as they move forward in an iterative process. Some may want to break into smaller teams of two or three people and work together to set the pace. Letting people work in ways they enjoy and in which they can be productive will unleash new energies.

Methods of Motivation. Just like people wanting to define how they work, many like to define the way they are rewarded. Each and every person will respond to motivation options in differing ways. Some may go for money. Some may want time off. Some may want advancement or to be put on a specific team or project. Some may like gift cards. Some may want to be introduced to your contacts. Some may want to just sit and pick your brain. The list is endless and varied. Don't try to put everyone into the same bucket for motivation.

By being flexible and customizing your leadership you can achieve more. By changing things up a little, you can go a long way.

Mark Kiker has more than 25 years of hands-on experience with technology. He is fully versed in every area of management from deployment planning, installation, and configuration to training and strategic planning. As an internationally known speaker and writer, he is a returning speaker at Autodesk University since 1996. Mark is currently serving as Director of IT for SIATech, a non-profit public charter high school focused on dropout recovery. He maintains two blog sites, www.caddmanager.com and www.bimmanager.com.

PRODUCT FOCUS

Understanding the CUI

The Customize User Interface (CUI) of 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 CUI Editor by clicking the Manage tab of the ribbon, Customization panel, and then User Interface (see Figure 1). Once you have opened the 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.

CUSTOMIZING 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,
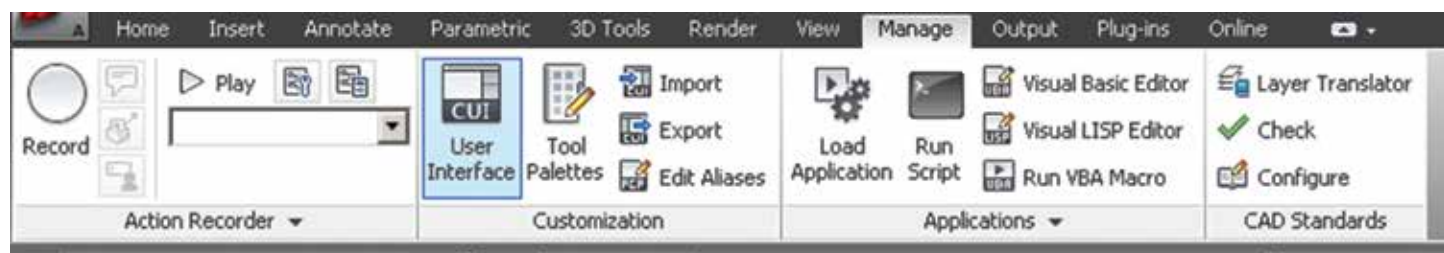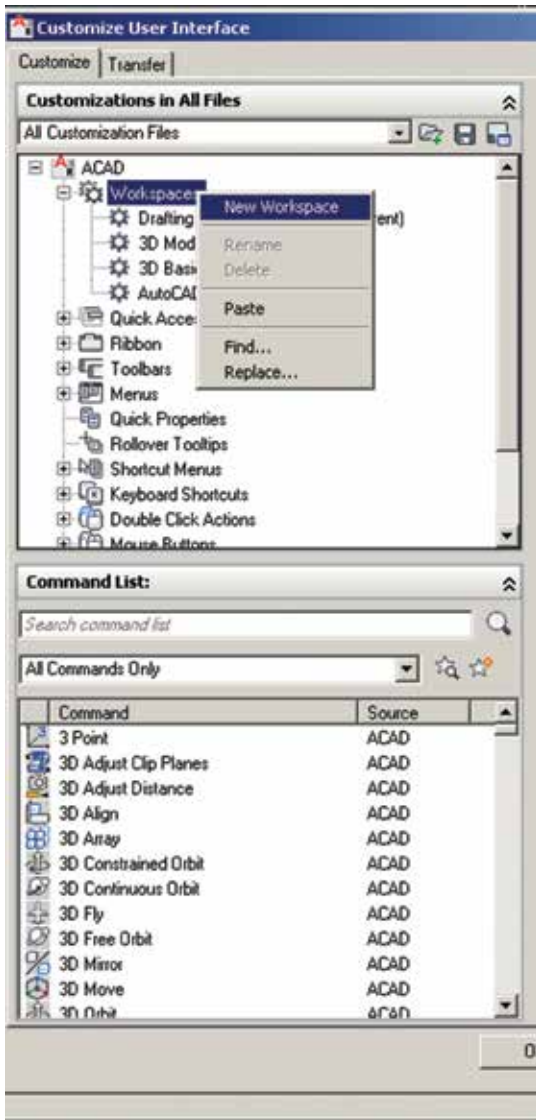

