AUGIWorld

The Official Publication of Autodesk User Group International

15th Annual AUGI Salary Survey

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Letter from the President

BENEFITS

This month's issue reveals the results from AUGI's Annual Salary Survey. I first want to thank all of you who participated in the survey. Your responses form the bedrock of something that is difficult to find in our industry.

One of the areas the survey looks at is that of benefits. Benefits are important to us. Most of us do not want to work for just a paycheck. The benefits we are provided make a difference in our happiness, satisfaction, and health.

Does your employer provide some form of educational assistance as a benefit? If so, have you ever taken advantage of the benefit?

I've said for years that the day I don't learn something is the day I die. In other words, we all can learn something each day we are alive. Granted, many days it is something small or what might feel insignificant. But we gain experience and wisdom as long as we pay attention to the things we learn each day.

What better way is there to broaden your horizons than to actively pursue new knowledge? Take a formal course at a school or college in a subject that improves your professional skillset. There is also a wide variety of online training resources, with an equally wide range in value. Why wouldn't you take advantage of the educational benefit that your employer offers?

One very common reason is that you are simply too busy. It is a valid reason. Our lives are just as busy as we make them. Another way of saying that is we make time for the things we want to do. Going to a class might mean giving up something else for a while. But the time is not going to magically make itself available. You have to find the time. It could be time well spent by opening new horizons to you.

What if a learning benefit is not offered by your employer? Does that mean you are stuck? Obviously not, since you could just pay for the classes yourself. (I know… easier said than done, Bob.) Yet there is a way that your employer can offer a learning benefit: seek out a mentor.

There is a vast amount of experience sitting around you in the office. Are you tired of doing the same thing every day? Why not seek out someone in the office to give you an extra challenge? Maybe there is something you see others doing that simply fascinates you. Muster up the courage to approach them and learn from them. Chances are they would be happy to provide some mentoring in the things they do.

Who knows? It could be the start of a new direction for you.

R. Robert Bell
AUGI President

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Revit MEP Families Simplified

Families are at the heart of everything in Autodesk® Revit®. Yeah—everything, man. Customization, scheduling, and calculations all rely on families. How data is entered and manipulated, the flow of procedures, and more are all affected by the way families are made. If families are truly the linchpin to Revit effectiveness, having an in-depth knowledge of the family editor, best practices, and quirks is essential to success. This article endeavors to go deep into the most mysterious or overlooked parts of Revit families, while attempting to establish a workflow for families in general.

TEMPLATES

The first thing a user will run into when making a new family is a vast choice of family templates. It can seem overwhelming, but the basics are this: most templates are specific to a Revit category and set the user a good way down the road for a specific family type. Alongside these templates are generic templates. The generic templates allow the user to choose what the family is based to and later pick the Revit category. Call me old-fashioned or a control freak, but I prefer starting a straight-up Generic Model template

or Generic Model – Face Based depending on my needs. There has been plenty of discussion over the years regarding the virtues of object-based families versus face-based families versus level-based families for MEP. It is deserving of research for individual firms. In the absence of a clear path, I suggest faced-based as providing the most benefits and the most flexibility.

Available Templates

- Generic Model *(Level Based)*
- Generic Model – Adaptive
- Generic Model – Ceiling Based
- Generic Model – Face Based
- Generic Model – Floor based
- Generic Model – Line based
- Generic Model – Pattern based
- Generic Model – Roof based
- Generic Model – Two Level based
- Generic Model – Wall Based

REFERENCE PLANES

Reference planes are the basis of nearly every family. That being the case, it is important to discuss some ground rules. First, understand that reference planes have a positive and negative side. What that means is that distances from the positive side are positive numbers and distances form the negative side are negative numbers. Knowing that forms will be driven by dimensions, not keeping parallel planes orientation the same can wreak havoc on families. To protect the family from unintended trouble, never mirror, rotate, reference planes, or drag reference planes end over end. This will cause the positive and negative sides to invert. It is best to establish a habit of always drawing reference planes the same. For me, that means vertical planes are always drawn from the top of the screen toward the bottom, and horizontal planes are always drawn from left to right. This puts the positive side always on the top of horizontal planes and to the right of vertical planes.

Another important habit to establish is naming reference planes. There are many times when the user will want to rehost an element to a specific reference plane, and being able to select it by name really speeds up the process. Naming reference planes also helps those who want to edit the family later. If the control freak in me was not obvious before, you should now recognize it in that I highly recommend having a reference plane naming convention. It makes the naming process easier and consistent.

Every reference plane that is created should be assigned a value for "Is Reference." This tells Revit how magnetic to treat that plane of the family and what its orientation might be.

"Is Reference" Choices

- Not
- Weak
- Strong
- Left
- Right
- Front
- Back
- Bottom
- Top
- Center (Left/Right)
- Center (Elevation)
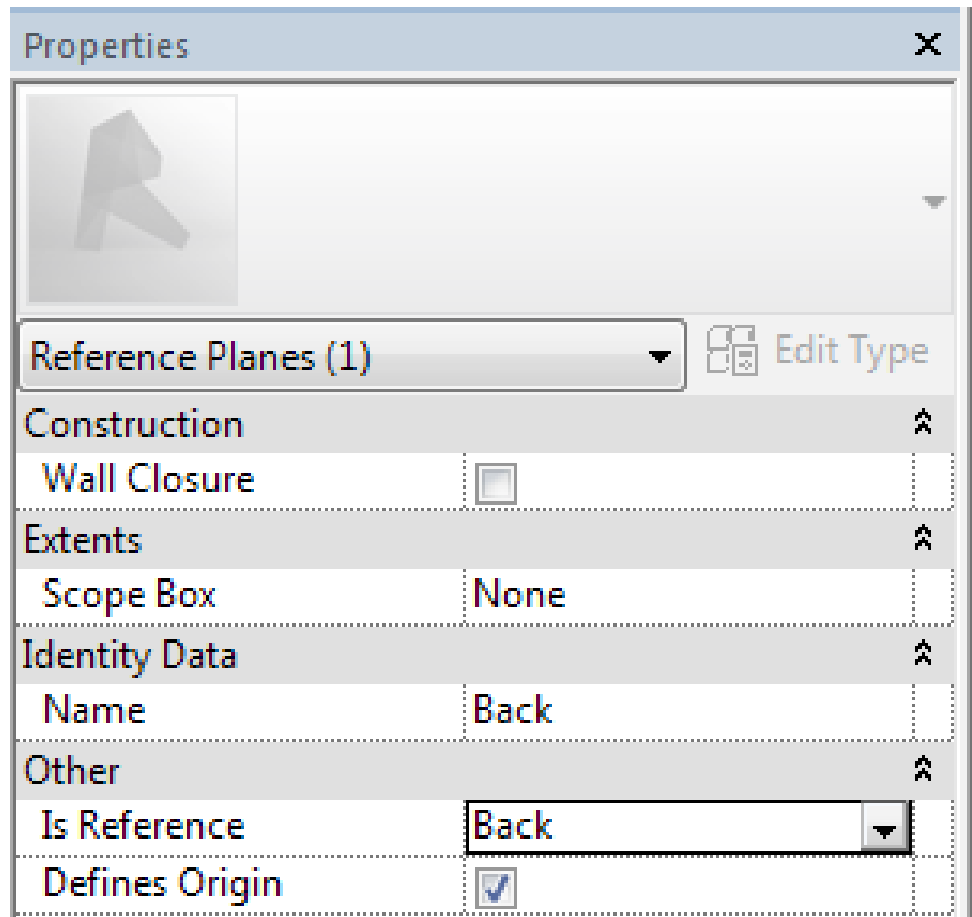
Figure 1

Revit allows the user to check the "Defines Origin" box on two non-parallel planes. The intersection of these planes defines the origin of the family. The origin is the place the cursor resides on the family when the family is inserted into a view of a project. Think about where the user wants to hold on the family when picking the defining origin planes.

