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The Official Publication of Autodesk User Group International

January 2017

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# Letter from the President



**H**appy New Year! January is a great time to look back on the year we've just finished and to look ahead at the year to come. (And to sign up for gym memberships that we won't use after February.) It's a time to plan big, and dream bigger.

As I write this, it's just a few weeks after Autodesk University 2016. Talk about a place for big ideas! In the past, AU was mainly composed of picks-and-clicks classes. You can still find them there, but now there are just as many sessions with more high-level topics: discussions of process, theory, and possibilities.

I always come back from AU with some great new ideas. Sometimes they're really specific feature-related tips that I just know my colleagues will love. Sometimes they're more blue-sky concepts—ones that I want to keep an eye on to see how they develop.

The trick, though, is turning these ideas into actions. You can think about things all you want, but eventually you'll need results. How to get from point A to point B?

Despite the season, I won't be making any resolutions. Resolutions are too easy to break. (See above re: gym memberships.) Instead, I set goals. Once you have a goal, you can make plans to achieve it.

For many of you, the goals you set for 2017 will involve expanding your professional skill set. In that spirit, this issue of *AUGIWorld* is dedicated to advanced topics. You'll hear from people who are pushing their design software to the limits—and beyond—with some amazing results.

Implementing plans often means dealing with change. We heard a lot about change at AU, especially at the closing keynote. Andrew Anagnost highlighted three Autodesk customers that changed themselves, changed their companies, and changed their industries. If you weren't in Las Vegas, I highly recommend that you watch the recording, and be inspired yourself. (All three keynotes, along with many other sessions, were recorded live and are now available at AU Online.)

2017 will also be a time of change and growth for AUGI. The Board of Directors is bidding farewell to three long-serving volunteers: Robert Bell, Melanie Perry, and Walt Sparling. We thank them for their service and dedication to our organization. They're leaving some big shoes to fill, but we're confident that our two newest directors will be up to the challenge! As of January 1st, Kimberly Fuhrman and Robert Green have joined the board. Their names should already be familiar to *AUGIWorld* readers as content managers and frequent contributors, and the Board is looking forward to the addition of their skills and talents to our team. We'll be working hard this year, along with our fantastic Management Team, to set our own goals for supporting our current initiatives and developing new ones.

So what's your big idea? Maybe you'll find something in the pages of this magazine that will spark your creativity. Maybe you saw a post on the AUGI Forums that will jumpstart an improvement to your company's workflow. Or maybe you're working on an app in your free time that will change how your industry does business.

Whatever your idea is, whatever your goal, I wish you success with it!

Kate Morrill  
AUGI President

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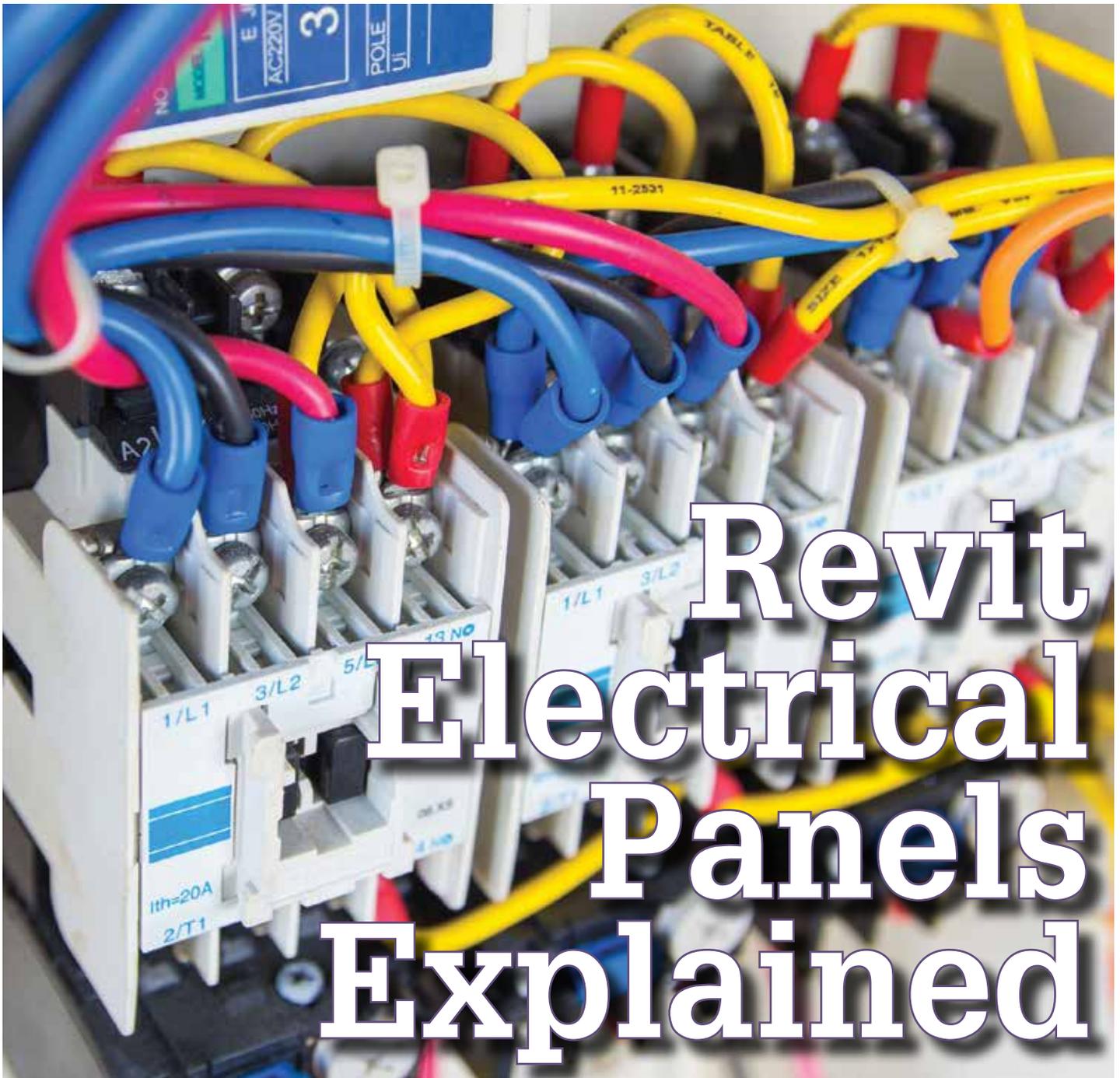
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# Revit Electrical Panels Explained

**I**f you are utilizing Autodesk® Revit® for electrical engineering design, then you are using electrical panels and likely electrical panel schedules. While the process of inserting electrical panels and connecting basic circuits to them is pretty straightforward, there are some items that are good to know to help you better utilize panels and their associated schedules.

First off, a requirement in this process is to make sure that after you place an electrical panel in the Revit model, you set the Distribution System for it. Otherwise, you will not be able to connect any electrical device or other electrical equipment to the panel. The Distribution System is shown in both the panel's Properties palette, and on the Options Bar on the ribbon.

Panel Schedules in Revit are a report of the information that is contained in the electrical panel, and schedules cannot be created without having a panel family placed in the project file. They are not like a spreadsheet where the numerical values are entered into the spreadsheet. The values shown in the panel and on the panel schedule are a result of connected loads to the panel and are only as good as the information in the items connected to the panel.

Following are some aspects of electrical panels and panel schedules that are important to know.

## CIRCUIT NUMBERING

When adding a circuit to a panel, Revit will assign the circuit to the first pole that is open on the specified panel per the Circuit Sequence setting value in the Electrical Settings dialog box.

The following options have been available since Revit 2015:

- Numerical (1,2,3,4,5,6,7,8,9,10,11,12)
- Group by Phase (1,3,5 / 2,4,6 / 7,9,11 / 8,10,12)
- Odd then Even (1,3,5,7,9,11 / 2,4,6,8,10,12)

You cannot specify a different circuit number when creating a circuit. I would love to be able to specify an actual circuit number when creating a circuit, especially for as-built projects. A common way to get the circuit to the desired pole is to move it on the panel schedule afterwards. Beginning with Revit 2015, there is a nice Move To button on the ribbon that allows you to pick the pole number where you want the circuit to be. Otherwise, you can use the Move Up/Down/Across buttons to relocate the circuit.

Another way is to place Spaces on the panel schedule in the slots preceding the desired location. This is not efficient for adding one circuit, but may be beneficial when you want circuits to start at a specific pole number. Just remember to go back and remove the temporary Spaces.

## REPLACE SPARE OR SPACE WITH NEW CIRCUIT LOAD

There are times when an electrical panel is not loaded with actual circuits, but has Spares and/or Spaces on the panel schedule to “fill” all of the poles of the panel schedule. It is possible to have a newly created circuit be assigned to this panel even if it is “full” (see Figure 1). If a Spare or Space is not locked, Revit will allow a new circuit to replace the first unlocked Spare or Space. When you specify this panel for a circuit, Revit will ask if you want to replace the Spare or Space with this circuit. You must answer yes.

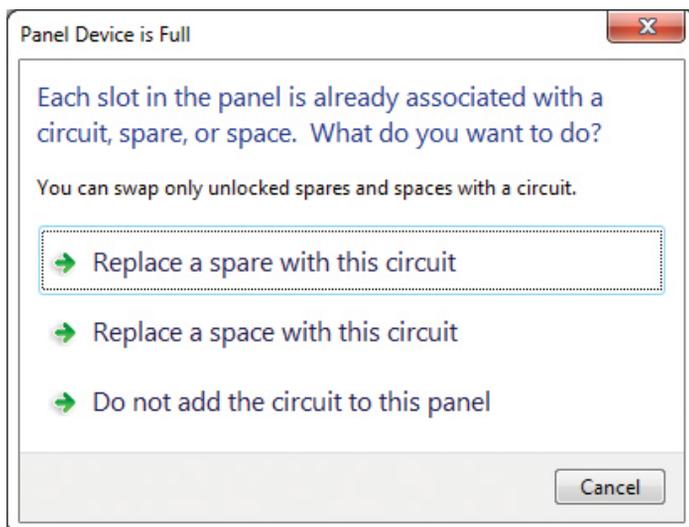


Figure 1

Revit “locks” Spaces and Spares when you add them to a schedule, highlighting in a pale yellow/peach color, so this feature will not work by default. Therefore, you need to unlock Spares and Spaces to enable this to work.

Note that this only works if the specified maximum number of poles for the panel is equal to the “Max #1 Pole Breakers” parameter on the associated panel schedule.

Every panel has the instance-based “Max #1 Pole Breakers” parameter under the Electrical – Circuiting category. This parameter needs to match the “Number of slots shown” value in the Set Template Options dialog box when editing a panel schedule (see Figure 2).

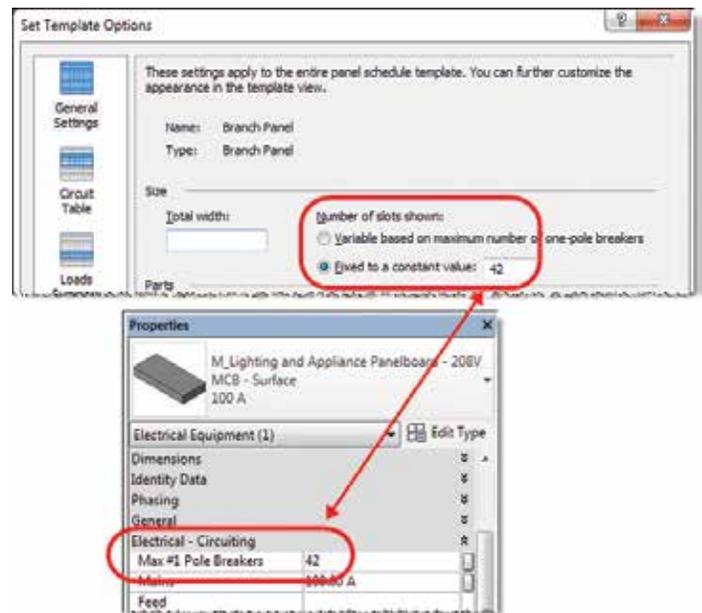


Figure 2

If the panel occurrence has a quantity greater than the quantity of poles on the panel schedule, then the new circuit will be added to a circuit number that does not actually appear on the panel schedule. For example, if the panel says 84 “Max #1 Pole Breakers,” but the panel schedule shows only 42 poles, then a new circuit can be assigned to a circuit 43 to 64, but never be seen on the panel schedule.

If the specific panel instance has a quantity less than the quantity of poles on the panel schedule, then Spares, Spaces, and Circuits cannot be added to the panel schedule beyond the “Max #1 Pole Breakers” value.

## GROUPING CIRCUITS

There are times when a device contains multiple circuits that need to be kept together in sequential circuit breakers. After assigning the circuits to the desired circuit numbers, highlight the desired circuits and select the Group/Ungroup command on the Circuits panel of the ribbon menu to keep them together.

# Revit MEP 2017

An example of this is a floor box that has more than one circuit in the box, such as a furniture feed for multiple cubicles. You will typically want those circuits to be consecutive in the panel schedule. By grouping these circuits, they will always move together in the panel schedule.

Temporarily grouping circuits is also a great way to move a group of circuits at one time versus moving each circuit individually. Just remember to ungroup the circuits if they do not need to remain grouped together.

When circuits are grouped, the panel schedule will show a blue dotted line around the circuits that are grouped together. Each group has a separate rectangle encircling them.

## LOCKING CIRCUITS

It is often a good policy to lock your circuits on the panel schedule after you have them located as desired. This prevents circuits from moving unexpectedly. Circuits that are locked will not be moved on the panel schedule when you use the “Rebalance Loads” command on the ribbon.

This is not a requirement by any means and sometimes you want them to be unlocked to have more flexibility on the panel. If the location of individual circuits does not matter, then not locking them may be your best option. Spares and Spaces will be locked by default when you add them to a panel schedule. Locked circuits will be highlighted in a pale yellow/peach color.

## CIRCUIT NAME

Each electrical circuit has a parameter named “Load Name,” which is the description that typically gets placed in the electrical panel as “Circuit Description,” “Description,” or something similar. This name can be changed either within the panel schedule or in the Properties dialog box for the actual electrical circuit. If the project file is using Revit Spaces (not to be confused with “Rooms”), then the Load Name parameter value will default to the Load Classification name plus the Space Name and Space Number. For example, if a receptacle with a Load Classification of “Receptacle” is placed in a space named “Office” and numbered 105, then the Load Name value will default to “Receptacle Office 105.”

**Caution:** The Update Names command on the ribbon will rename the Load Name parameter back to the default name for the circuit, which may not be what you desire.

## DISTRIBUTION SYSTEM

I will not go into Distribution Systems much here other than to say that Panels must be connected into an electrical distribution system with other electrical panels, transformers, etc. for electrical loads to carry through the system (Figure 3).