Figure 1: Customize User Interface

Figure 2: New workspace

Figure 3: Customize workspace

menus, ribbon tabs, and palettes). You can customize a workspace 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 CUI 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.
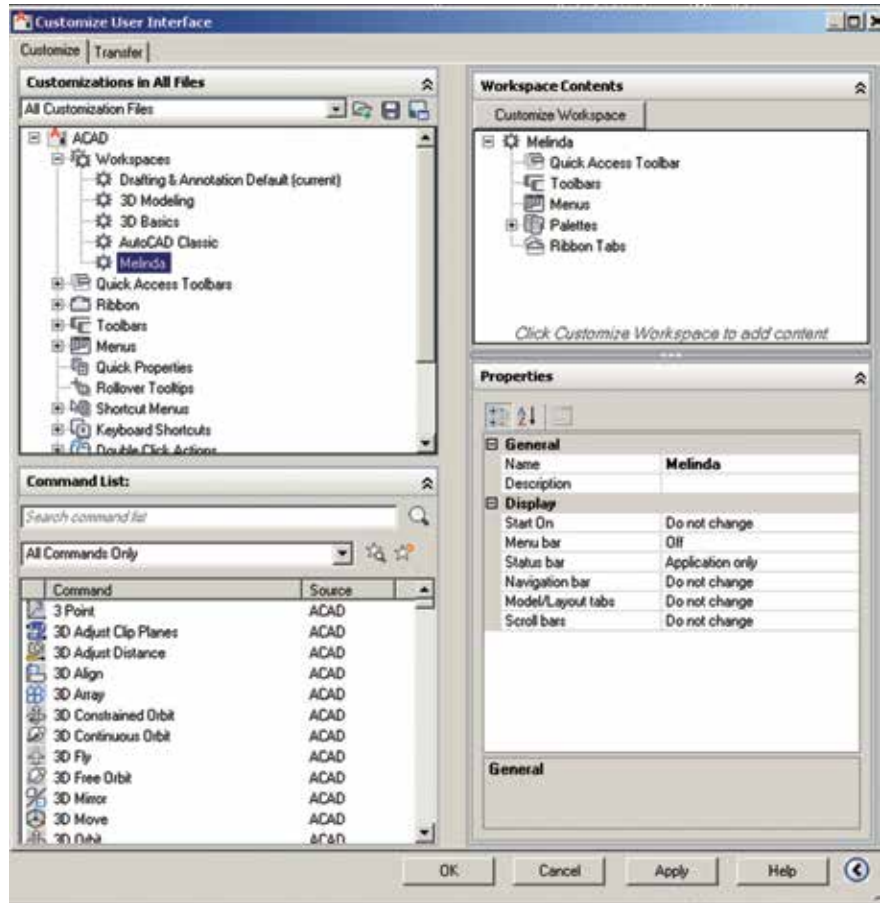
The new workspace you have created can be set as the default workspace. To do this, click the Manage tab of the ribbon, Customization panel and then select User Interface. In the CUI Editor, Customize tab, in the Customizations In <file name> pane, click the plus sign (+) next to Workspaces to expand 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 do this, the Customizations In <file name> pane lists the user interface elements that can be added to the workspace that is 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 CUI 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