Once the reference planes have been drawn to represent the faces of the geometry, dimensions can be drawn from plane to plane to define a distance which can be assigned to a parameter. This constrains the planes and allows users to drive the dimensions via that parameter. The example in Figure 2a shows a plan view with reference planes for a cube. The front, back, left, and right sides each have a plane, as well as the center (left to right) and the center (front to back). To keep the center planes in the exact center of the form that will be created, a dimension string has been added starting on the left plane to the center (left to right), then onto the right plane. When the dimension is placed, the EQ control is selected to force an equal distance on both sides of the center plane to the edge planes (Figure 2b). For consistency, I always lock the back and right planes and make them define origin. The origin point location doesn't matter as much as the fact that users appreciate predictability and it will increase speed, even if only fractionally so.

Revit MEP 2017
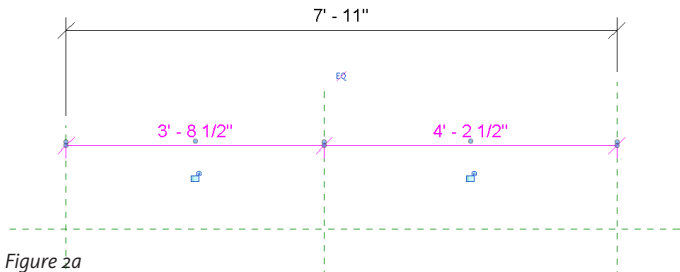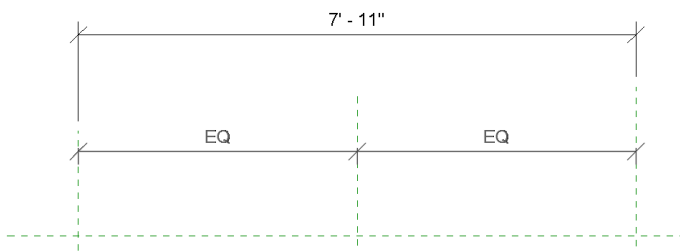
Figure 2a

Figure 2b

PARAMETERS

To define the length, width, and depth of this cube, parameters should be created. This also gives users the ability to adjust those dimensions in the project. Again, I will preach standard naming. Choose parameter names and stick to them. Height, width, depth, and length lose their meaning when used inconsistently. Pick something for the X,Y, and Z direction and stick to it. I put a screen shot of an appropriately labeled cube in my firm's standards manual. To apply a name (Label) to a dimension, select the dimension and pick the "Label" drop down from the Options bar. Select <Add parameter> to add the desired label.
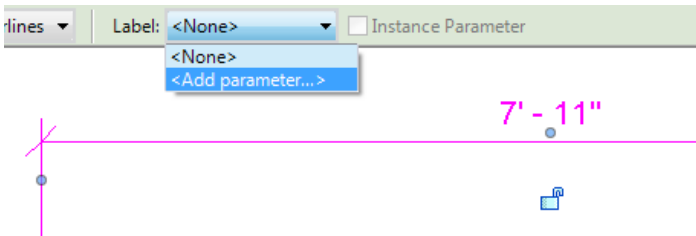
Figure 3

The Parameters Properties box will appear. First, choose to use a Family parameter, Project parameter, or a Shared parameter. The Family parameter will only apply to this specific family. In Revit 2017, Project parameters were introduced which are specific to a project. A shared parameter is independent of the family and the project. The dimensions of a form will usually end up being a family parameter. Next, give the parameter a name. Last, decide if this parameter should be instance or type. An instance parameter applies to individual instances of the family, and a type parameter is tied to family types placed in the project. Creating types gives users control groups of the families by editing a type. This makes a lot of sense for light fixtures and diffusers.

Once the parameter is created and associated with the dimension, it will appear in the Family Types dialog. Repeat this process for width and height. Change the dimension in the dialog to flex the family and ensure the planes adjust as expected (see Figure 4).
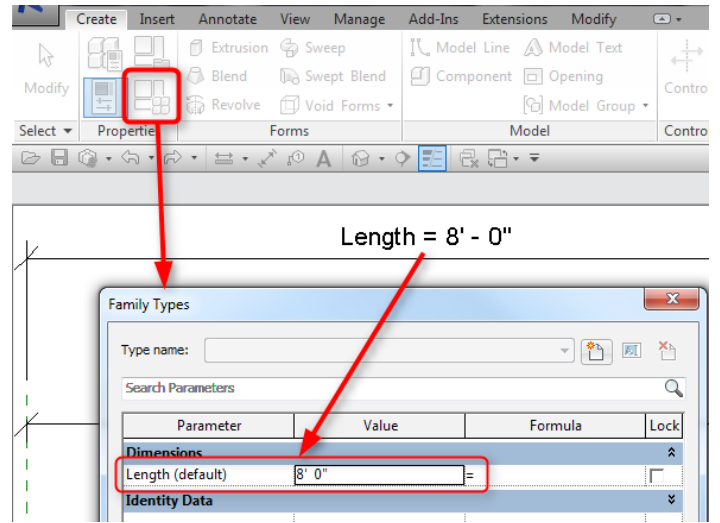
Figure 4

With all the work put in to simply produce a flexible cube, it's beneficial to create a family template for the firm that has named, properly drawn reference planes that have been assigned the proper "Is Reference" value, and even pre-labeled to standard parameters. Revit does allow users to save to *.RFT, but users can create a family, save it, and rename its extension to *.RFT. Be mindful of what gets included in a template. Garbage in a template will be garbage in every family created from it.

FORMS

With the reference planes playing ball, creating the solids and voids that make up the family's three dimensional shapes can begin. Revit provides five methods of creating a solid form.

Extrusion — Adds depth to a defined footprint. Makes a cube from a square.

Blend — Adds depth between differing upper and lower profiles. Creates a shape that is square at the bottom, a circle at the top, and a squircle in the middle.

Revolve — Rotates a profile 360° round and axis to define a shape. Creates a donut from a circle.

Sweep — Extrudes a profile along the length of a path.

Sweep Blend — Creates a form along a path starting with one profile and ending with another.

There is also a void version of each of the five forms listed above

Figure 5

CONNECTORS

In the world of MEP, it isn't done until the correct connectors are added. Connectors are the fundamental element that differentiates MEP from Architectural in Revit. Connectors pass information from family to family. Current, air, gas, fluids, and their properties are transferred and combined through the use of connectors. Connectors want to live on a face of a solid form. Their locations can be very predictable, like the open end of a pipe, conduit, or duct fitting, or simply placed in the center of a light fixture.