Figure 3

## PANEL LOAD INFORMATION

Panel loads are a result of the electrical items connected to the panel. An electrical panel in Revit is generally classified as a Panelboard part type in the Electrical Equipment category. Panelboards are meant to pass loads through them and not to generate a load. A Panelboard cannot generate a load even if a connector on the Panelboard is assigned a load. Panelboards should be assigned the “Other” Load Classification.

## DEMAND LOAD

Demand load is part of the panel information and not part of the circuit. Default panel loads <Val> that are shown on a distribution board show the Connected Load and not the Demand Load. Demand Load cannot be shown on a per circuit basis.

## DEMAND FACTOR

Demand factors are applied at the panel level and not the individual circuit level. Revit will look at all of the families connected to the panel through circuits and find connectors in the families with similar Load Classifications. Those with similar load classifications are analyzed in whole at the bottom of the panel in the summary section. The demand factor is then applied to the entire specific load classification at once. The demand factor percent that is shown at the bottom of the panel is an average for all connectors that are assigned that demand factor. It will often show an unusual percent due to it being an average.

## MOTORS

A motor demand factor will apply 125 percent load to the largest motor on the panel. It doesn't matter if the motor is the last one added to the panel, as Revit will always find the largest motor. When multiple panels that contain motors are connected to a distribution board, the distribution board will only have one motor designated as the largest motor and will search across any of the connected branch panels to find it.

## RECEPTACLES

Typically, the first 10 kVA of the Receptacle load classification is calculated at 100 percent, and then the remaining Receptacle loads are calculated at 50 percent. Revit will calculate

the load for all devices connected to the panel that use the Receptacle load classification and then apply the demand factor to display the proper demand load at the bottom of the panel in the summary area. If there is less than 10 kVA of Receptacle load on the panel, then all of the load will be at 100 percent. If there is 20 kVA of Receptacle load on the panel, then the second 10 kVA will be calculated at 50 percent so the Demand Load for Receptacles on the panel will be 15 kVA. When multiple panels are connected to a distribution board, Revit will only calculate the first 10 kVA of all receptacles on all those connected panels combined at 100 percent. The remaining receptacles are calculated at 50 percent.

If five panels each have 20 kVA of Receptacle load classification connectors, each of those panels will see a demand load of 15 kVA for receptacles. When those five panels are connected to a distribution board, the first 10 kVA of the 100 kVA total (five panels x 20 kVA) is calculated at 100 percent. The remaining 90 kVA is calculated at 50 percent for a load of 45 kVA. The panel will have a total demand load of 55 kVA for the distribution panel.

## SPARES

Adding Spares to represent loads on panels is a common occurrence for companies as a method to “cheat” Revit into showing what they desire on the panel. This creates items on the electrical panels that have not been truly circuited in the model. A “Spare” is added to the panel and then the description of the circuit is changed from “Spare” to the desired item. The desired load value is added to the leg (A, B, or C). This gives the appearance of the panel having correct loading on each leg as the leg totals at the bottom of the panel added up correctly. Sometimes, the entire panel schedule is made up of Spares with their descriptions renamed to fake a panel schedule. While this may look fine if you do not include the load totals, it is not truly Building Information Modeling (BIM) and is not accurate.

## POWER FACTOR EFFECT ON LOADS

When a power factor is assigned to a connector, it will show up on the Distribution panel.

- Val (default) on distribution board shows the full load without power factor applied. It uses the Connected Load parameter value.
- Apparent Current on distribution board shows the full load without power factor applied.
- True Current and True Load on distribution board shows the load with the power factor applied.

The load shows the full Connected Load (Apparent Load of the circuit) at the panel, including at the circuit level and at the totals

at the bottom of the panel. A connector may have a 1 kVA apparent load assigned to it and a power factor of 0.1. At the branch power the circuit load will show as 1 kVA (1000 VA). At the distribution board, the load comes through differently depending on the parameter that is used on the distribution board. A differing value can signify that a family somewhere has a questionable power factor assigned to it.

- Val (default) on distribution board shows 1.0 kVA (1000 VA).
- Apparent Current parameter on distribution board shows 2.8 A.
- True Load parameter on distribution board shows 0.1 kVA (100 VA).
- True Current parameter on distribution board shows 0.28 A.

The value modified by the power factor is carried through to upstream panels/distribution boards/switchboards even though it does not show on the panel containing the originating circuit with the power factor.

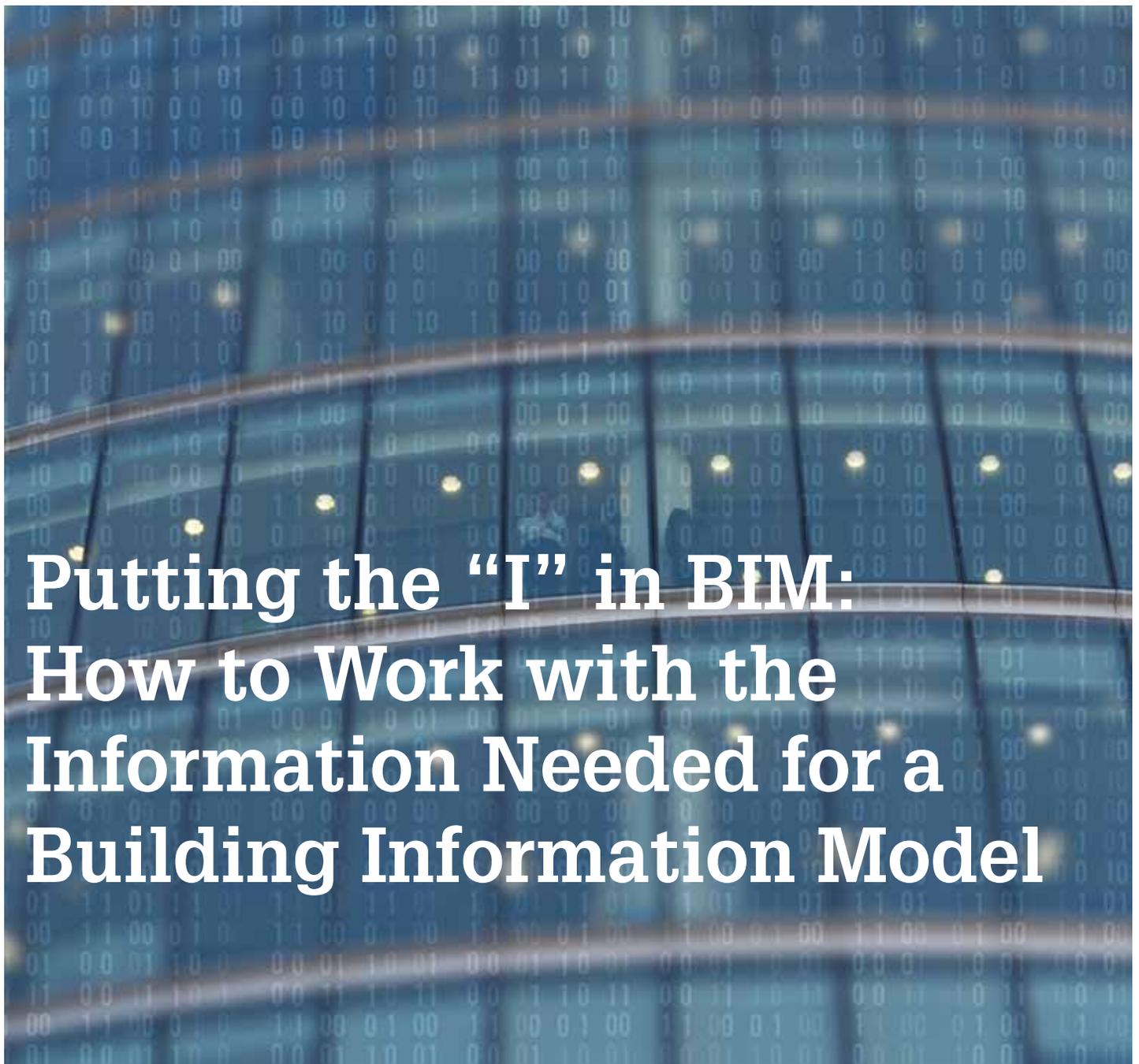
**Problem:** Calculation between kVA and kW is  $kVA * PF = kW$

- $1.0 kVA * .2 PF = .2 kW$
- $.2 kW$  is not the same as  $.2 kVA$

While the True Load parameter for the circuit shows the correct number (.2 vs 1.0), the correct units is not set. The units can still say VA or kVA even though the units are actually W or kW. Revit needs to change the units to the appropriate value and not allow kVA to be shown if the internal power factor calculation has changed the value to kW. Branch panels do not have the ability to show the True Load parameter that will actually show the kW load with power factor applied. There is no parameter for Total True Load or Total True Current for showing total kW at the bottom of the panel schedule if desired.



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# Putting the “I” in BIM: How to Work with the Information Needed for a Building Information Model

**T**he “I” in BIM stands for the information you put into the model, not the appearance of a construction documents set. We have all heard the terms LOD (Level of Detail), BIM (Building Information Modeling), and BIM Execution Plan (what is the information needed, how to model that information, where the information is located), but how do they all affect each other when modeling? How do we ensure we are not over- or under-modeling on each project? I will provide a few tips for working with the information needed for a Building Information model.

To answer the questions posed above, we must first have a clear understanding of the client’s expectation of the model. We can talk about space and planning, but the moment the term BIM

is used, we move away from a printed construction document to a database that can be used for so many different things. The printed construction document may still only be the focus of the deliverable, but now we need to look at LOD and contract wording. We must understand what the term BIM means to the client, not just *our* understanding of it. Does this mean we should never use the term BIM while talking to a client? No, in fact you should have an in-depth conversation about it. Not only will you know what to model and how, but you might find ways to support your client before and after the project.

Where we start is simple. Have a clear understanding of quantum mathematics, dark matter, and how time began and you have it nailed! Okay, it’s not that bad, but a good game plan is important.



DISCOVERY TALKS

## DISCOVERY TALKS

The first big question to the client is, “Would you like to use the model’s database?” If the answer is no, then you have two choices. Focus only on the design of the project and the deliverables, or find new ways to support the client as additional services. If they do want to use the model database, then you need to do a deeper dig into how they intend to use the data. When you are in talks about the needs of the building, ask questions to understand what you are modeling in specific areas of the project and how it will affect the client’s business model and workflow. “Always design a thing by considering it in its next larger context. A chair in a room, a room in a house, a house in an environment, an environment in a city plan,” Eliel Saarinen stated.



DOCUMENT IT

Find out how the model can help in the process of the project. Can it be used to help relocate people before, during, and after the renovation? Can the model help the IT department track computer assets in the building? Can HR have parameters to track personnel? As always, how can facilities management use the data in the model to streamline their process? There are so many different questions that can be asked and information that can be used in the discovery talks phase that will define what the “I” is that you need to put into your model.

## DOCUMENT IT

Now that the intent for the model is clear, the expectations are understood for the data in the model and there is a plan for how to model all of it, get it all down in

writing. It is always a good idea to write a BIM execution plan for every project, large or small, even if it is for internal use only. This will help the modeling process become more efficient and ensure that there will be no over- or under-modeling.

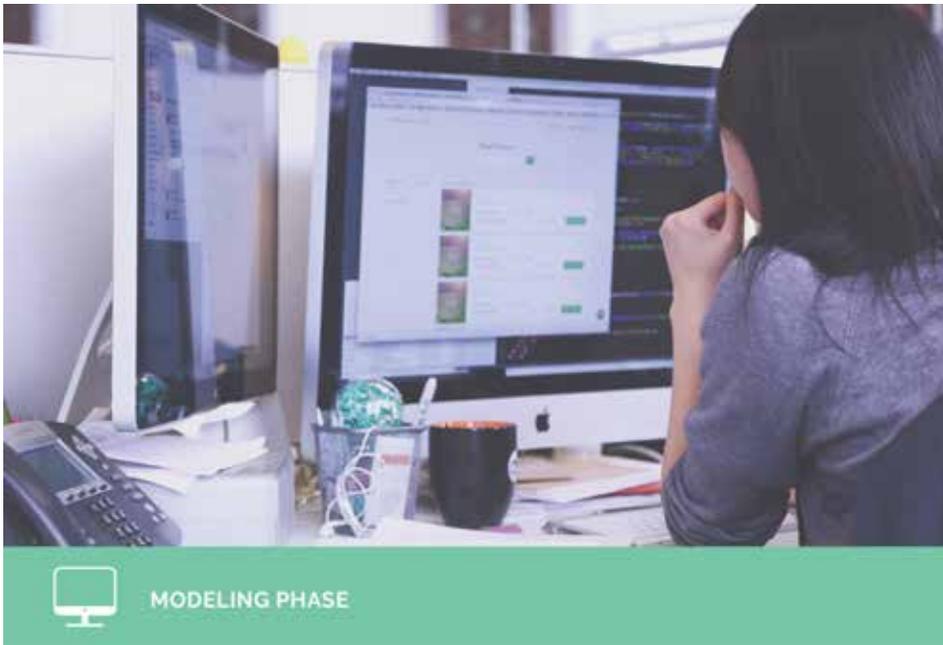
On small projects, develop an internal BIM execution plan that is no more than one or two pages. Clearly define the LOD by breaking down the two areas of modeling: family information input and design modeling. Give direction as to what details are needed and what areas need to be modeled more than others. The size of the project will drive your bigger BIM execution plans. If the client intends to use the model to track specific information, it is critical to outline that clearly.

Some of your “I” in BIM may come from consultants on the project. If they are not part of the discovery talks, you will need to explain what information is needed and where that information is coming from. The AIA also has developed documents to help outline the LOD of a project (G202 and E203). The more documentation you have that explains where the “I” in BIM is integrated in the model and the intended use of that information, the better the outcome.

## MODELING PHASE

Now that we know what the client’s needs are, how do we make sure we are modeling the right way? Never assume the way you modeled on the last project is the way you will model on the next. When modeling, the first step is to start with the family library you pull from (Family Information).

# Revit Architecture



A good rule of thumb is to have the families in the library built to support a high LOD. Add the parameters you will need for future projects to each family, even if they are not going to be used. This allows for a simple drag and drop by your users, saving time on any size project and any level of LOD. Most of the time the “I” the client wants to use is in this area. As you complete more BIM projects, you will see what parameters are good to pre-load into families. A family library should always be updated. Never let the dust settle on your library. What you learn from the last project should be updated in the library to support the next one.

The other area where modeling affects time is during design modeling. For example, do we use a Basic Wall Generic – 6” for the outside of the building because we are not touching it in the renovation? Or do we create a new wall with a fully defined assembly including “Physical” and “Thermal” properties for each? Can we pull details from the library, or do we detail everything from scratch? Can you use a line, does it need to be a family, or does it come from the model? The material library will also help expedite the “I” process. You will want to keep this library updated the same as you do your family library. The important thing is to get the design intent out. What needs built for the project should remain the priority. The way you model can change with each project, so always look for ways to save time on design modeling.