AutoCAD Architecture 2014

Transfer tab is displayed, with the main CUIx file displayed in the Customizations In <file name> pane (left side). In the CUI 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 CUI Editor, Customize tab, right-click Toolbars in the Customizations In <file name> pane and select New Toolbar (see Figure 4). A new toolbar (named Toolbar1) is placed at the bottom of the Toolbars tree. Next, right-click Toolbar1, select Rename, and 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 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 then 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.
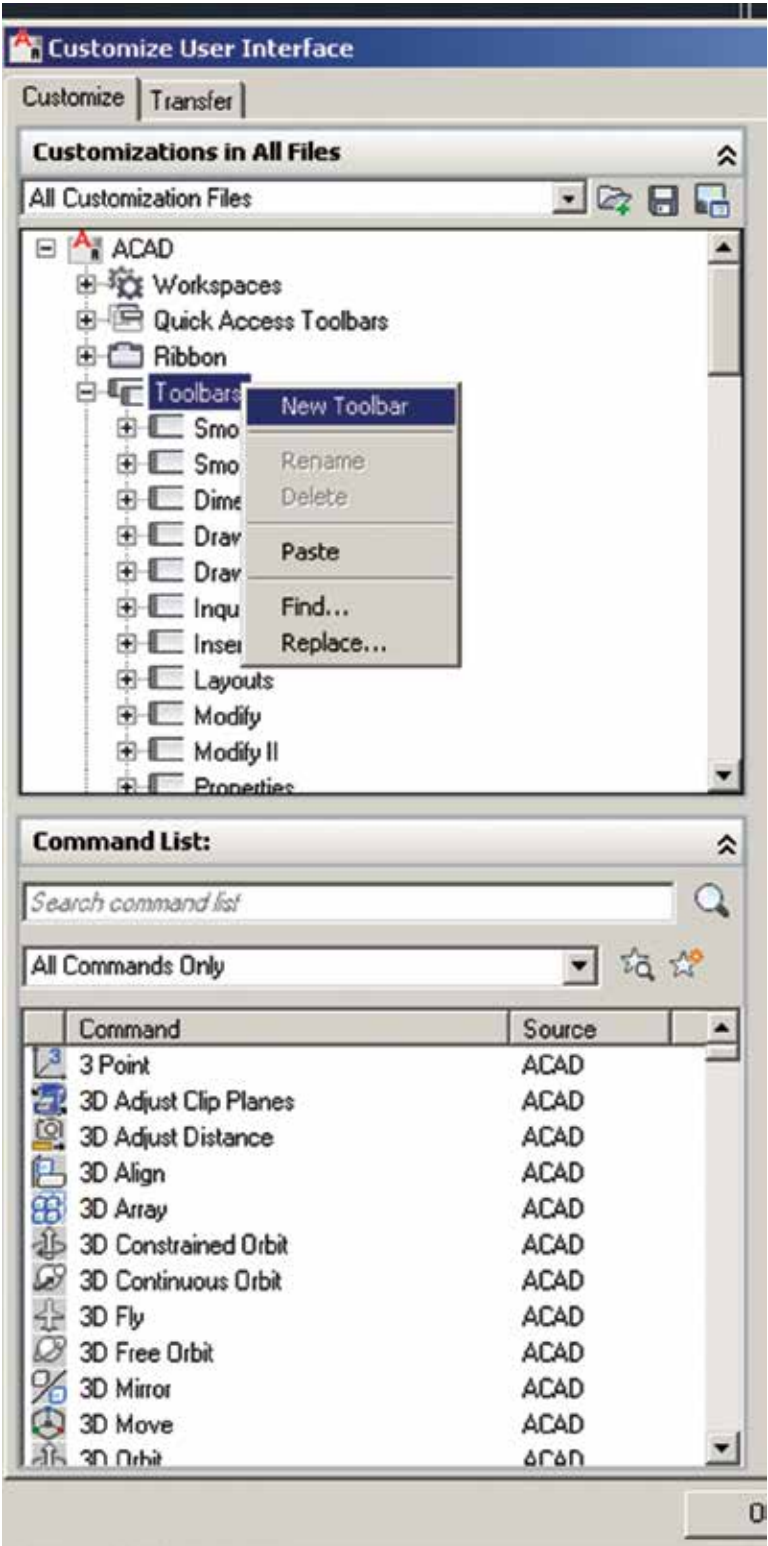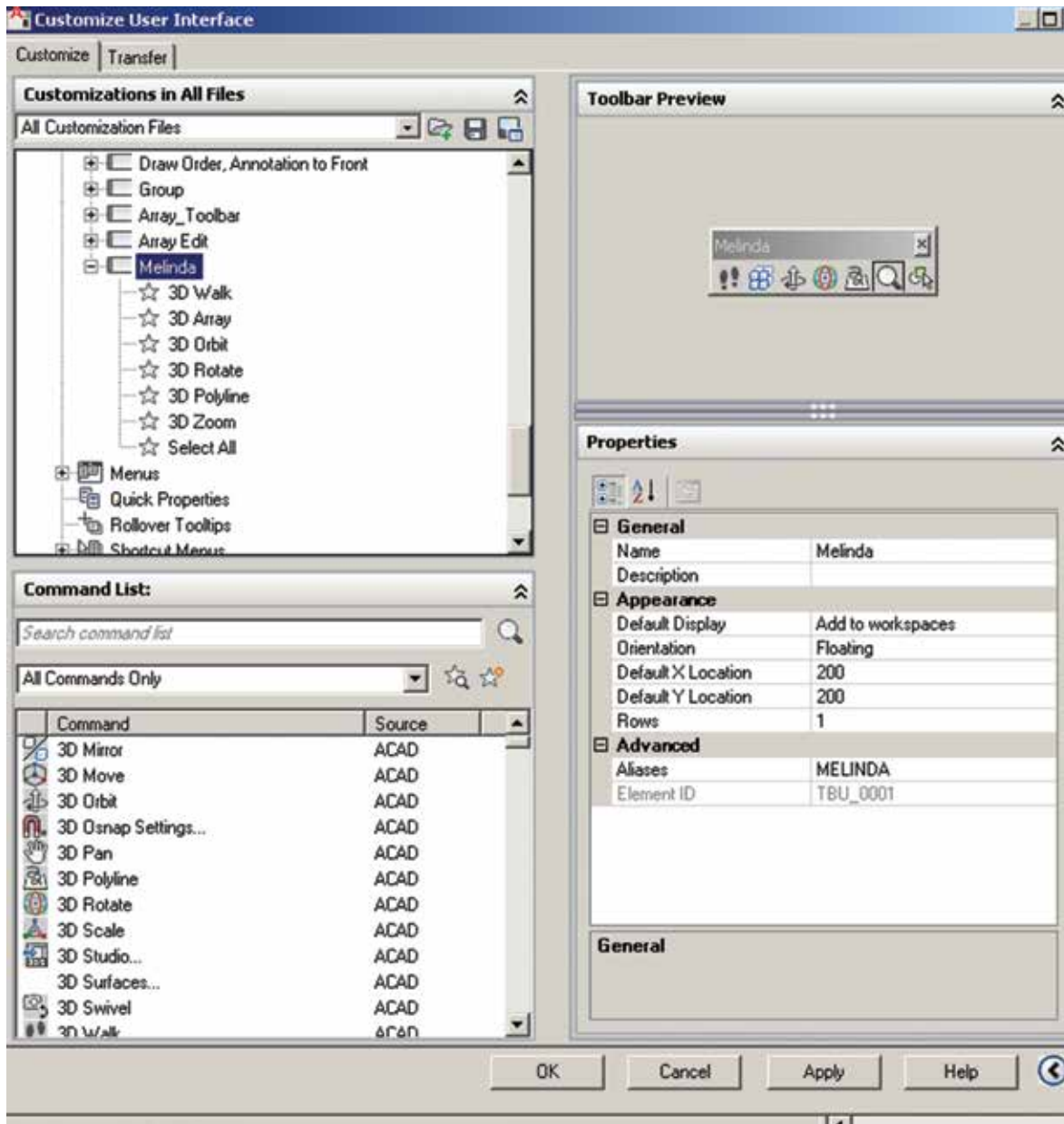