There are five connector types: Electrical, Duct, Pipe, Conduit, and Cable Tray. Once a connector is placed, select it to set its properties appropriately. The shape and size of duct and pipe can be driven from here along with system type, flow, and more. These values can also be driven by parameters via the "Associate Parameter Value" button directly to the right of their values in the Properties dialog.

When a Generic model template is used to start a family, don't forget to set the appropriate category for that family using the "Family Categories and Parameters" dialog. While there, any family that provides illumination will require a lighting source. This can be added by checking the Light Source check box in the "Family Categories and Parameters" dialog box. Select the light source to adjust the shape of the light source and distribution type (see Figure 5).

There is much more to families and lots to learn before becoming a real guru. Formulas, nesting, symbolic representations, visibility, subcategories, swappable symbols, and more haven't been discussed in this article. The intent here is to show a general workflow and get new users over the hump to making their own families. It is complex with many moving parts, yet relatively straightforward. Following the path outlined is more than enough for the average user to find success. Good luck.
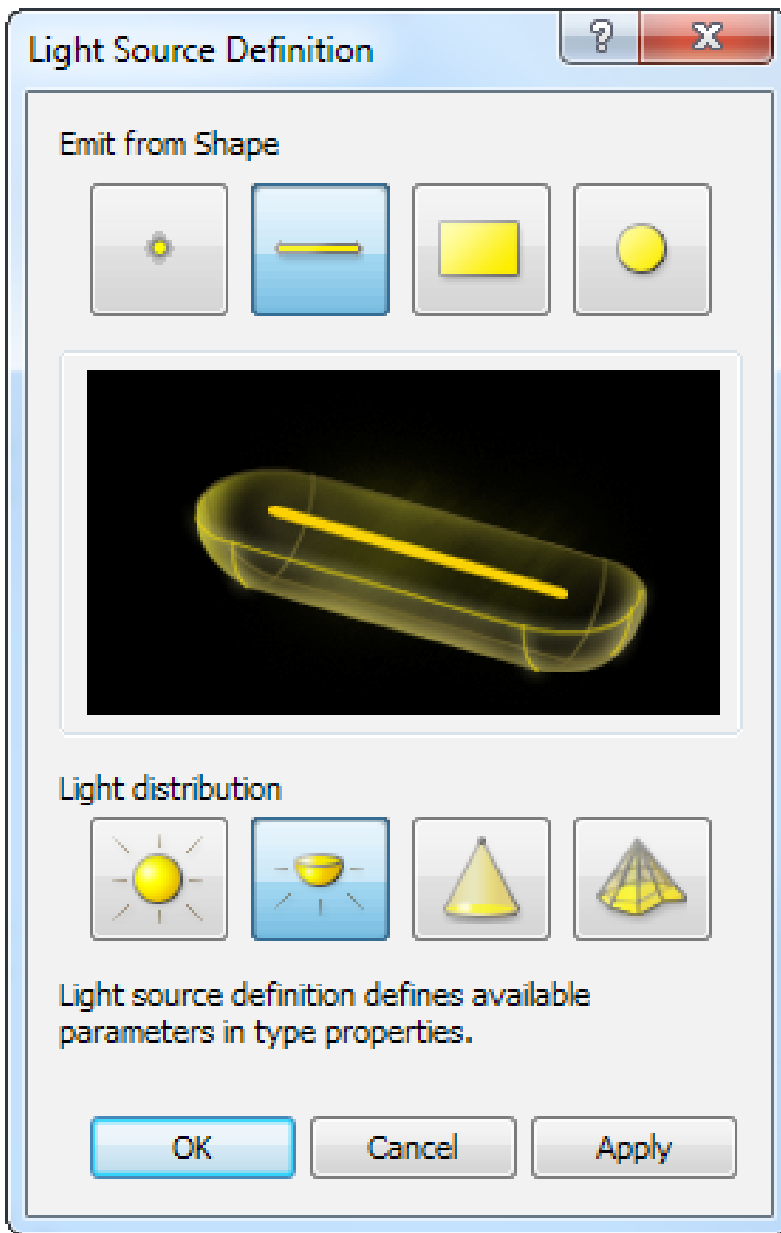
that will create an empty space inside a solid form. Between these 10 options, pretty much anything can be modeled with practice. Start simple and keep improving.

Use the Align tool to align the faces of the forms to the appropriate reference planes and lock them with the lock control. Be mindful that it's relatively easy to go overboard on parameters and over constrain a family. Don't worry, Revit will let you know that it cannot process all the constraints simultaneously. It is up to the user to decide which constraint(s) to remove to get things working. To expose any remaining problems, flex the family again by changing values in the Family Types dialog and verifying the correct results.

Warning: take care not to over-model with details. Model what needs to be modeled without showing off. Think about what needs to be shown for what use, and stay close to your goals. Overdo it and the return will be slow-moving models and complicated families that users have trouble working with.
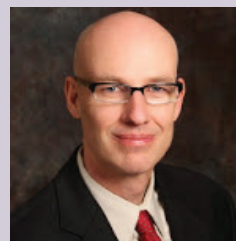
Todd Shackelford provides strategic BIM leadership for Alvine Engineering; he is an Industry fellow at the University of Nebraska, and a founding member of the Omaha BIM Collaborative and the Revit Workshops. He authors two Blogs; CAD Shack and The Lazy Drafter. A frequent industry speaker and Revit Certified Professional, Todd looks for his missing socks when not otherwise committed. Tweet Todd @ShackelfordTodd or email Todd at tshackelford@alvine.com

Inside Track

by: Brian Andresen

Welcome to *AUGIWorld* Inside Track! Check out the latest opportunities to advance your skills, processes, and workflows in your firm with the most current AEC-related software and hardware updates available.

ARCHETRIS SCHEMA

http://bit.ly/2bnKVqk

Archetris Schema is a cloud-based app developed by architects for architects to support early stage design tasks. Schema has modules for Programming, Stacking, Blocking, and Space Planning, allowing designers and planners to focus on the specific task at hand with tools specific to that task. The Programming module was created specifically to support architectural programming and includes only the features you need for architectural programming. The Stacking module... you get the point. Each module works on a single set of project design data, ensuring consistency and eliminating the time and errors inherent to data re-entry. The Schema integrates with Autodesk® Revit® via a plug-in available on the app store and the Archetris website.

Note: This is only a trial; visit the link to find out more!

Inside Track

AUGIWorld brings you recent developments in Autodesk and related software items

TRACING PAPER

http://bit.ly/2aZholx

Tracing Paper is for old-school drafters or new-school artists looking for a way to have the option of using trace paper while still going digital.

This application for the iPad, iPhone, and iPod Touch helps you practice and improve your drawing and sketching skills by giving you a blank translucent canvas with a clean and simple grid on which you can trace anything you wish as often as you like. It will be great for anyone who enjoys drawing or for kids that just want to play around!