At this point in the process, we understand the client’s needs, we have developed a clear execution plan, big or small, and we have communicated these needs to our internal team and to our consultants. We now need to input the “I” in the Building Information model. There are a few ways to do this with families where most of the “I” will be held. You can have your design and/or production team input the information or export schedules so the support members can enter the information and then import it back into the model. Being able to export the schedules and import them back into your model is a great way to allow your model to develop. Things change, as we know, so

it is helpful to designate someone who does not normally work in the model to keep the information updated. This may include training support staff to access and update schedules in the model. Doing so will allow the design and production team the opportunity to focus on the design and the printed set or even move on to another project. Document where the “I” is in the model as part of your BIM Execution plan so later down the road, that information can be accessed.

One thing to keep in mind, and an option not often used, is continued client relationships—using the model to keep relationships open between you and the client. Find ways to support the client during the construction phase by helping them with relocating staff. We can show phasing in a model, so use that not only to show what

walls are coming down and are getting built, but what staff is moving to where. Not all clients will have a full-blown facilities management software, so once the project is complete, show them what information can be pulled from the model’s database and how you can help them get that information out. This is a service in which few firms are participating because it is not included in the design and/or construction documents. The connection between client and firm will be stronger with this constant information sharing. If you have a running updated model of the client’s building, it makes for an easy sell when it comes time for the next project with them.

The big takeaway for the “I” in BIM is to establish a clear understanding of the wants and needs for the data. The “**Discovery talks**” phase is the best place to start this conversation. Help guide clients to define this data and show them how they can use it. “**Document it**” by building a game plan around how to collect this data and how you will share this information with anyone who will work with the model. Have an efficient “**Modeling phase**” so to not over- or under-model. In the end, you will have a successful B”I”M project.



*Rick Burchett has more than 16 years of experience with CAD software and architecture. Rick has been a BIM Manager for more than 10 years and started working with Revit when it was first acquired by Autodesk in 2002. As a member of Autodesk Advisors Community and Feedback Community, Rick strives to stay in the forefront of technology. He is currently with DesignGroup Architecture & Planning and is active in his Flipboard, “BIM Integration” [www.designgroup.us.com](http://www.designgroup.us.com)*



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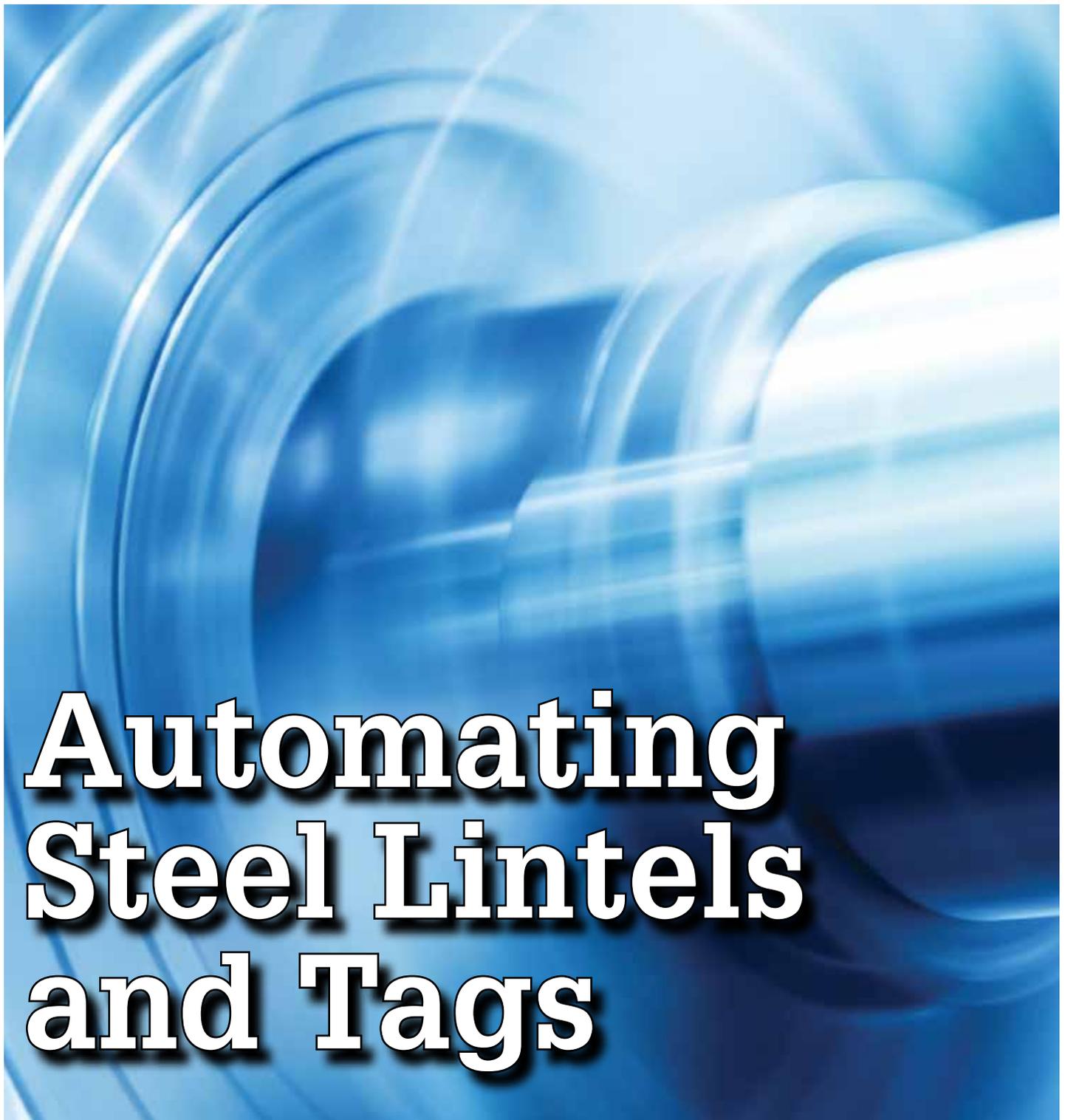
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# Automating Steel Lintels and Tags

 During my time at Autodesk University this year an attendee approached me, thanking me for a class I taught at a BIM workshop in 2014. That was a great feeling that a small topic on formulas triggered him to explore the possibilities and ultimately launch him into a great career. I am going to do my best to turn that class into an article in hopes that it triggers some greatness amongst the readers. A special thanks goes out to Marcello Sgambelluri for helping me through some sticking points when I first developed this workshop.

## SETTING THE GOAL

The goal of this development project was to take a standard steel lintel legend that our structural group uses on projects and end up automating the steel lintel and the tag.

LINTEL SCHEDULE				
TYPE	MAX. M.O.	TH.	SECTION	LINTEL SIZE
L1	5'-0"	8"		(2)-L3 1/2 x 3 1/2 x 5/16
L1	5'-0"	10"		(2)-L4 x 4 x 5/16
L1	5'-0"	12"		(2)-L5 x 5 x 5/16
L2	7'-0"	16"		(3)L5 x 3 1/2 x 5/16
L2	7'-0"	18"		(3)L4 x 4 x 5/16
L2	7'-0"	20"		(3)L5 x 5 x 5/16
L3	12'-0"	8"		W8x21 w/5/16" B/PL
L3	12'-0"	10"		W8x24 w/5/16" B/PL
L3	12'-0"	12"		W8x31 w/5/16" B/PL

Figure 1: Steel lintel legend

### THE FAMILY

My first task was to create the steel lintel family. When I looked over the legend I determined that I would create every instance of the steel section types shown in the legend into one family. From there I would just control the visibility based on a formula. Easier said than done, right? Yes! This did prove to be very tedious, but worth the effort.

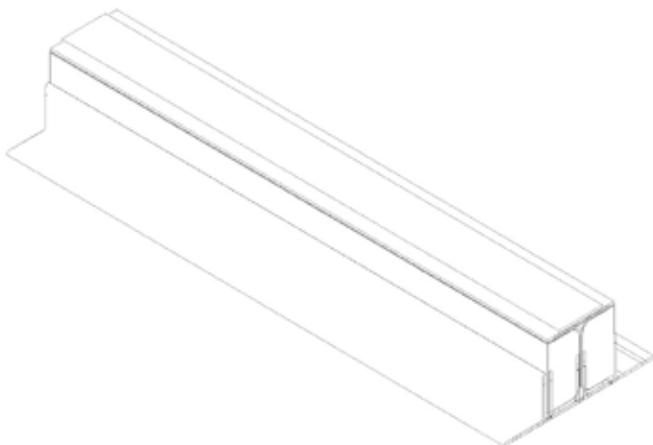


Figure 2: 3D view of the family

Of course, more than just the visibility of each steel section had to be taken into consideration. I still needed to control all of the typical parameters such as height, length, thickness, offset, etc.

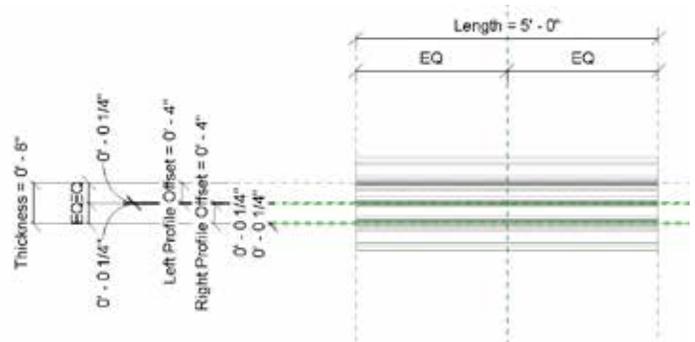


Figure 3: Plan view of the family

### CREATING THE PARAMETERS

Based on the legend, the steel lintel to be used was based on the maximum masonry opening and the thickness of the wall. Based on the combination of those two values I would be able to determine the steel lintel section to use.

Item A, shown in Figure 4, is the value to be used in a tag to tag the steel lintel once it was placed in the model. We will take a look at the formula used to generate that label later in the article.

Item B is converting the format of the basic parameters controlling the height, length, and thickness of the lintel into an integer. This is necessary for the formulas to interpret the value correctly.



## THE FORMULA FOR THE TAG

```
if(and(ConvertLength < 6.334, ConvertThickness = 8), "L1",
if(and(ConvertLength < 6.334, ConvertThickness = 10), "L1",
if(and(ConvertLength < 6.334, ConvertThickness = 12), "L1",
if(and(ConvertLength < 8.334, ConvertLength > 6.334,
ConvertThickness = 16), "L2", if(and(ConvertLength < 8.334,
ConvertLength > 6.334, ConvertThickness = 18), "L2",
if(and(ConvertLength < 8.334, ConvertLength > 6.334,
ConvertThickness = 20), "L2", if(and(ConvertLength < 13.334,
ConvertLength > 8.334, ConvertThickness = 8), "L3",
if(and(ConvertLength < 13.334, ConvertLength > 8.334,
ConvertThickness = 10), "L3", if(and(ConvertLength < 13.334,
ConvertLength > 8.334, ConvertThickness = 12), "L3", "NEEDS
ENGINEERING"))))))))
```

The same exact formula and logic is used for the parameter controlling the tag, with the exception that the resulting value is a text value instead of an integer. Based on our lintel legend each lintel type has a value of L1, L2, L3, etc. At the end of the formula, if none of the parameters are met the result is "NEEDS ENGINEERING." This is great for the engineers to isolate areas for which they need to run calculations. With this set up we can now use the SL\_LABEL parameter in our tag family.

## TAG FAMILY

This is just a simple annotation tag family that uses the shared parameter SL\_LABEL that is used in the steel lintel family to populate the tag.

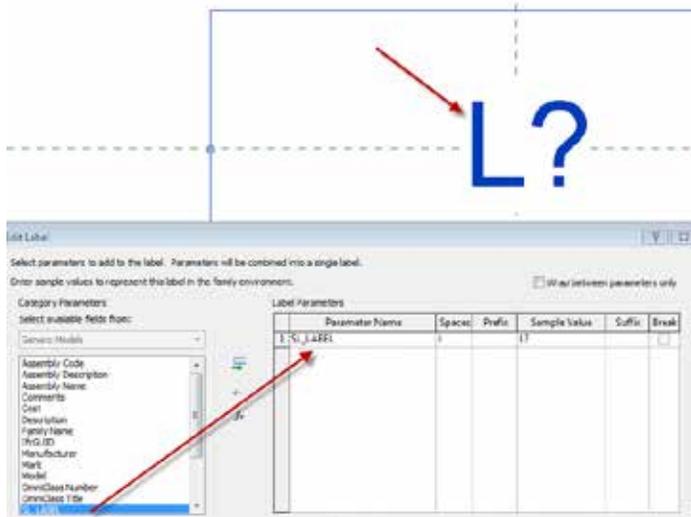


Figure 5: Tag family for steel lintel

## THE RESULT

Figure 6 shows several lintels placed in a floor plan view that have been tagged. Each one is a different length and wall thickness to ensure the formula is working correctly with the family and the tag.

Figure 7 shows one of the Steel Lintels in section to test the visibility and tag formulas in a section view.

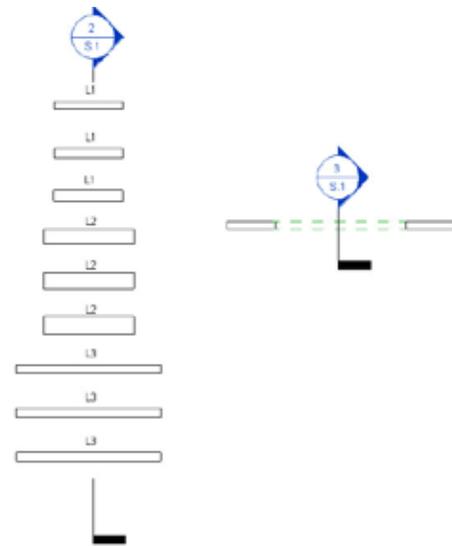


Figure 6: Plan view for all steel lintel sizes

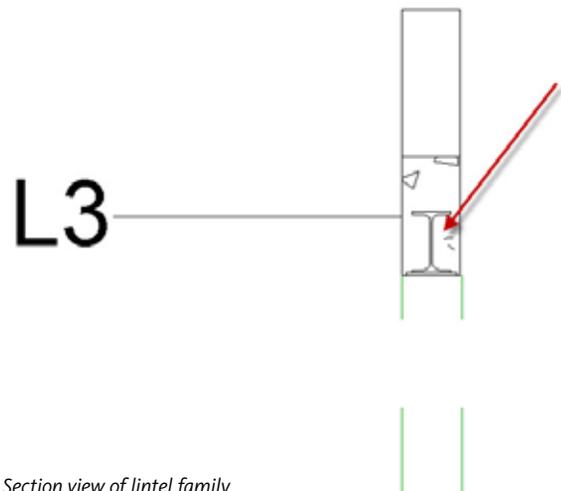


Figure 7: Section view of lintel family

## SUMMARY

I hope you found this article useful and that it triggers some creativity in yourself to produce more intelligent families in the future.