Figure 4: New toolbar

Figure 5: Customize toolbar

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 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, 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 that 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.
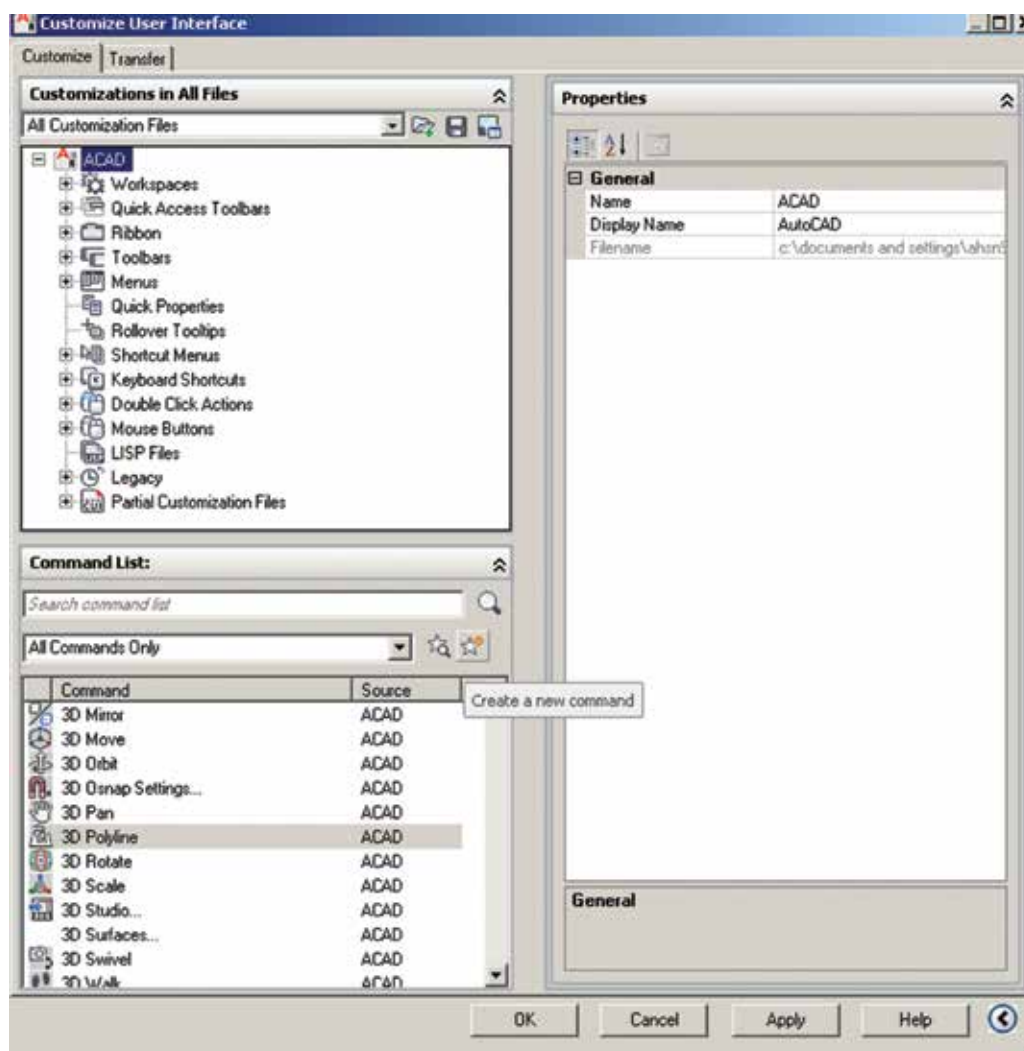
AutoCAD Architecture 2014
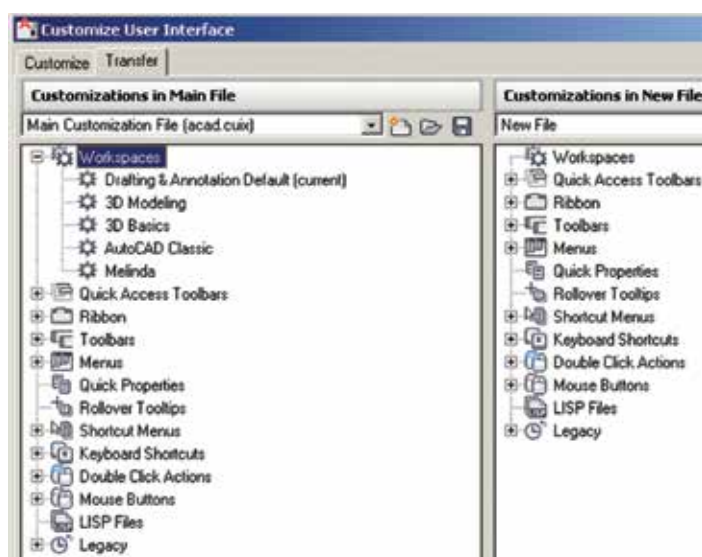

Figure 6: New command

Figure 7: Transfer tab

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 that 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. It is important to 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 if you wish 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.

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To edit a command, begin by clicking the Manage tab of the ribbon, Customization panel, and then select User Interface. In the CUI Editor, Customize tab, Command List pane, select the

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