Tracing Paper features:
- Super-smooth drawing with proprietary OpenGL-based rendering engine
- Support for tracing any photo from your device's photo album
- Gallery mode to browse to create/load/edit your traces
- Shading support just like a real pencil—draw over the same area multiple times to shade it darker
- Change brush size to help draw or shade larger areas
- Allows zooming, rotating, and panning of the image to focus on the details that matter
- Flood fill
- Undo/redo up to eight actions
- Save your creations to your Photo library
- Send your traces via email, Facebook, Twitter, PDF, Open-with for other programs

SWEETS

http://bit.ly/2aZhhqi

Sweets is a building product resource for design professionals. Sweets app for Autodesk® Revit® allows the entire design team (architects, engineers, contractors, and designers) to easily SEARCH, SELECT and ANNOTATE (TAG) manufacturer building product data directly into their projects.

The Sweets app for Revit streamlines product selection, improves project documentation, and allows in-project search, selection, and annotation (tagging) for products. No more typing in manufacturer product info, no more errors, and no more leaving the project to find detailed product information. Visit the link above for more information.

If you have some news to share with us for future issues, please let us know. Likewise, if you are a user of a featured product or news item and would like to write a review, we want to know. Contact brian.andresen@augi.com

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BCS is co-located with RTC, both in North America and Europe. The program for the 2-day event in Arizona, USA is now available, whereas the program for the inaugural European BCS will be announced shortly.

We are excited about the opportunity to positively influence content creation and industry practices, and you need to be a part of it.

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3ds Max 2017

by: Brian Chapman

Max Efficiency

Properly managed libraries in 3ds Max® empower users to create with freedom and without distraction. In order to understand how to create a professional library for content used inside 3ds Max, the functions of a library should be reviewed. In this article we'll review some of those functions and how they relate to creating libraries for content used with 3ds Max.

FUNCTION ONE: COLLECT, SAVE, AND CULTIVATE KNOWLEDGE

I believe success is based on a single factor: being a student for life. As digital artists, one of our greatest resources for learning is the Internet. Unfortunately, we can neither study nor collect the vast amount of resources available. The key is to sift through the litter and find what is essential, unique, and specific to our goals. For example, if we wish to pursue a path in architectural visualization using 3ds Max it would make sense to study and understand how Roman architecture influenced modern society rather than collecting one of a hundred likely tutorials describing how to create a classical style column in 3ds Max. Storing a professional library for reference remains essential to providing content with greater understanding and competency.

FUNCTION TWO: DOCUMENT UNIQUE ITEMS TO PRESERVE SIGNIFICANCE

An asset library consisting of a random toy truck model may not be the most efficient use of hard drive space. There are thousands

Figure 1: Roman architecture photo by Pedro J. Perez

Figure 2: Example high-quality model of a cat

of models available online, many for free. To create a professional library, focus on unique items with exceptional quality that you would be excited to use in future scenes.

FUNCTION THREE: PROVIDE PROPER AND REASONABLE ACCESS TO CONTENT

A catalogued and sortable library allows artists to free their mind and work seamlessly. Having to search for content creates unnecessary disruption during the creative process. On the other hand, going overboard with cataloging data can serve as an equal distraction. For example, creating separate folders for interior scenes and exterior scenes is a good idea. To expand further, one might create subfolders for commercial scenes versus residential scenes, but to expand further may become too distracting to navigate and may break the creative process. The key is to confine your categories to the essential items and utilize additional tools to add information. This can consist of a PDF document, word document, notes within the files properties, or tools and plug-ins available online.

FUNCTION FOUR: PLAY A CENTRAL PART IN PROVIDING CONTENT FOR SPECIFIC AREAS OF EXPERTISE

I'd recommend not downloading every script, model, or

3ds Max 2017

Figure 3: Example of a file structure for 3d models

material available online. Focus on what you enjoy doing in 3ds Max (or do most often) and start collecting information related to it. Treat it as though you wish to specialize in that particular function. Based on that, store the best content you have created or found. Eventually you'll find you've developed a professional library of content particularly catered to skills you've specifically honed.

FUNCTION FIVE: PROMOTE THOUGHT AND CREATIVITY

It's my opinion that libraries serve to promote thought and creativity. A library in 3ds Max should do the same. Weed out junk from libraries until all that's left are objects you are searching for reasons to use.

FUNCTION SIX: SERVE AS INFRASTRUCTURE FOR STUDY, REVIEW, RESEARCH, AND PRESENTATION

Finally, 3ds Max users should be as proud of the libraries they have created as they are of the content created with them, whether it's a library for models, materials, lights, scripts, or anything else they can collect, preserve, and use. With these libraries we should have the ability to consistently refer to them for notes as well as to use or present them with future work.

CONCLUSION

By understanding some functions related to libraries it should become clear how to categorize and store information and assets used while creating content with 3ds Max. With hope, this will free up time for the creative process while making it simpler to provide a high-quality product that artists can be proud of.
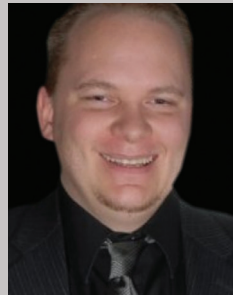
Brian Chapman is an Autodesk Authorized Developer, creator of Pro-Cad.Net and Senior Designer for Slater Hanifan Group, a civil engineering and planning firm dedicated to superior client service. Brian can be reached at procadman@pro-cad.net.
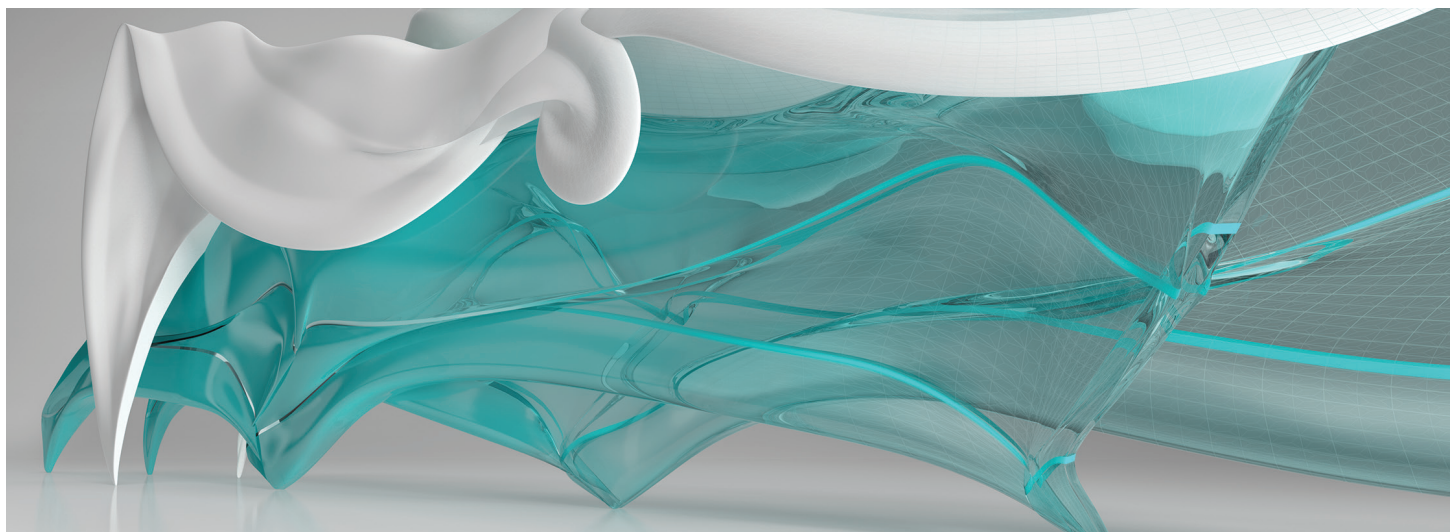
BIM Is More Than Software