Philip Russo began with AutoCAD version 2.5 in 1986. Through the years he has held positions in the CAD industry such as CAD draftsmen, CAD Manager, Sr. Applications Engineer, and is a Certified Autodesk Instructor. Philip currently has a seat on the AUGI Board of Directors and holds the position of Corporate BIM Applications Manager at O'Brien & Gere Limited, an engineering firm located in Syracuse, New York. His latest certifications include 3Ds Max 2013, AutoCAD 2013, Revit Architecture 2017, Autodesk Building Performance analysis and LEED Green Associate. Philip can be reached at phil.russo@obg.com

# Advanced Lighting: Light Balance with 3ds Max



Figure 1: Lighted scene

## THE LIGHT AT THE END OF THE TUNNEL

**I**n the December 2015 issue, I discussed the basics of the 3ds Max® lighting system, light setup, and analysis using the 3ds Max Light Meter. This month I'd like to dive into a more advanced topic with light called light balance and how it's applied to our scenes. At the end of this article you should view your renderings differently and produce a more professional and realistic final product.

## GETTING STARTED

For the sake of visualization with 3ds Max, I'd describe light balance as our efforts to negate the negative effects lights and shadows have on our scene based on lighting placement and values, making our scenes appear unrealistic and lower quality.

First, let's talk about the physics of lighting as it relates to the visualization industry. They don't matter. Well, they matter very little. Now, for those who came out of the womb pocket protector and calculator first, give me a minute before your head explodes to pres-

ent my case. The ability to create a good rendering is not particularly based on a formula, but more on our ability to bend values in 3ds Max to present our scene as professionally or artistically as we want. The same applies to lighting. Instead of applying an exact formula, we need to use common sense and apply a litmus-test approach to viewing our scenes to decide whether our scene “just can’t be right” or “looks about right” and present it as professionally as possible.

Let’s start by looking at Figure 2. Can you point out what makes the scene appear unbalanced? If you turn your attention to the sidewalk you’ll see that it’s very bright, while at the same time if you focus underneath the eave on the porch you’ll find the shadows are very dark. While our thoughts may not have been driven to these locations without them being pointed out, viewers apply their own senses to determine the scene “just can’t be right” and decide that it’s a computer-generated image within nanoseconds. As visualization experts, our job is to trick the viewers by bending the values in 3ds Max to balance the scene and make it appear realistic.



Figure 2

## WHAT IS REAL?

In the case of Figure 2 we need to understand how natural lights and shadows work and how it should be applied. There are three factors to consider. One is that exterior natural light washes out our environment in a uniform manner, creating smoother shadows with a softer contrast. This is caused by natural effects as well as light deflecting off the various surfaces and materials all around us. The second factor is that the human eye is able to compute light and shadows extraordinarily in real life.

An example would be watching an iPod in a dark room. The iPod illuminates the room very little, but after our eyes adjust we are able to capture extraordinary detail in almost every corner of the room. The third factor is that digital reproductions by computer, camera, or phone often distort colors of a scene in its attempt to replicate it. In photography this is corrected with attachments and camera settings or corrected in post process. 3ds Max does not do



Figure 3

any of these naturally so we need to work with the lights and values inside the software to ensure our scenes look appropriate.

One additional item worth noting that can contribute to a scene appearing unrealistic is the temperature related to the lighting. Essentially the tint of light can vary from cool to warm in a unit of measurement called “Kelvin.” The effect a tint of light has on a scene or object can increase or decrease its realism. For example, if we want to create a candle that appeared realistic we would use an orange tint, not blue. In Figure 3 you can review a guide to understand how the tint of light affects a scene, its mood, and appropriate places they might be used.

## WORKING INSIDE 3DS MAX

The best way to get started practicing light balance is working with a single object. See Figure 4.

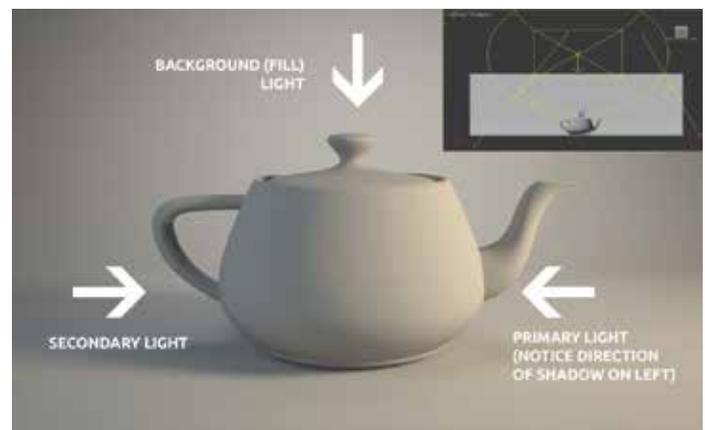


Figure 4

In comparison to Figure 2 presented in this article, notice the softer shadows and contrast between light and dark, creating more balance and contributing to more realism. For this scene, balance was achieved using three light sources. First there is the primary light. This light is perhaps the strongest light meant to control the shadows direction and is generally warm. Next is the secondary light meant to reduce the darkness of shadows and is generally more cool. Finally, the background light, or fill light, meant to cover areas that remain in shadow (primarily behind the object). One particular item to note is by utiliz-

# 3ds Max 2017

ing the primary light with a warmer tint and a secondary light with a cooler tint we are essentially creating a chromatic effect that helps to better balance the scene. One additional tip: it is simpler to review the light balance in a scene prior to applying materials. A good material to start from is a light to medium gray standard material, or the default Vray material. Alternately, Vray users can rely on the global switch to override the material settings during render for review.

## ADDITIONAL ELEMENTS

With the ability to render out the specular, shadows, reflection, refraction, and illumination elements of our scenes as images, we can manipulate them with software such as Photoshop to increase the quality of our final production. This allows us to further manipulate our scene to balance the light and shadows to appear more realistic. To demonstrate this, I used the “Studio Scene Share” example file provided with 3ds Max and rendered out the elements presented in Figure 5.



Figure 5

Using Photoshop, we can overlay the various elements and adjust them to manipulate the various results. See Figure 6 examples.

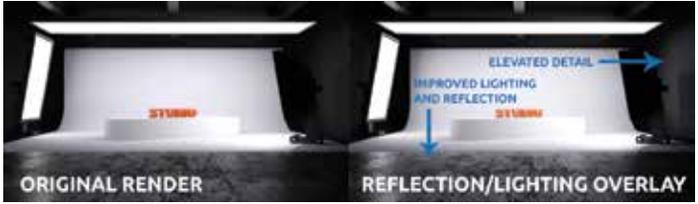


Figure 6

To accomplish this, navigate to the Render Setup dialog box, select Render Elements, then choose “Add” and select the elements you wish to render out separately as shown in Figure 7. Be sure to add the output path for each element when selecting them.

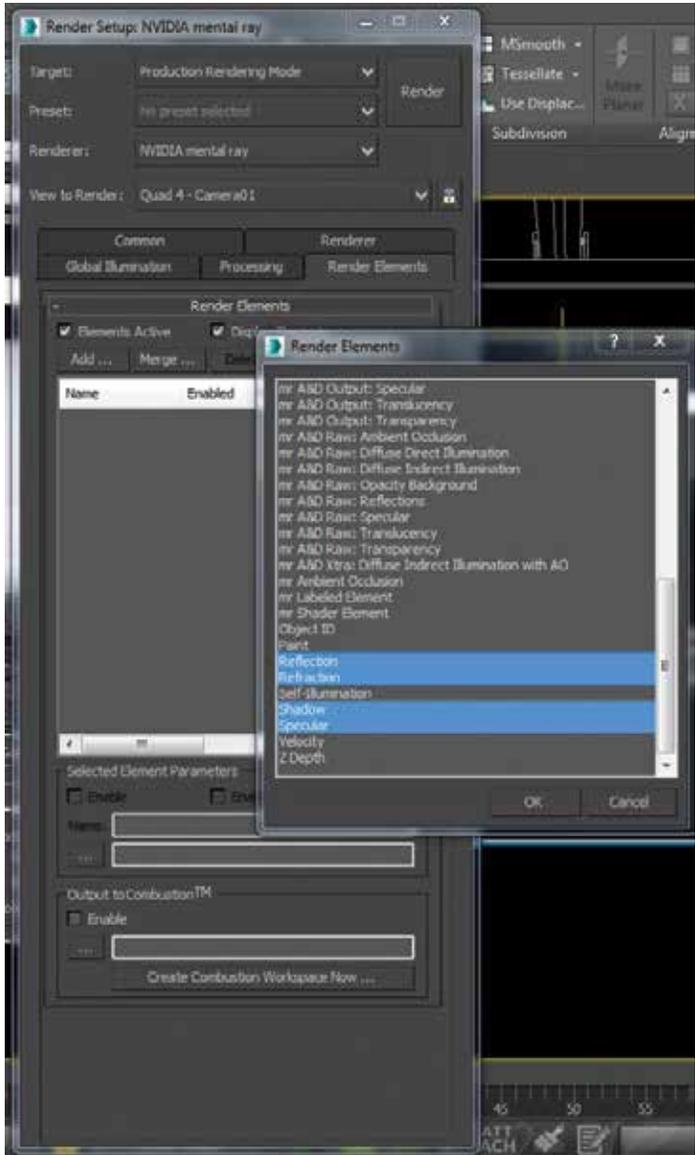


Figure 7

## CONCLUSION

Light balance can be key to presenting a realistic and professional scene. By focusing our attention on the details in our scene related to lights and shadows themselves, we can work to remove anomalies that cause our viewers to question whether or not our scene is real and if it was intended to be that way.



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by Robert Green

# Squeeze more performance from your HP Z Workstations.

When workstations are brand new they come loaded with the latest operating system service packs, modern BIOS support for hard drives, and certified graphics drivers for the latest CAD software. All this leads to great performance and that “new car smell” experience that users love. But as time goes by, operating system service packs emerge, CAD software changes and drivers for graphics processors must be updated if optimum performance is to be maintained. Of course, these responsibilities often fall to your IT department which may or may not have the time needed to find all the right drivers and tweaks to optimize your workstations.

HP’s Performance Advisor is a software utility provided with every HP Workstation that does the dirty work of keeping your workstation updated so you (or your IT staff) don’t have to. As Paul Mazurkiewicz, PhD, Senior Scientist at HP Commercial Solutions Materials Science Lab puts it, “Performance Advisor is about as close as you can get to having an engineer in the box.”



Figure 1 – Performance Advisor’s three main functions shown in the startup screen.

## THE COMPLETE PICTURE

In short, HP Performance Advisor gleans all manner of information from your workstation’s hardware and software to determine if everything is running optimally. Far more than just giving you stats, it creates valuable reports that can be shared with IT to help evaluate decision making processes like RAM

or disk hardware upgrades as well as ways to configure the workstation’s settings to squeeze every bit of performance from the Intel processors for optimal software performance.

Performance Advisor has three basic functions:

**Your computer.** Controls hardware configuration issues like system drivers for the various components in your workstation based on your workstation’s operating system.

**Your software.** Helps keep software up to date by managing service pack updates and certified driver notifications that make sense for your installed CAD applications.

**Your performance.** Close cooperation with Intel has provided a warehouse of information on memory and processor resource usage so you can see if you have enough RAM and disk bandwidth to fully optimize processor performance for your installed applications.

Let’s explore how Performance Advisor works by stepping through its three major areas of functionality.

## HARDWARE MANAGEMENT



Figure 2 – The Block Diagram view gives an easy to understand view of system resources.

To see Performance Advisor’s functionality, simply click the Your Computer menu option, which opens the graphical Block Diagram screen, as shown below.

The block diagram displays an overview of your workstation’s hardware devices including Intel processors, RAM, motherboard, graphics card and available PCI slots,

thus making it easier to understand what is inside the workstation without having to open it. Simply click on the block diagram component and you’ll see a summary of all system resources relating to that component – including Windows operating system information – in the middle Configuration Details tab.

The final tab of the interface – the Configuration Report – collects the configuration data into a unified report that tells you everything you need to know about hardware usage. An additional bonus is the ability to save the configuration screen to a file that you can send to your IT support personnel so they can see everything going on with your machine without having to stop by or log in remotely, thus saving them time.

## DRIVER MANAGEMENT

How hard is it to keep all the correct system drivers on a normal desktop computer during a three-year life span as operating system service packs and CAD updates are applied? Your IT department will tell you it isn't easy but Performance Advisor keeps track of what graphics cards and CAD applications are installed so it can find and install vendor-certified device drivers for you.



Figure 3 – Automatic driver selection and downloading.

## APPLICATION MANAGEMENT

Of course, making your workstation efficient isn't just about hardware and driver management. Most CAD users must run a small selection of CAD applications every day and this software performance is the ultimate measure of productivity. HP Performance Advisor helps to realize a workstation's full potential by allowing you to manage all your programs using the Your Software tab.



Figure 4 – Application specific configuration recommendations are provided for each installed software product.

## PERFORMANCE TUNING

The final element of the Performance Advisor interface is the Your Performance tab, which provides two useful functions for analyzing your workstation's performance.

The first useful tool (shown right) is the Memory Graph function, which allows you to see RAM and disk allocations for all processes running on your

workstation. The Memory Graph allows you to understand which applications require the most memory so you can determine which applications to run concurrently -- or which to unload -- to squeeze maximum performance from your workstation.

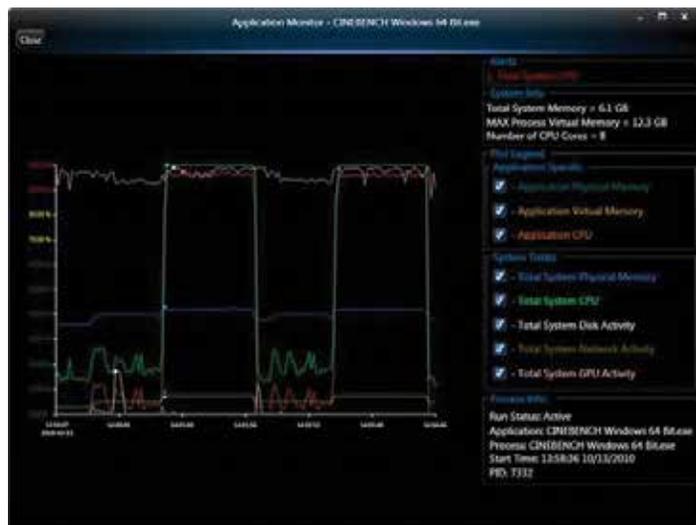


Figure 5 – The Memory Graph shows the utilization of RAM over time to help size memory optimally.

The second useful tool is the Application Monitor that shows RAM and disk virtual memory use for the entire machine in a resource-monitor-like timeline. In fact, Application Monitor stores data so you can share your workstation-performance parameters with your IT department. And since you can configure these tools to store time lapse performance data over a user defined period, you'll be able to collect real world information on how your CAD applications are performing to support requests for RAM or SSD upgrades.