It's Part Technology, Part Balancing Act

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by Robert Green

Configuring your workstation for Autodesk software

Between Revit, Inventor, AutoCAD and 3ds Max, Autodesk users can experience very different usage cases for their workstation usage. Furthermore, the sizes of the models and the visual/rendering requirements can have profound effects on the memory, disk and graphics subsystems required. All this begs the question: What is the best way to configure a workstation for maximum throughput? The answer is: It depends on your needs. In this month's Tech Insights, we'll provide guidance to help you specify the workstations that'll power you through your unique workload.

PROCESSORS AND APPLICATIONS

Using multiple Autodesk tools is not new for many of us, but what is changing is how many applications that can be running concurrently. Rather than simply running an AutoCAD session with general office software it is now common for many of us to use a modelling tool (like Revit or Inventor), analysis tools and a rendering package in addition to many more browser based tools. Depending on your usage cases, the processor and memory requirements for your workstation can be quite different. Let's break it down:

A single CAD application: If you'll be using a single program then the bulk of the processing load will be concentrated on a single core of your processor. These so called "lightly threaded" applications do best when the clock speed of the processor is maximized but don't require more than 4 cores. Consider an HP Z240 Tower Workstation based on the Intel® Core™ i7 6700K quad core processor which can attain up to 4.2GHz[1] maximum processing speed.

Multiple CAD applications: If more than one CAD application is running then multiple processing cores will be called upon to balance out the load. For these applications the highest possible clock speed on multiple cores becomes the driving performance factor. Consider an HP Z440 or Z640 Workstation based on Intel® Xeon® E5-1600 v4 series processors. These processors use Turbo Boost Max Technology (TBMT) 3.0 to speed two processor cores up to 4.0GHz[1] while offering up to 8 total cores for challenging CAD application environments.

Analysis/simulation applications: For analysis, simulation or rendering applications, many of which do support multithreading, multiple processors with lots of cores and RAM are critical. Consider an HP Z840 Workstation which can support two Intel® Xeon® E5-26xx v4 series processors for a maximum of 44 hyper-threading enabled cores[2].

RAM

Of course the processor can only do its job if it has enough memory (RAM) to keep up with the demands of your programs. The logical question then becomes how much RAM really is required? Here are some generally accepted guidelines for finding the ideal amount of RAM:

⁘ Start with 4GB for Windows

⁘ Add another 1GB for email/browser general office applications

⁘ Add 1GB for each CAD/analysis/rendering application to be open at the same time

⁘ Add 20x your maximum model size for each application

⁘ Round up to next standard size

So an Inventor user working with 100 MB assemblies performing analysis on the design would require 4GB + 1GB + 1GB + 1GB + (2 x 20 x 0.100GB) = 11GB so round up to 16GB. But a Revit user working with 250 MB design files, a solar analysis add-on plus 3D Studio Max would need 4GB + 1GB + 1GB + 1GB + 1GB + (3 x 20 x 0.250GB) = 23GB so round up to 32.

Rounding up to the next higher RAM increment is generally recommended because over a workstation's lifespan – 3 years or more – it is highly likely that increased model and application requirements will make the extra RAM worthwhile. And no matter how much RAM you install always buy the faster RAM your processor supports, always install all four memory modules and be sure to purchase ECC[3] memory for Intel® Xeon® processors.

SOLID STATE DRIVE (SSD)

The processor and RAM in your workstation has to boot up, load software and open model files from some sort of permanent disk storage and that storage should definitely be a high speed SSD to gain maximum performance. HP Workstations support the latest NVMe technology to yield performance levels from 4x up to 16X[5] higher than conventional SSD's. Deployed as a single 512GB add-in module on the motherboard (Z Turbo Drive G2) or as an add-in card (HP Z Turbo Drive Quad Pro) with up to 2TB of storage with full power fault protection these devices allow your processor and RAM to perform at the peak of their efficiency – particularly in multiple CAD or analysis/rendering environments.

With 512GB models at just $549 HP Z Turbo Drives are an affordable add-on that dramatically improves CAD workstation performance.
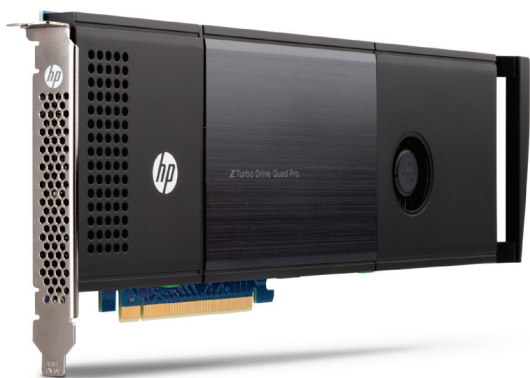

Figure 1 - HP's Z Turbo Drive Quad Pro SSD[4] add-in board supports up to 2TB of storage with NVMe level performance – beating conventional SSD's by up to a factor of 16x[5].

GRAPHICS PROCESSING UNITS (GPUs)

Graphics processor options range from Intel® HD Pro graphics (available on select processors) to add-in cards costing from a few hundred to several thousand dollars. As with other system components, identifying your requirements will help you pick the correct GPU for your needs. Start by answering these questions:

1. Will you be designing small projects with limited 3D?

2. Will you design larger 3D systems with some need for visualizations?

3. Will you need to create high resolution screen images from your models?

4. Will you be using additional rendering tools like 3ds Max to create photorealistic images or animations?

In minimal usage cases (question 1) an inexpensive add-in GPU or Intel® HD Graphics will be up to the task but as you move towards the most aggressive usage (question 4) a high end GPU like an NVIDIA Quadro or AMD FirePro with higher resolution and more video memory will be required. Usage cases somewhere in the middle (questions 2 & 3) should be specified based on how much rendering will be needed today since GPU's can be upgraded if needs increase.

HP Workstations offer Autodesk certified professional graphics options to guarantee updated driver support for glitch free operation. You can always use the Autodesk Certified Hardware page to verify compatibility between available GPU's and Autodesk software packages.

MAXIMIZE YOUR INVESTMENT

By taking the time to understand the software usage cases you'll use – now and later – you'll be able to specify the right processor, RAM, solid state drive and graphics subsystems for your needs. By specifying the best workstation components you'll save user time and speed task throughput which means the workstations actually pay for themselves in savings.

ABOUT HP

HP helps you stay ahead of the curve with professional desktop and mobile workstations designed for large and complex datasets, dispersed teams, and tight deadlines. HP Z Workstations deliver the innovation, high performance, expandability, and extreme reliability you need to deliver your 3D CAD projects in less time. To learn how to configure a HP Z Workstation, visit the HP and Autodesk page at www.hp.com/go/autodesk.

ABOUT ROBERT GREEN

Robert Green provides CAD management consulting, programming, speaking, and training services for clients throughout the United States, Canada, and Europe. A mechanical engineer by training and alpha CAD user by choice, Robert is also well known for his insightful articles and book, Expert CAD Management: The Complete Guide. Reach Robert at rgreen@greenconsulting.com

1. Clock rates shown represent maximum turbo step speeds.

2. Multicore is designed to improve performance of certain software products. Not all customers or software applications will necessarily benefit from use of this technology. Performance and clock frequency will vary depending on application workload and your hardware and software configurations. Intel's numbering is not a measurement of higher performance.

3. Intel® Xeon® E3/E5 processors can support ECC memory; Intel® Core™ i5/i7 processors only support non-ECC memory.

4. Supported on the HP Z440, Z640, and Z840 Workstations, HP offers both 256GB or 512GB modules for a potential 2TB total storage on one PCIe card.

5. Sequential read performance tested with Iometer 1.1.0 with 12 workers, queue depth of 128, file size of 128K.

PRODUCT FOCUS

Leveraging Corridors and Feature Lines within Civil 3D 2017

ver the past few releases of AutoCAD® Civil 3D® there has been a lot of emphasis on corridor modeling, corridor modeling techniques, and advanced modeling workflows. Much of this is because the Department of Transportation is getting deeper into Civil 3D workflows and larger companies are pushing for things to behave a certain way. But even for those doing "simple" site plans and subdivision roads, Civil 3D 2017 has a great new way to increase your productivity and help streamline your workflows.

This article walks through a couple scenarios for when you could possibly use feature lines in your corridor modeling. If you would like the data used for this article, please email me and I will send the files.

NEW IN CIVIL 3D 2017

Let's start with a couple new features I outlined in a previous *AUGIWorld* article about what's new in Civil 3D 2017 ("Enhance Your Workflows," May 2016).

In addition to alignments and profiles, feature lines can now be used as corridor baselines. Feature lines can also be selected when creating the corridor and when adding baselines (see Figure 1).

A parking lot is a good example of where to apply this new workflow. When I design a parking lot, I typically design the edge of pavement
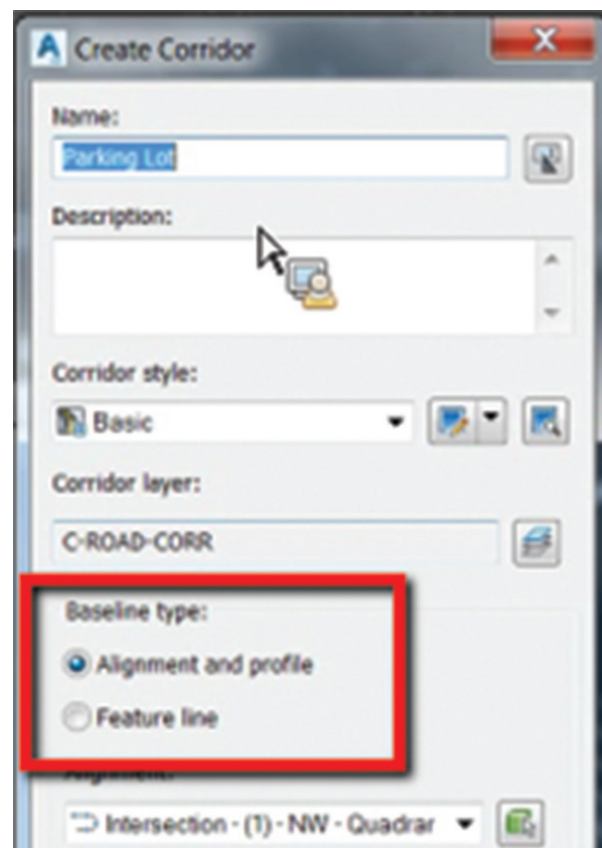
Figure 1

in order to see true slopes of asphalt. I then use the stepped offset command to give me flow line and/or back of curb elevations, and sometimes I may use grading objects to keep some level of dynamics. But now you can add the feature line to a corridor along with a curb & gutter assembly and have a much more dynamic and accurate surface.

An intersection is also a great example of using feature lines within your corridor model. Many people feature line intersections, but up until now it was more of a manual process and not very dynamic. Extracting and targeting these feature lines is very simple and easy to use in corridor modeling.

The functionality of extracting feature lines and keeping them dynamic has been in Civil 3D for as long as I can remember. However, this functionality has now been enhanced with many new options. The options for selecting which feature lines to extract include:

- Extract all feature lines at once
- Select them one by one
- Define Station Range
- Select a subset based on a corridor region or a simple polyline
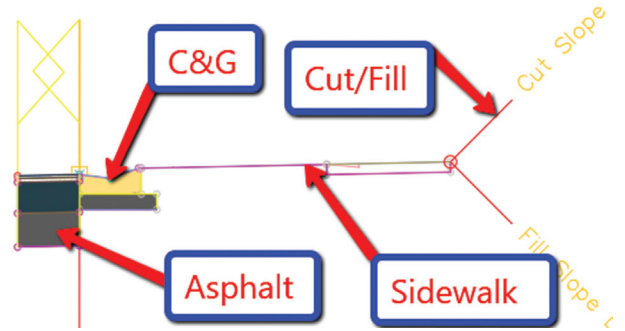
Figure 3

THE ASSEMBLY

We will need to create an assembly for our curb & gutter. We will use this assembly for both examples. This will typically be a simple assembly, and can even be a copy/modification of your corridor's full assembly. Figure 3 is what I will be using.