## IT'S ALL ABOUT VALUE

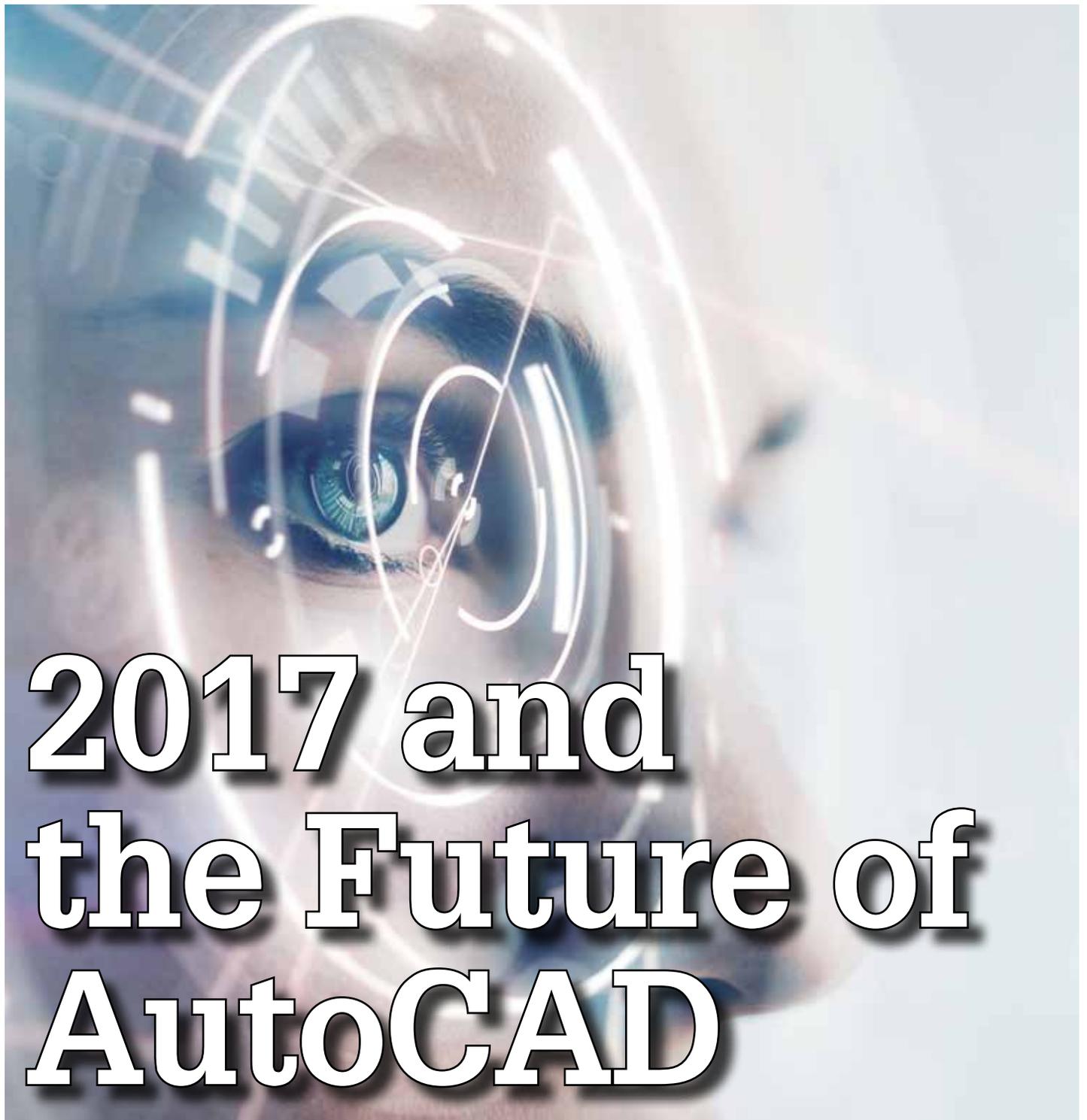
The key value of HP's Performance Advisor is its ability to deliver an optimally configured workstation with maximum Intel processor performance over the entire life of the workstation. And when you think about the time you spend keeping up with a workstation over a three-year period, that's when you begin to understand the actual savings delivered. In fact, if you total up the savings over a three-year workstation lifespan the impact of less IT support and faster performance can more than offset the cost of purchasing a workstation instead of a lesser consumer grade PC.

Just think of how much time and money your company could save by letting HP's collaboration with Intel deliver maximum computing power with minimum support requirements with Performance Advisor.

*\*Performance Adviser requires internet access.*



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# 2017 and the Future of AutoCAD

**L**ike me, a lot of you may have recently returned from the 2016 Autodesk University event. Between walking to and from classes, touring the exhibit hall, and making the long trek back and forth to the hotel room, I managed to rack up a lot of steps on my Fitbit (17,500+ in one day alone!).

As these events typically go, attendees get a glimpse into the future for both hardware and software. This year it seemed that “Reality” was a big theme.

Virtual Reality (VR) and Augmented Reality (AR) were popular themes among the vendor booths, Autodesk’s included. Of the 186 vendors represented, at least 12 had some form of Reality going on.

Back in our own Realities at home, depending on your exposure it seems as if AutoCAD® software’s imminent death is right around the corner. All the Revit and Fusion folks are confident that AutoCAD is a thing of the past and its users are just dinosaurs who have not seen the light.

AT AU, AutoCAD had a booth which, while not as big as the Autodesk Architecture, Engineering, and Construction zone, still had a decent footprint. Seeing all the amazing technology out there and knowing that is likely to become a real part of our daily lives, I am sure many are wondering just how long before AutoCAD goes away.

AutoCAD has been around a long time—since 1982, in fact. At 24 years old, AutoCAD is older than many of today's Revit users. AutoCAD also comes in a variety of offerings (see Figure 1).

AutoCAD	AutoCAD Map 3D
AutoCAD 360	AutoCAD Mechanical
AutoCAD Architecture	AutoCAD MEP
AutoCAD Civil 3D	AutoCAD OEM
AutoCAD Design Suite (renewal only)	AutoCAD PGID
AutoCAD Electrical	AutoCAD Plant 3D
AutoCAD for Mac	AutoCAD Raster Design
AutoCAD Inventor LT Suite	AutoCAD Revit LT Suite
AutoCAD LT	AutoCAD Utility Design
AutoCAD LT for Mac	AutoCAD WS (now AutoCAD 360)

Figure 1

That is a lot of products with an equally large number of customers.

In a normal week, I will deal with anywhere from three or four consultants or clients to a dozen or more—and all use AutoCAD. About 95 percent of all interactions with outside design software users are AutoCAD based.

Although I work with a small firm, and many members of the various teams I am on are also part of similar sized firms, collectively there are hundreds of AutoCAD users interacting in just my business circle. The firms I interface with cover a cross-section of the AEC industry, and include:

- Architects and architectural designers
- Interior designers
- Custom millwork designers
- Mechanical engineers and designers
- Electrical engineers and designers
- Civil engineers and designers
- Fire sprinkler engineers and designers
- Fire alarm system designers
- Low voltage distribution designers
- Sign designers
- Warehouse and distribution logistics designers
- Real estate developers
- And more...

So many different and unique design needs—and AutoCAD covers them all. AutoCAD may not provide the same level of detail as a fully coordinated BIM model or a Fusion 360™ mechanical model, but it offers the flexibility and power to create design documents for a multitude of project and product types.

Don't get me wrong—these and many other products that currently exist and are in development can do some pretty amazing things. With all the power and flexibility that AutoCAD offers, these other products offer speed, coordination, and viewing capabilities that AutoCAD cannot compete with.

So what am I getting at? As a longtime user of AutoCAD, I am very comfortable with it, which allows me to do my job with little to no learning curve. I can also experiment with tools and features I have not yet used. With many of the quick turnaround projects that designers deal with, that comfort level allows for profitable production. I believe this is a big reason why so many companies and individuals continue to use it and why it will continue to be the go-to product for many users for years to come.

Being comfortable with a tool does not mean you have mastered it, though. So unless your career is wrapping up, keep pushing the limits of AutoCAD and learn as much as you can to make yourself more knowledgeable, efficient, and valuable.

AutoCAD is going to be around for years to come and, like it, the other technical tools we use regularly are getting faster, smarter, and cheaper. Don't let the tools be your crutch—keep learning, keep experimenting, keep up!

P.S. If you are a long-term user of AutoCAD or even a short-term user that really loves it and wants to share with others how to maximize its use, consider writing an article about it for *AUGIWorld*. If you're interested in writing about AutoCAD, drop me an email at [Waltspar@gmail.com](mailto:Waltspar@gmail.com) and let's get you published!



Walt Sparling has worked in the building design industry for 25+ years, starting as a hand drafter. He moved on to CADD in the mid 1980s and then into CADD and networking training and consulting. Walt has served as project manager and designer in the mechanical and architectural realms and currently works with an electrical engineering firm in Tampa, Florida. In his spare time, Walt maintains a couple of blogs and a personal website: [FunctionSense.com](http://FunctionSense.com) and [waltsparling.com](http://waltsparling.com)



# Point Clouds in ACA

**A** point cloud is basically a large collection of points that are placed on a three-dimensional coordinate system. Point cloud files greatly speed the design process by providing real-world context where you can recreate the referenced objects or insert additional models. Point clouds are derived from raw data gathered by using a 3D scanner to obtain points from such things as buildings, topographies, or manufactured items. Before you can use the data in your drawing, however, it needs to be converted to a point cloud file. This process is sometimes referred to as indexing. You can use AutoCAD® Architecture to convert raw scan files to an ISD or PCG format. You can use the Autodesk® ReCap™ product to convert raw scan data to an RCS format. Autodesk ReCap can also save files in an RCP format that serves as a project file that references multiple RCS files. Both formats can be attached to an AutoCAD Architecture drawing.

## CREATING POINT CLOUDS FROM SCAN FILES

A scanned data file can be converted to a point cloud file that can then be attached to your drawing. To do this, begin by clicking the Insert tab of the ribbon, Point Cloud panel, and then select Create Point Cloud. In the Select Scan File dialog box, find and select one or more files that you want to use to create point clouds. You can choose the following formats: LAS, XYB, FLS, FWS, XYZ, TXT, ASC, PTG, PTS, PTX, CLR, and CL3. In the Create Point Cloud File dialog box, enter the settings for the imported point cloud, including whether to merge the files, where to store the point cloud files, and what point cloud file format to use (see Figure 1).

If you import more than one file, you can merge them by selecting Merge All Scan Files Into a Single Point Cloud. When selecting what point cloud format to use, you can select the Autodesk format (PCG) or Ambercore (ISD). With PCG files, you can import such properties as color, intensity, normals, and custom attributes. Now click the Create button to start the process, which can take minutes or hours, depending on the file size. The dialog box is minimized, so you can continue to work while the scan is in progress. When the process is complete, the Status column in the table changes to “Click to Attach.”

To attach the new point cloud file to the current drawing, you can either click the “Click to Attach” message or click the link in the balloon message on the task bar. While point cloud creation is in process, hover the pointing device over the point cloud icon in the drawing status bar in order to view the status of the background point cloud creation. To cancel a point cloud creation process, while the raw point cloud scan files are being indexed, you can either right-click the point cloud icon in the drawing status bar and select Cancel Point Cloud Creation, or you can click cancel in the Create Point Cloud File dialog box.

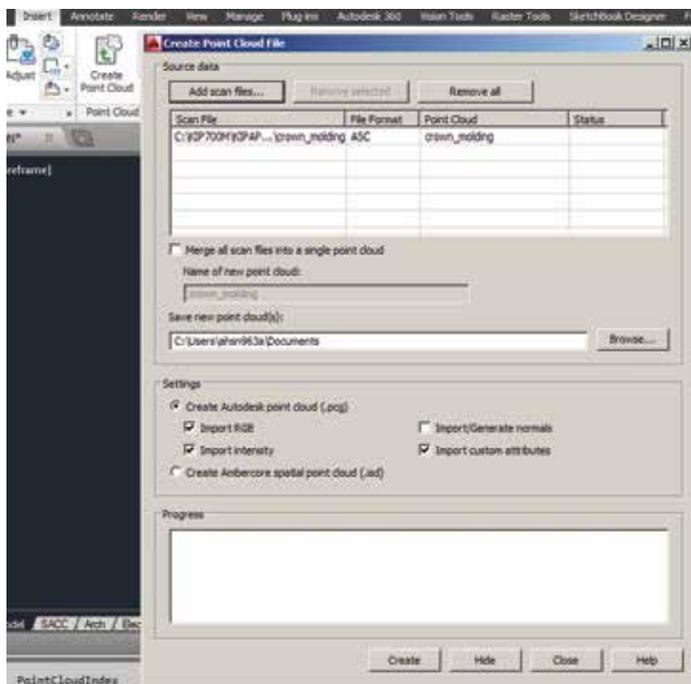


Figure 1: Create point cloud

## ATTACHING POINT CLOUDS

Attaching an RCS or RCP file to a drawing is much like attaching any other external reference (xref). If the unit of measurement in the attached point cloud differs from the units in the target drawing, the point cloud is automatically scaled based on the unit type in the target drawing. It is important to note that point clouds are not supported on 32-bit systems. To work with point clouds, you need a 64-bit system and hardware acceleration must be turned on. To attach a point cloud file as an external reference, begin by

clicking the Insert tab of the ribbon, Point Cloud panel, and then select Attach. In the Select Point Cloud File dialog box, find and select a ISD, PCG, RCS, or RCP file to attach to the drawing and click Open. In the Attach Point Cloud dialog box, specify your preferences for insertion point, scale, and rotation (see Figure 2). If you would like to prevent the attached point cloud from being moved or rotated, select Lock Point Cloud.

You can control the individual scan file settings in the attached RCP file. You should turn on this setting if you do not want your drawing to be affected by changes to the on/off status of individual scan files that are referenced in the reality capture project (RCP) file. To do this, at the Command prompt, enter POINTCLOUD-VISRETAIN. Then enter either 0 or 1. For zero (0), the drawing inherits the most recent on or off status of individual scan files referenced by the attached RCP file. For one (1), the drawing retains the on or off status of individual scan files at the time the RCP file was attached.

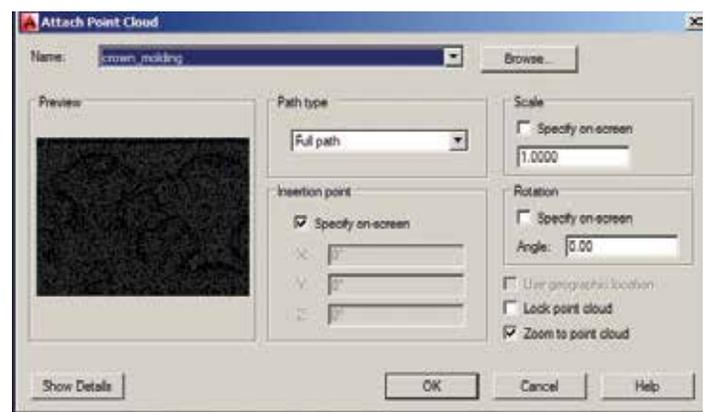


Figure 2: Attach point cloud

## WORKING WITH POINT CLOUDS

Once a point cloud is attached to a drawing, you can modify it, use it as a guideline for drawing, change its display, or apply a color mapping to distinguish different features. You can modify an unlocked point cloud in several ways.