INTERSECTION WORKFLOW

Yes, we could use the intersection tool to create this, but sometimes that just doesn't accomplish what we want to do. Sometimes you need just a bit more control, and feature lines will allow you to do so.
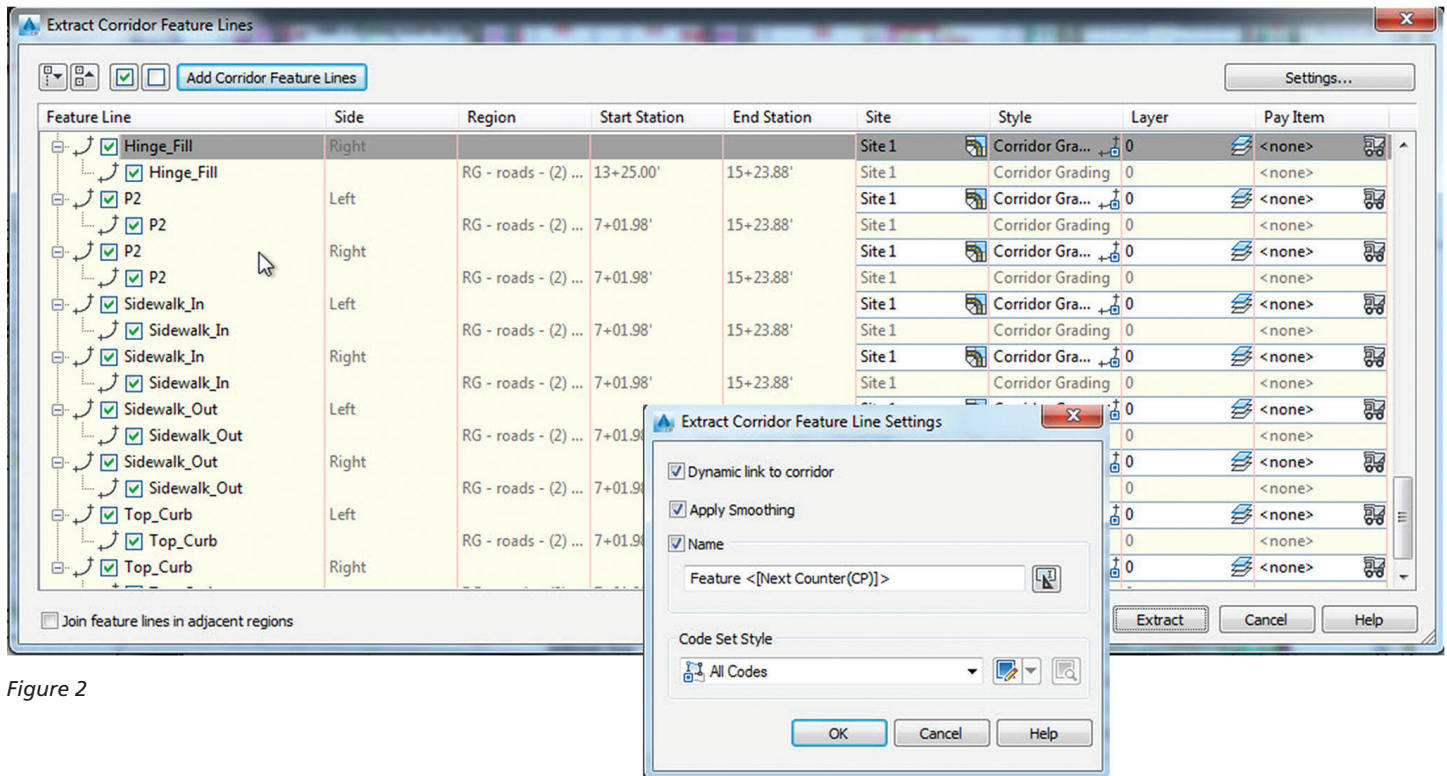
Figure 2

By selecting a polyline, you will then be given the option on which feature lines to include/exclude for the extraction procedure. Select the settings option to choose whether or not to dynamically link them to the corridor. You can choose to add them to a site or now use the "Siteless" feature line options.

Let's take a 4-way intersection, for example. I first start with extracting the centerline feature lines as a dynamic link to either my profile or corridor. In this case I chose to use my FG profile as the feature from which to extract a feature line (we will keep both crowns maintained).

AutoCAD Civil 3D 2017
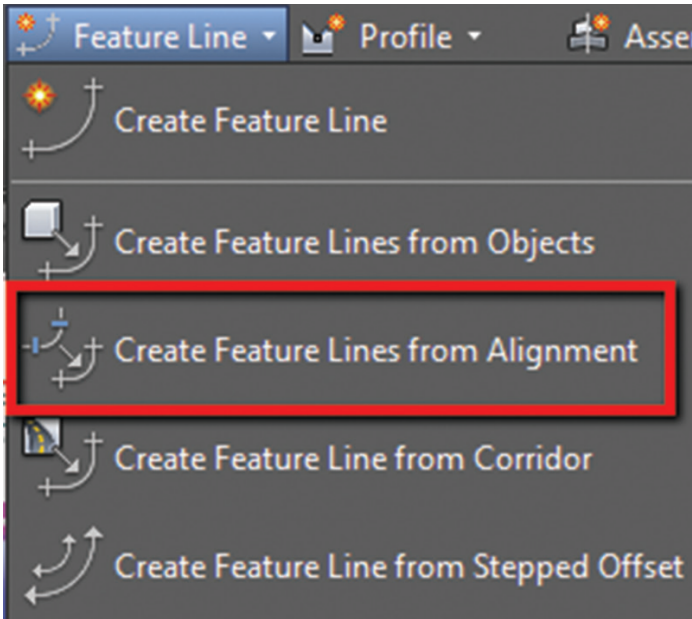
Figure 4
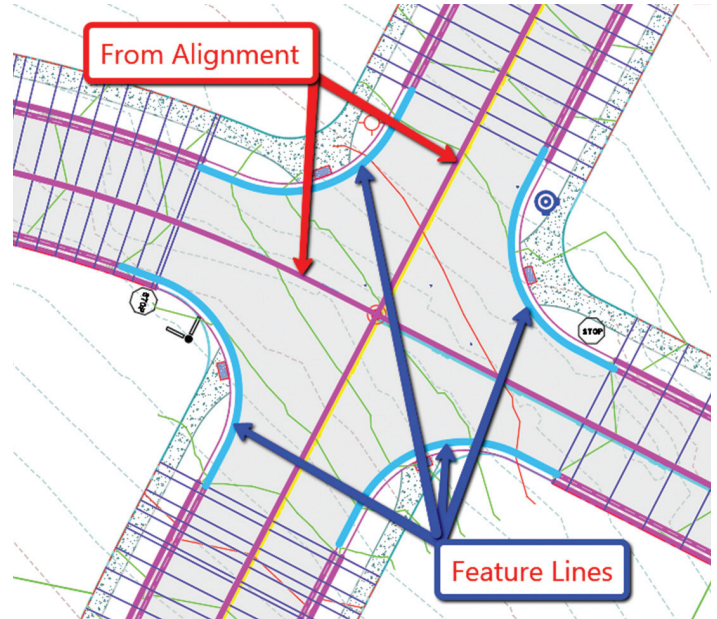
Figure 5
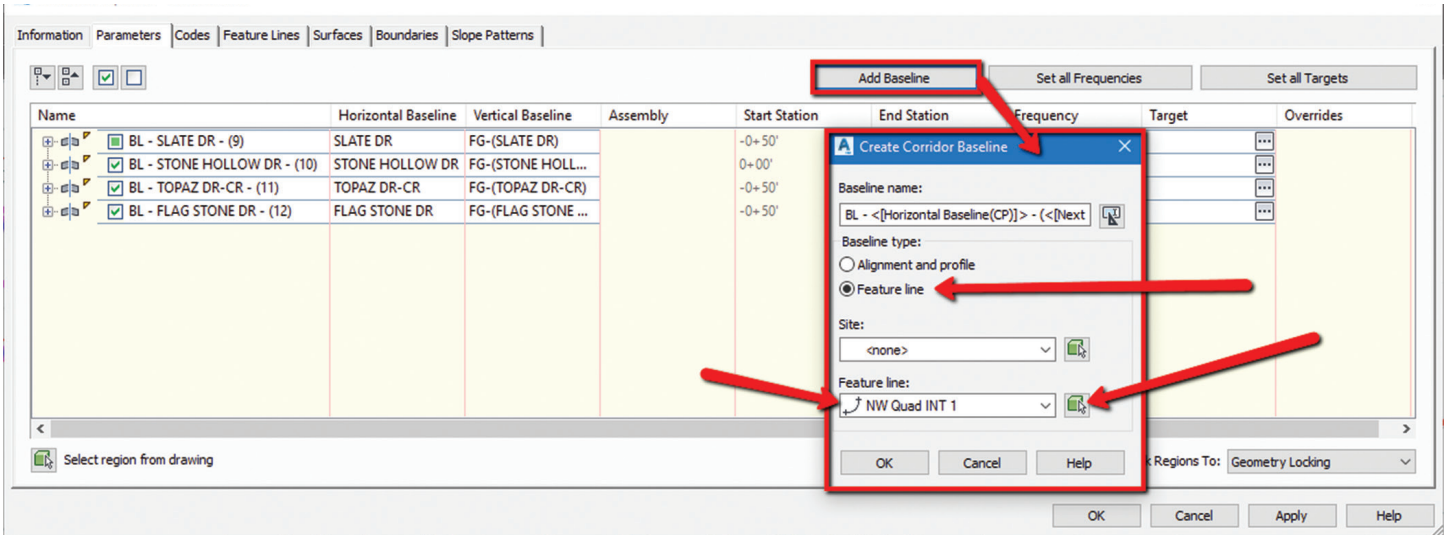
Figure 6