1. Filter un-needed points by clipping – You can create one or more clipping boxes to show only the most relevant areas of the point cloud. Drag the clipping boundaries to change the display and turn off or invert the clipping filters as you work.
2. Modify point cloud density – You can manage program performance and visual noise by increasing or decreasing the number of visible points.
3. Standard editing operations – You can cut, copy, paste, move, scale, rotate, stretch, and erase a point cloud.
4. Edit properties – You can change general properties such as color and layer in the Properties window. You can also modify the insertion point, rotation, and scale as well as turn locking and clipping on or off and control whether the color is derived from the source or the current color settings.

# AutoCAD Architecture 2017

5. Use components as a reference when drawing – You can turn on the Node object snap and snap to individual points as you draw. You can also snap to the insertion point.
6. Use color stylization – You can use color stylization to help you analyze features within the point cloud. You can retain the original scan colors or specify color stylizations that are based on objects, point orientations, or intensity.

For point cloud files that inherit intensity values, intensity stylization helps distinguish between features such as foliage and buildings. Use different color schemes such as Spectrum for more complex images or Grayscale for simpler visualization. You can use color mapping on both locked and unlocked point clouds. You can print a point cloud and retain the color stylizations in all visual styles except for 2D Wireframe and Wireframe. It is important to note that the MIRROR3D command copies and moves a point cloud but does not mirror it. You cannot explode a point cloud.

## CHANGING POINT CLOUD DENSITY

You can control the number of displayed points to help you manage program performance and decrease visual noise. You can change the maximum number of points in the drawing, which is controlled by the POINTCLOUDPOINTMAX system variable (only for 64-bit operating systems). Increasing the limit improves visual fidelity for the point clouds, whereas lowering the limit improves system performance. This option is disabled on 32-bit systems, which are limited to 1.5 million points. Begin by clicking the Application menu and select Options. In the Options dialog box, 3D Modeling tab, drag the Maximum Point Cloud Points Per Drawing slider to change the number of points that can be displayed in the drawing.

You can change the density of all displayed point clouds. To do this, begin by clicking the Insert tab of the ribbon, Point Cloud panel, and select Density slider (see Figure 3). You can now either drag the Density slider to increase or decrease the percentage of cloud points that are displayed in the drawing or you can enter a value that represents a percentage of the maximum number of points set by POINTCLOUDPOINTMAX.

You can change the density of displayed point clouds during Pan, Zoom, or 3D Orbit. Lowering the realtime density degrades the point cloud display during panning, zooming and orbiting, but makes those operations quicker. To do this, begin by clicking the Insert tab of the ribbon, Point Cloud panel, and then select Realtime Density slider (see Figure 3). You can now either drag the slider to increase or decrease the percentage of cloud points that are displayed during realtime pan, zoom, and 3D orbit, or you can enter a value that represents a percentage of the maximum number of points that can be displayed in the drawing during pan, zoom, or 3D orbit. This value represents a percentage of the maximum number of points set by POINTCLOUDPOINTMAX.



Figure 3: Adjust point cloud density

## POINT CLOUD CLIPPING

If needed, you can clip or hide a portion of a selected point cloud. If you wish to create a 2D rectangular or polygonal point cloud clipping boundary, then in the drawing area, select the point cloud. Now on the Point Cloud tab, Clipping panel, select Create Clip Box flyout. Now you can either Select Rectangular or Select Polygonal on the flyout (see Figure 4). If you Select Rectangular, on the XY plane of the drawing area specify diagonal corners of the rectangular clipping boundary and press Enter. If you Select Polygonal, on the XY plane of the drawing area specify three or more segments for a closed polygonal boundary and press Enter. The point cloud points that fall outside the defined clipping boundaries are hidden.

Both rectangular and polygonal clipping boundaries can be reshaped. In the drawing area, select a point cloud. Select a grip on the clipping box and when it turns red, drag it to change the clipping box shape. The point cloud display is updated after the drag operation is complete.

If you wish to convert a polyline to a 2D clipping boundary, then in the drawing area select the point cloud. Next, on the point cloud tab, clipping panel, Create Clip box flyout, select Polyline (see Figure 4). In the drawing area, select a polyline to define the clipping boundary. The polyline can be open, but must have straight segments. The point cloud points that fall outside the defined boundaries are hidden.

Sometimes, however, you may find it useful to have a polyline that coincides with a 2D point cloud clipping boundary. To create the polyline, enter POINTCLOUDCLIP at the command prompt. Then Enter p (generate Polyline). Now, in the drawing area select a point cloud. The new polyline will inherit the current layer, line-type, and color settings.

A 3D point cloud clip box can be reshaped based on the bounding box. To do this, select a point cloud and then click the Point Cloud tab on the ribbon, Clipping panel, and then select Clip Box. A clipping box that is the same size and shape of the point cloud bounding box is displayed. If the point cloud already has a clipping box that has been modified, you can choose whether to restore the default clipping box or retain the modifications. To adjust the clipping box, drag the grips using either Standard grip (square) or Height grip (triangle). Standard grip resizes the length and width of the clipping box along the XY plane of the point cloud object. Height grip resizes the height of the clipping box along the Z axis of the point cloud object.

The point cloud clipped view can be turned on and off within a drawing. When the ribbon button is highlighted, select a point

cloud clipping boundary or clipping box. Click the Point Cloud tab on the ribbon, Clipping panel, and then select Show/Hide. This turns the view on or off. Sometimes instead of turning it on or off, you may need to remove it completely. Select a point cloud and click the Point Cloud tab on the ribbon, Clipping panel, and then select Delete Boundary. Select the clipping boundary or clipping box that you want to remove and press Enter.

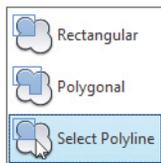


Figure 4: Point cloud clipping boundary

## COLOR MAPS THAT DISPLAY POINT CLOUD INTENSITY

Some types of scan files contain color intensity data that can be retained in the point cloud. These file types include LAS, PTG, PTS, PTX, CLR, and CL3. To assign colors to map the point cloud intensity, in the drawing area, select a point cloud that contains intensity data. Click the Point Cloud tab on the ribbon, Visualization panel, then select Intensity Color Mapping. In the Point Cloud Intensity Color Mapping dialog box, adjust the following settings:

- Color scheme – Select a color scheme to help illustrate the point cloud intensity mapping. Colors range from Spectrum to Gray-scale and single colors.
- Color ramp – Drag the sliders to define the color range to use in the mapping.
- Intensity minimum and maximum – Enter values between 0.000 and 1.000 to specify the percentage of intensity values to be displayed using the color map stylization. These values represent the high and low values of the entire range of intensity values associated with the selected point cloud. Points with intensity values that are outside the limits you specify are displayed using the original scan colors.

Once that's complete, click Apply to test how the settings affect the selected point cloud.

If you are not a fan of the color scheme, you can change it in the Properties palette. If the Properties window is not displayed, select any object and then right-click the object and select Properties. In the drawing area, select the point cloud. In the Properties window, under Point Cloud Visualization, Intensity Color Scheme box, select a different option.

You can also perform this function using the ribbon, which I find a little easier. In the drawing area, select the point cloud. Then click the Point Cloud tab on the ribbon, Analysis, then select Intensity. Now you can select a color scheme under the Spectrum flyout or select Intensity Color Mapping and select the color scheme you want to use (see Figure 5).



Figure 5: Point cloud intensity color mapping

## WORKING WITH POINT CLOUD VISUAL EFFECTS

When working with Point Cloud visual effects, settings are applied to all point clouds attached to the drawing.

To set Point Cloud Lighting, click on the Point Cloud tab on the Visualization panel and select lighting (flyout). Choose one of the following options to convey the source of light reflected by the points:

- No Lighting – Lighting is ignored. Points are colored according to the scan colors or object colors mapped to the points. This is the default setting.
- Single Sided – Colorization is based on the light sources and the normal vector of the points. Points are illuminated when the normal is facing toward a directional light source.
- Double Sided – Colorization is again based on the lighting, but the normal vector of the points is treated the same whether pointing toward or away from the viewing angle.

To set Point Cloud Shading, click on the Point Cloud tab on the Visualization panel and select shading control. Choose one of the following shading options to convey the relative brightness of the points:

- Diffuse Shading – The relative brightness of points is similar regardless of view angle and normal of the points. The surface luminance is isotropic (has uniformity in all orientations). This option gives the appearance of a matte finish. This is the default setting.
- Specular Shading – Uses the normal of points to give each point a brighter appearance as the normal more closely approaches the view direction of the drawing. This option gives a lustrous look with specular highlights.



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# Advance Your Workflows with Civil 3D 2017 v1 Updates



As changes in Autodesk licensing occur, you will find yourself getting periodic updates throughout the year. Why wait until the next release when you can download them immediately from the Autodesk Desktop App (Application Manager)? In previous versions of AutoCAD® Civil 3D®, these were referred to as Productivity Packs. Once you have installed the update, you can then access them from the Toolbox tab of your Toolspace (see Figure 1).

This article will look at some the advancements made possible with the Civil 3D 2017 v1 update. Many of these items are updates to previous productivity packs, so some of these may be in the 2016 release.

## WHAT IS WITHIN CIVIL 3D 2017 V1?

The New Functionality Includes:

- Analyze Gravity Networks
- Add Property Set Data to Labels
- Swap Pressure Network Parts

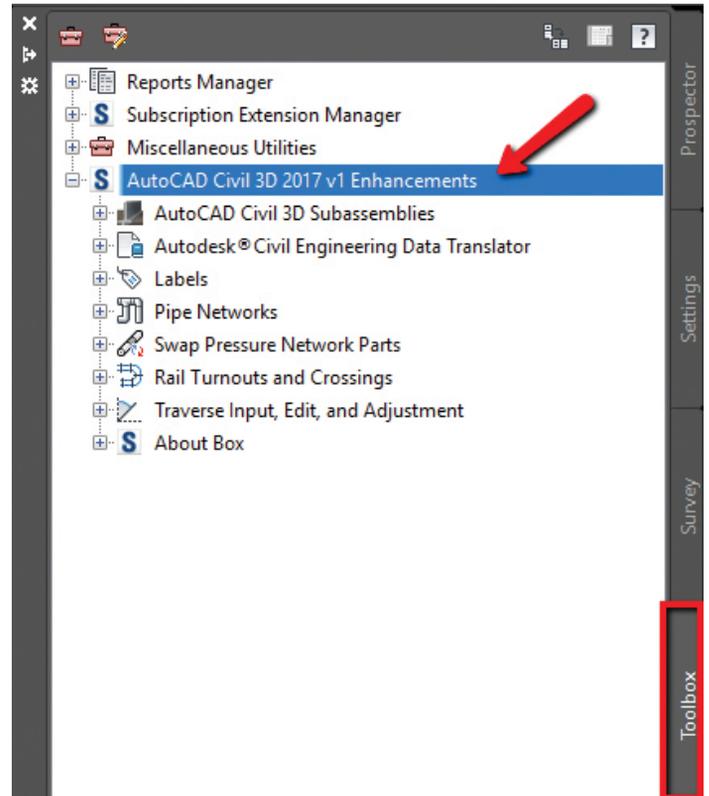


Figure 1

Updated functionality includes:

- Traverse Editor
- Traverse Adjustment
- New subassemblies
- Autodesk Civil Data Translator (for 2017)
- Create 3D solids from Pipe Networks
- Rail Turnouts and Crossings

## SWAP PRESSURE NETWORK PARTS

It's about time, right? Ever since the release of the Pressure Pipe tools, I get the question on whether or not you can swap parts.

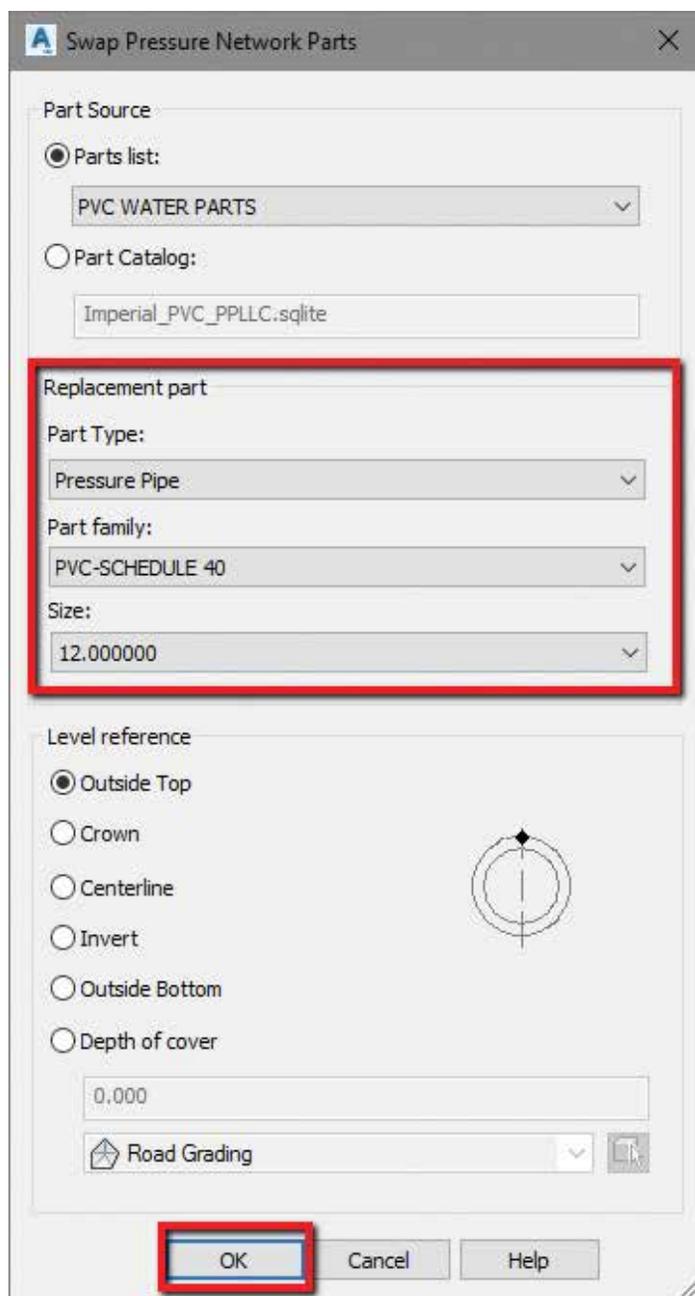


Figure 2

Well, now you can!

1. Once you have laid out your pressure network, simply go to Tool-space, on the Toolbox tab, expand AutoCAD Civil 3D 2017 v1 Enhancements, Swap Pressure Network Parts. Double-click Swap Pressure Network Parts to launch the command.
2. Select the pressure network part or parts to swap.
  - You can select the pressure network parts in either plan view or profile view.
  - The selection set must be limited to parts in only one pressure network.
3. The Swap Pressure Network Parts dialog box will appear; adjust your Replacement Parts and select OK (Figure 2).

## ANALYZE GRAVITY NETWORKS

You have Storm and Sanitary Analysis, Hydraulflow tools as well as Infracworks to conduct your H&H analysis. So why this tool? Because you can do it right inside Civil 3D now! This utility enables you to resize pipes and reset inverts, and to compute the energy and hydraulic grade lines according to HEC-22 standards.

You can use this utility to:

- Iteratively analyze a network using appropriate rainfall data.
- Review results graphically and in a .csv file.
- Modify the results and re-run the analysis.
- Apply the results to the pipe network.

You'll need to create catchments and assign them to the appropriate structures and then run the command. Choose the IDF curve, set the properties of the parts in the network, and then review the results.

There are two analysis types you can select (Figure 3):

- Resize Pipes and Reset Inverts – analyzes the flow through the pipes, and then resizes the pipes and resets inverts to accommodate the flow.
- Compute Energy and Hydraulic Grade Lines – calculates the energy and hydraulic grade lines, and then displays a graphical preview of the results.

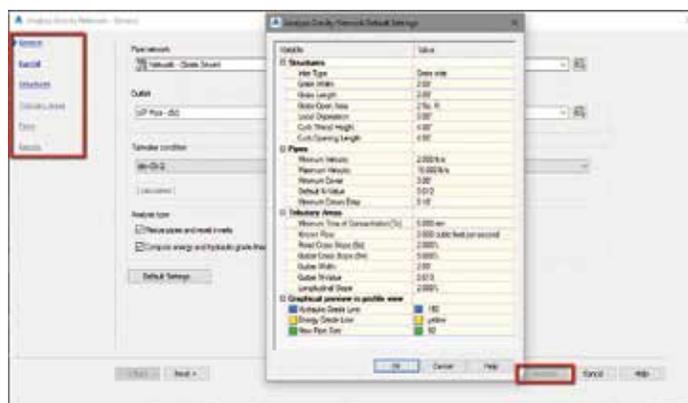


Figure 3

# AutoCAD Civil 3D 2017

As you move through the Analyze Gravity Network dialog box, you can specify the rainfall intensity-duration data to use and to select the Annual Exceedance Probability (AEP) to use for analyzing and sizing the pipe network.

## Rainfall File

Specifies the rainfall intensity-duration file to use for the analysis (Figure 4). The following file formats are supported:

- NOAA file (\*.csv)
- H&H IDF Tabular file (\*.idf)
- X-Degree file (\*.csv)



Figure 4

Once you analyze your system, you are given the following options on how to accept the results.

- Export the Results to CSV and View in Profile – saves the results to a .csv file in a specified location and displays temporary graphics in an existing profile view so you can preview the results.
- Modify the Results – applies the calculated results into the Pipes page of the wizard so you can modify the data and re-run the analysis.
- Apply the Results to the Pipe Network – applies the calculated results to the pipe network.

## ADD PROPERTY SET DATA TO LABELS

You can now add custom data to Civil 3D object labels by using property sets. 2016 was a start—you could add the properties to the object, but you couldn't use that property in a label. So first we will add some custom properties to a pipe and a pipe label.

First thing to do is launch the PropertySetDefine command, or from MANAGE tab on the ribbon, to the far right, select DEFINE PROPERTY SETS (Figure 5).

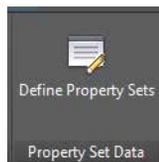


Figure 5

- Right click on Property Set Definition and select NEW. For this example, I will use PipeYear, as I want to label the year installed on my pipes (Figure 6).
- On the “Applies To” tab, select the type of object for which you want to create a custom property. I chose PIPE for this example.

- On the Definition tab, add your new properties. Click the top button on the right side (ADD MANUAL PROPERTY) to create the new property, and then fill in the data. I chose to call mine InstallYear.
- Select OK.



Figure 6

There is one more step in order to see this new property. On the Extended Data tab of your properties, you'll need to select the object (or objects) to which you want these properties assigned and click the button at the bottom left of the properties, “Add Property Sets” (see Figure 7).

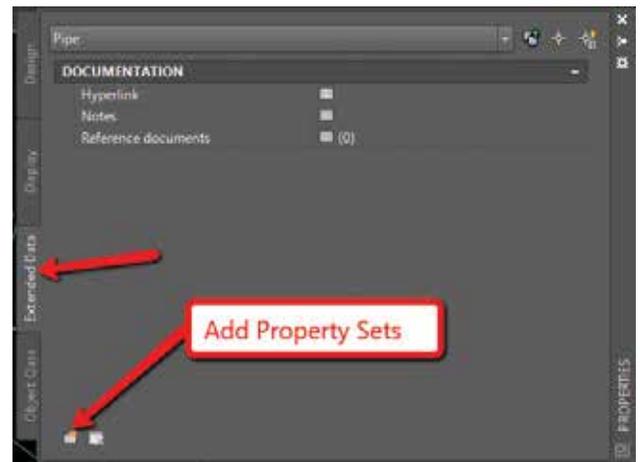


Figure 7

This will bring up another dialog box. Choose the property(ies) you wish to add to the objects and select OK. You will now see them in your properties dialog box.

That is where it ended in 2016. But now, with 2017 v1, we can add that to a label style! Once you go into your label style composer, and select one of the components to edit, you now have a third tab called “Property Sets.” You can select and add to your styles as needed.

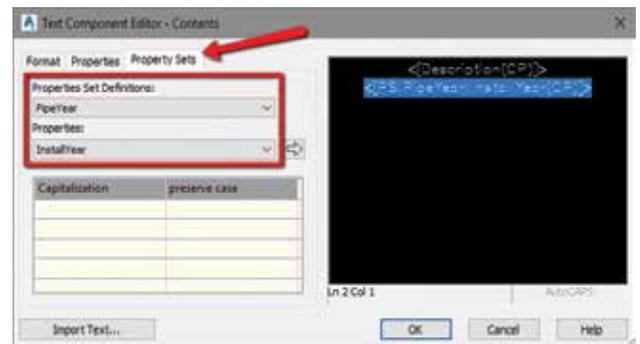


Figure 8

The possibilities are endless with this function. The example in Figure 8 shows you how to add custom properties in order to label. But you can also add custom properties that are derived from the objects themselves. For example, if you want to know the volume of a surface, you have to view it in the Surface Properties, or use the Volumes Dashboard. But you can now view the automatic data for one object at a time. Very cool, in my opinion!

## NEW SUBASSEMBLIES

There is a whole set of new subassemblies included in this release including subassemblies for benches, curbs, ditches, shoulders, tunnels, and single-track and double-track railways. Ever want to edit the subassemblies that ship with Civil 3D? Well, you can't. But these new ones ship with the PKT file that you can edit inside Subassembly Composer if needed. Just a few of the new ones are below:

### ◆ SimpleCutWithLanding

The SimpleCutWithLanding subassembly allows a simple landing/shoulder with a cut option. The subassembly only daylights in a cut situation.

### ◆ ValleyGutterSimple

The ValleyGutterSimple subassembly is a concrete valley gutter with user-defined widths, concrete depths, and flow line depth. The width can be modified and the flowline stays at the center.

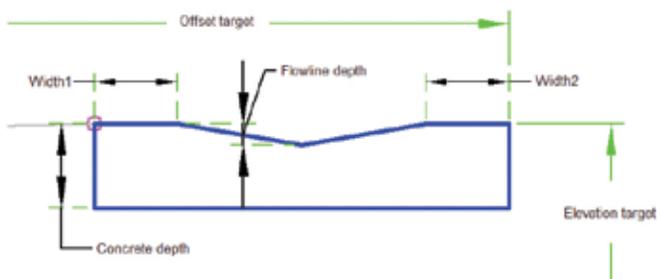


Figure 9

### ◆ ShoulderParabolicDaylight

The ShoulderParabolicDaylight subassembly provides rounding at the Point of Vertical Intersection (PVI) between the shoulder and daylight links as well as fillet rounding between the daylight link and target surface.

### ◆ ShoulderRoundedTarget

The ShoulderRoundedTarget subassembly provides rounding of a shoulder.

## AUTODESK CIVIL 3D DATA TRANSLATOR

You can use the Autodesk Civil Engineering Data Translator to translate AutoCAD Civil 3D files to files that can be used in Bentley

GEOPAK and Bentley InRoads, and to translate GEOPAK and InRoads files to files that can be used in AutoCAD Civil 3D.

The commands for the Autodesk Civil Engineering Data Translator are available in the AutoCAD Civil 3D Toolbox.

The Autodesk Civil Engineering Data Translator requires an Autodesk 360 (A360) account and an Internet connection.

## TRAVERSE EDITOR AND ADJUSTMENTS

Use the Traverse Editor to create 2D traverses by entering data or by selecting a polyline from the drawing. After entering the data, you can send the traverse data to the Traverse Adjustment dialog box to apply an adjustment method.

You can enter traverse data in the Traverse Editor by creating traverse sides. Side types can be Point, Line, Chord Arc, Radial Arc, or Side Shot. The first entry must be a point of beginning (POB). See Figure 10.

Side	Occupied Point	Point-Line Chord		Arc			Coordinate		COGO Point Name	Description	
		Angle	Distance	Radial	Radius	Δ Angle	Length	North			East
1 Point	CO							0.0000	0.0000	1	
2 Chord Arc		E	200		1.80	67°29'53"	212.95	0.0000	200.0000	2	
3 Line											
4 Line											

Figure 10

## CONCLUSION

I enjoy seeing the little changes throughout the year. Items such as adding property data sets and swapping pressure parts are needed right away, and shouldn't wait until the annual release. I believe we will see many more changes throughout each version and although they may seem small, some are very powerful and important to everyday workflows.

Hope you enjoyed!



Shawn Herring is a Civil Engineer based out of Utah. Shawn has been a part of the design engineering community for roughly 12 years in all aspects of design, construction and software implementations. He has implemented and trained companies across the Country on Civil 3D and other infrastructure tools and their best practice workflows. Shawn can be reached for comments or questions at [awautocadcivil3dcm@augi.com](mailto:awautocadcivil3dcm@augi.com).

# How Cool Is Your Software?

 You may never have asked that question, but you probably have said the word “cool” in relation to software before. While attending Autodesk University in Las Vegas, I noticed that word was part of a lot of conversations—both from vendors trying to push their latest revisions, upgrades, and offerings, and from fellow conference attendees describing what they just saw, were told in a class, or discussed in the hallways.

## DEFINING COOL

Cool is an elusive word that can be applied to so many things or people. We usually hear words like “innovative.” When compared to innovative, we see that “cool” is not really a synonym, but cool might include innovation. Innovation is a new method, feature, combination of disparate tools, or a very creative approach to something. Cool may be innovative, but innovation is not always cool. The same applies to other terms such as “cutting-edge,” “groundbreaking,” or even “new-fangled.” But these terms are not what I am driving at.

In my quest for a definition, I turned to the Internet. I found a lot of sites defining people who were thought of as cool. Events that were cool to attend. Many sites defining cool as related to heat or chill. Others had definitions related to acceptance, “Cool, I will be there,” or approval, “I am cool with that,” but not much more.

Getting closer I found the following on Dictionary.com: “Slang use for “fashionable” is 1933, originally Black English; modern use as a general term of approval is from late 1940s, probably from bop talk and originally in reference to a style of jazz; said to have been popularized in jazz circles by tenor saxophonist Lester Young.” Ah... getting closer, but these have no relationship to software or technology, and especially not to CAD or BIM.

An online article posted on May 27, 2010 by Ben Zimmer states, concerning the word, “Its lasting appeal is perhaps due to what the linguist Donna Jo Napoli has called its “underspecified” nature, allowing it to adapt to a myriad of contexts. No question about it, cool is in no danger of cooling off.”

So adapting all of this vagueness embedded in the word to technology and specifically to design technology, here is what I think makes software cool.

Cool software must violate the status quo.

In the book *The Humor Code*, Dr. Peter McGraw and Joel Warner attempt to define humor via a global search for what is funny. Like the

term cool, funny is also hard to define. They come up with the Benign Violation Theory, which says that humor exists when three conditions are met: 1) something threatens one’s sense of how the world “ought to be,”; 2) the threatening situation seems benign; and 3) a person sees both interpretations at the same time.

As explained on Wikipedia: “From an evolutionary perspective, humorous violations likely originated as apparent physical threats, like those present in play fighting and tickling. As humans evolved, the situations that elicit humor likely expanded from physical threats to other violations, including violations of personal dignity (e.g., slapstick, teasing), linguistic norms (e.g., puns, malapropisms), social norms (e.g., strange behaviors, risqué jokes), and even moral norms (e.g., disrespectful behaviors).” The theory suggests that anything that threatens one’s sense of how the world “ought to be” will be humorous, so long as the threatening situation also seems benign.

From Humor Research Lab web page: “For example, play fighting and tickling, which produce laughter in humans (and other primates), are benign violations because they are physically threatening but harmless attacks.”

A strength of the theory is that it also explains when things are not funny: a situation can fail to be funny because it depicts a violation that does not simultaneously seem benign, or because it depicts a benign situation that has no violation. For example, play fighting and tickling cease to elicit laughter either when the attack stops (strictly benign) or becomes too aggressive (malign violation). Jokes similarly fail to be funny when they are either too tame or too risqué.

You can see a TEDx Talk by Dr. McGraw here: <https://youtu.be/ysSgG5V-R3U>

Opposed to the benign violation that describes humor, software should rattle your cage to be cool. Software must take you places you may not have thought of going. It must shake off the limitations of the past to move toward the future.

Arthur C. Clarke, the futurist and writer, developed three laws of which the third is most quoted, “Any sufficiently advanced technology is indistinguishable from magic.” So true.

## COOL SOFTWARE MUST BE REBELLIOUS

Like James Dean in the movie “Rebel without a Cause,” cool software is fed up with compliance. It refuses to be used the same way by everyone. It allows for deviations from the expected. It allows you to do things in

ways the developer never thought of. It allows for a prominent deviation away from the standards and uniformity.

## COOL SOFTWARE HAS TO GET SOMETHING DONE

It needs to accomplish its goal of enhancing designer's ability. Unlike being a rebel WITHOUT a cause, it has a cause. It makes designing and documenting easier. It makes project delivery faster. It allows creativity to flourish. Like so many people that we might consider cool, it has a purpose in deviating from the norm. It is not pointless. It is not that way just to be different.

## COOL SOFTWARE HAS TO BE AUTONOMOUS (IN AN APPROPRIATE WAY)

According to a study in the *Journal of Consumer Research*, people and brands become cool by understanding what is considered normal, obeying the rules considered necessary, and then diverging from the rules considered expendable. "Our research explores how brands and people become cool in the eyes of consumers. We reasoned that brands could become cool by breaking rules that seemed unnecessary or unfair, but not by breaking legitimate rules," wrote authors Caleb Warren (Texas A&M University) and Margaret C. Campbell (University of Colorado).

Software that is cool follows the generally accepted norms of design and production, but breaks free (becomes autonomous) of the rules that just don't make any sense. Ever get annoyed and wish that your software would not require something that your industry did not agree applied to everyone? Shouldn't it let me do what I want or what my firm wants without restricting me to one way of doing or building things? Cool software lets you stand apart.

## COOL SOFTWARE IS CONFIDENT, YET APPROACHABLE

Cool software knows what it is supposed to do and it does it well. This is the technical side of cool software. It has to convince you that it is competent and make you confident that it works great. It has to be technically advanced and advancing, but may not be the *most* advanced. I know that some software is so advanced and hard to use that it is unapproachable. Cool software needs to be user friendly or at least not overly complicated to use. It also has to have a way to provide feedback (be approachable) and actually listen/make changes based on the feedback.

## COOL SOFTWARE DOES NOT LOSE ITS COOL

In software terms, not losing your cool means stability. Cool software is just stable. It continues working even when pressed hard. Cool people never lose their cool and neither should your software. It should not cor-

rupt files. It should not fail to function. It should not refuse to let you get to your files/models when you want them.

## COOL SOFTWARE HAS A FOLLOWING

Any software that is cool must have a following—i.e., a user group. The more groups, the better. The bigger the groups are, the better. And I'm not talking about just user groups or communities that are started and maintained by the software vendor. Third-party user groups rock—like AUGI. They are created and maintained by the users who think the software is cool.

## COOL SOFTWARE IS TRENDY, TIMELESS, AND TIMELY

Cool software does what is needed today and what is needed tomorrow. It does not change what is foundational and timeless. It keeps the coolness of yesterday and yet is up to date. Like cool people, this software stays cool for the long haul and actually gets cooler. It changes at the right time. It keeps innovating and shocking the design fields by delivering new tools and perfecting the old ones.

## COOL SOFTWARE IS COPIED

Just like trendy clothes and cool accessories, software that not only changes itself but also reshapes the industry is cool. It takes its customers to new levels and also challenges the entire design field to keep up. It changes the conversation. It moves every other software tool toward its path. It redefines and redirects, and others try hard to keep up.

I know that I have not captured every nuance of cool that might be applied to software. Most of us know it when we see it. The word just spontaneously pops out in conversations and reactions to demos. If I have missed some things that you think make software cool, let me know or chat it up on the AUGI Forums. If you have not heard that word used in relation to the software you are using—maybe you need to rethink what may be next.



*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](http://www.caddmanager.com) and [www.bimmanager.com](http://www.bimmanager.com).*

# Creating Proposed Landscape Trees in Minutes



One of the most important duties engineers and designers have is understanding their client’s vision for a proposed project site. For decades, engineering and architectural firms have created preliminary and final site designs with 2D engineering and architectural plans and rendering images in order to create the client’s development vision. Even then, some of the vision gets lost or is not achieved during the design phases. For the past few years, 3D design software has become increasingly more powerful and intuitive with designing tools that help bring clients visions to life.

For the past several years, InfraWorks® 360 has helped engineers and designers created rich, high-resolution 3D models. With these 3D models, the designs and client can identify design issues that could not be seen on a 2D construction set of plans. In order to create these realistic 3D models, several site features must be added such as signs, parking striping, city furniture, vehicles, clouds, pedestrians, trees, and landscaping. In this article, you will learn how to layout preliminary proposed landscape trees quickly and easily.

## IMPORTING SITE TREES

Typically, when you start a preliminary site design, all you have to work with is a simple AutoCAD® drawing of the preliminary site and a few buildings elevation images. The proposed tree survey or landscaping plans will most likely not even be started. If you are lucky, you may be able to acquire as-built plans for a previous similar project from the client. Let’s assume you have the landscape plans for a similar project you are designing. You can review and analyze the landscape pattern, design, and scheme for proposed trees. Now go into your AutoCAD drawing and begin drawing small circles at the locations you think the proposed landscape trees would be, based off the other design.

In Figure 1, I created a few circles in my drawing to symbolize the location of the proposed trees. The size of the circles does not really matter. It would be easier to place them on their own layers.

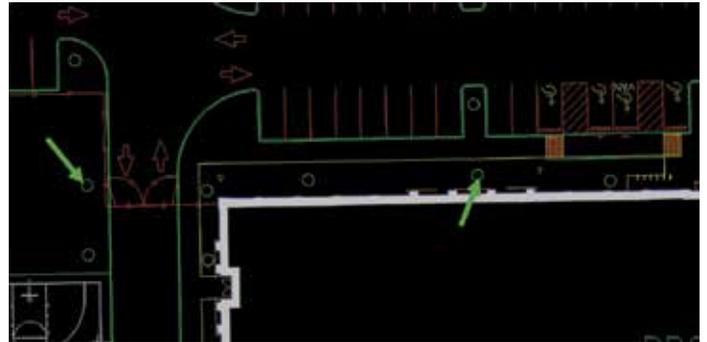


Figure 1

Once you have sketched out all the proposed trees in your drawing, use the LAYISO command to isolate the trees you drew. Next, in order for the trees to import into InfraWorks 360 at the right location, you will need to ensure that your drawing has a coordinate system assigned to it. If you are using AutoCAD® Civil 3D®, simply go into your Toolspace, Settings Tab, right click on your drawing name, and select Editing Drawing Settings. Assign the proper coordinate system for your site (Figure 2).

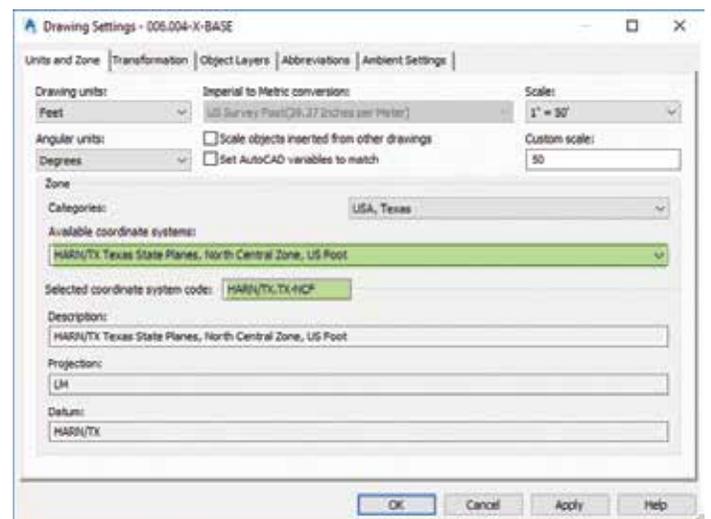


Figure 2

To ensure that your drawing linework is at the right location, use the GEOMAP feature in AutoCAD or AutoCAD Civil 3D to turn on the aerials. If the proposed site linework is correct, the aerial imagery will closely align with your drawing.

Next, use the MAPEXPORT command to export the proposed trees that you created. Within the Export Location dialog box (Figure 3), ensure that you select Autodesk SDF file format. While in the Export dialog box, use the filter selection feature and select the layer that the trees are on.

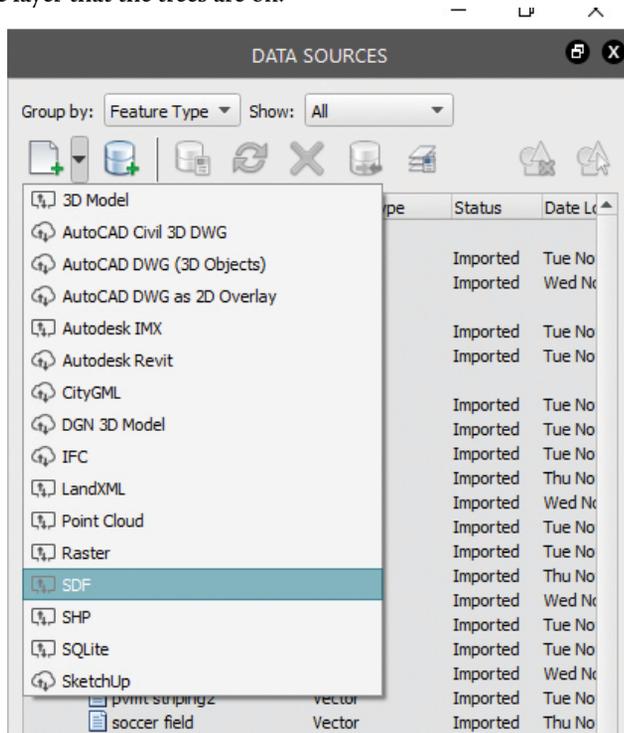


Figure 3



Figure 4

In the Options tab, check "Treat closed polylines as polygon." Click OK.

Now, go back into InfraWorks 360 and access the Data Sources panel, which can be found in the Intelligent Tools / Build-Manage your Infrastructure Model / Create and Manage your model (Figure 4).

Within the Data Sources panel, select SDF as your import file format and browse to your data file. Next, since the data is vector data, you will need to configure the data, so double click on the file. Within the Data Source Configuration dialog box under Type, select Trees (Figure 5). At the bottom under Styles select the Edit button and select a tree that closely matches the type of tree shown on the as-built landscape plans. Then, go to the Source tab and select Drape under the Draping options. Click Close & Refresh.

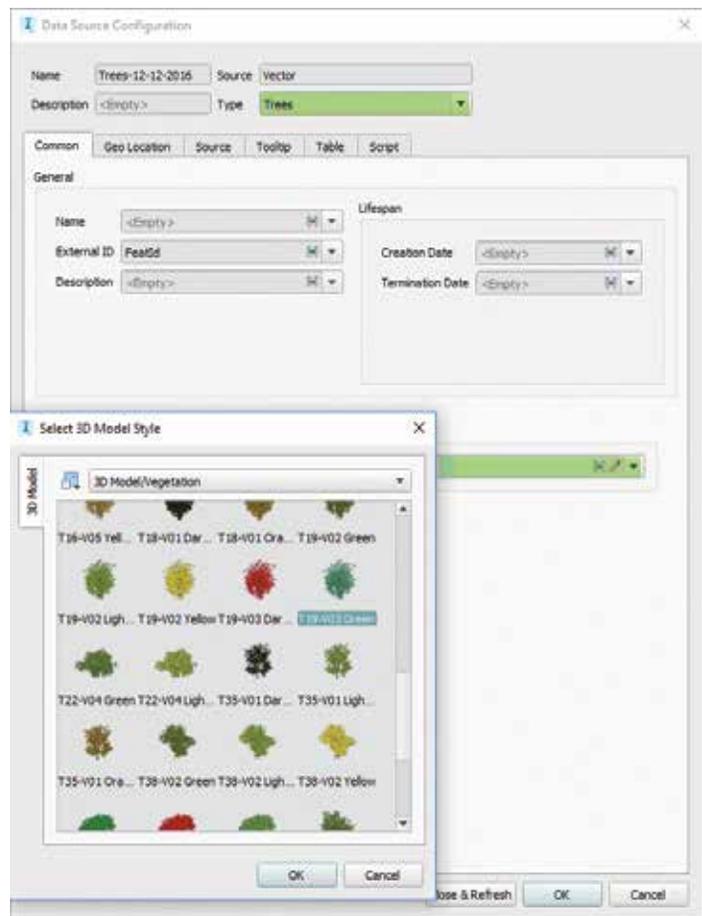


Figure 5

InfraWorks 360 will instantly bring in all the trees at the correct location. From this point, you can quickly and simply use the Styles palette to swap different types of trees at certain locations. In addition, you can change tree height to add more realism, as trees will most likely not be the same height.

With a simple AutoCAD file and circles representing proposed trees, designers can quickly and easily lay out trees within InfraWorks 360.



Tony Carcamo is a Civil Infrastructure Support Specialist, and Freelance Consultants. He has 19 years of experience in the civil engineering field performing a range of tasks from surveying and platting to site and utility design. In addition, Tony has spent several years in Autodesk software implementation and CAD management. Tony is also a blogger, sits on several Autodesk committees and council groups, and is president of the DFW BIM Infrastructure User Group. He is a certified professional in AutoCAD Civil 3D and InfraWorks 360 and an Autodesk Expert Elite.

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<http://www.wakingapp.com/augmented-reality>



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<https://apps.autodesk.com/RVT/en/Detail/Index?id=6425026133237544440&appLang=en&os=Win64>



## DUPLICATE SHEET

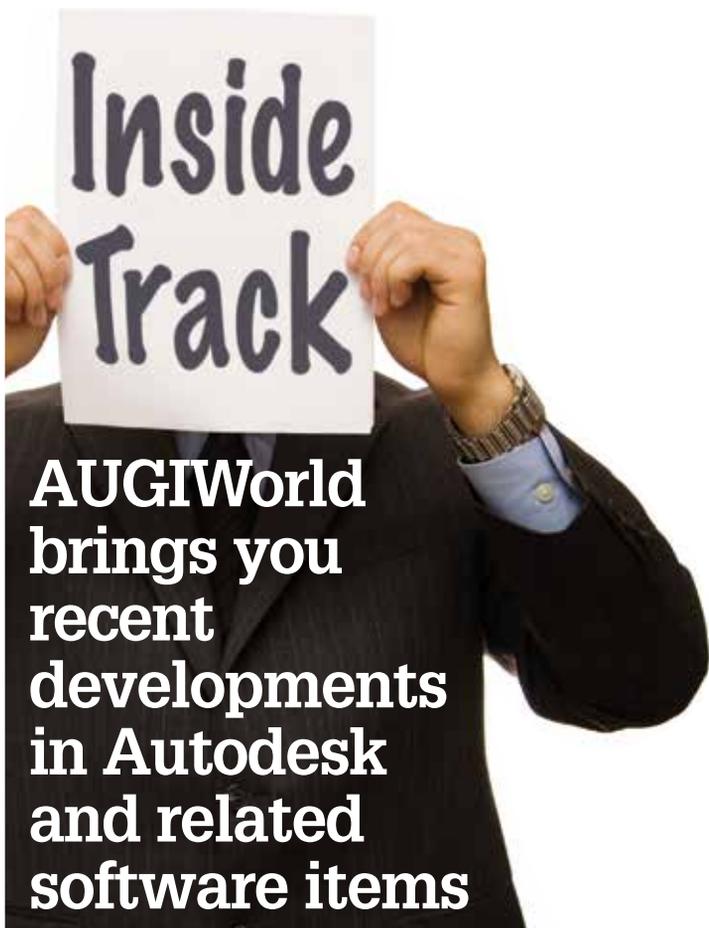
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  - ✦ set name of duplicated views with prefixes/suffixes.
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