1. From the Home tab > Create Design panel > Feature Line drop-down > Create Feature Lines from Alignment (see Figure 4)
2. Select your alignment, then select the profile you wish to dynamically link to. You will then have a dynamic feature line; therefore, when your Alignment and/or Profile changes, your feature line does as well.
3. Create your feature lines along the Lip of Gutter (Edge of Asphalt) using either a polyline and create from objects command, or manually draw in your feature line.
4. Set the grades as you would like along that feature line. For this example, I will assume you know how to do so.

The example I am using would look something like Figure 5. The corridor has already been started, with gaps for the intersection area to be modeled.

Once we have our assembly created and our feature lines in place, we are ready to begin modeling the intersection.

5. Select the Corridor, go into your Corridor Properties and select the Parameters tab.
6. From the parameters tab, select ADD BASELINE. The Create Corridor Baseline dialog box will appear. Select FEATURE LINE from the Baseline type (see Figure 6).
7. Use the icon next to the Feature Line drop-down to select your feature line from the screen. Once selected, you may be prompted to name the feature line. I chose to name mine NW Quad INT 1. Select OK.
8. The Baseline is now added to your corridor and we need to add the region and select the assembly.
9. Right-click on the new baseline and select ADD REGION.
10. Choose your assembly and select OK. Rebuild corridor if needed.

This will now place the assembly along the feature line. And no need to do a stepped offset! Pretty good so far, right? Let's finish up the intersection quadrant by targeting our centerline feature lines for width and elevation. I use the contextual ribbon for some very useful shortcuts. Use these to really speed up your corridor modeling workflows.

11. Select your corridor from the screen.
12. From the contextual ribbon for said corridor, select EDIT TARGETS from the Modify Region panel (see Figure 7).
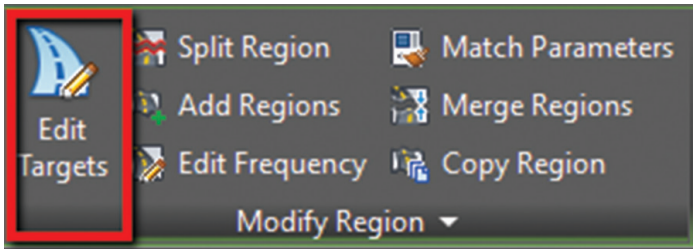
Figure 7

13. Select within the region for the intersection. The Target Mapping dialog box will appear.
14. We first will select the targets to set our Width. Select NONE next to Width Target for the asphalt portion.
15. Set the object type to FEATURE LINES, SURVEY FIGURES AND POLYLINES. Then select both centerline feature lines from the screen.
16. Select OK.
17. We now need to select the same feature lines for the Outside Elevation Target. Select NONE next to Outside Elevation Target and follow the same steps as outlined above for setting width targets.
18. Select OK to exit the Target Mapping dialog box and Select OK to complete the Corridor edits.

Repeat all the above for each intersection. Remember to use your contextual ribbon to assist. There is a MATCH PARAMETERS command that is very helpful in this case. This will allow you to set similar targets without going through all the same steps.

Your resulting intersection should look something like Figure 8. Keep in mind that you may need to reverse feature lines from time to time as well.

> ## "I USE THE CONTEXTUAL RIBBON FOR SOME VERY USEFUL SHORTCUTS. USE THESE TO REALLY SPEED UP YOUR CORRIDOR MODELING WORKFLOWS."
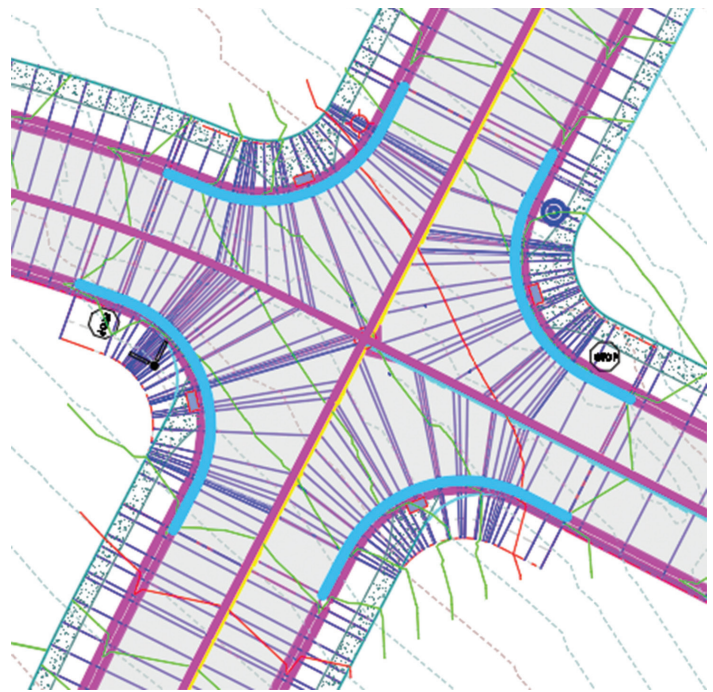
Figure 8

SITE/PARKING LOT WORKFLOW

Here is a question I probably get at least once a month: "Should I use corridors for parking lots?" My answer up until now has always been NO. Before now, in order to corridor a parking lot, you would end up with numerous alignment, profiles, assemblies, etc. And it just wasn't worth the hassle of managing all that data, and a lot of times resulted in a lot of rework.

Now for parking lots of any shape and size, you can simply add each feature line to the corridor as a baseline (not separate corridors) and apply the correct assembly. You also get the extended data a corridor offers with different materials and surface—something that can't easily be done with just feature lines and stepped offsets. The workflows are practically the same as I outlined within the intersection example, so I won't repeat everything, but a quick outline of this new workflow is below.

1. Add features lines to corridor as a baseline and apply the assembly.
2. Repeat as needed for all curbing.
3. After the first couple are in place, create a surface from your corridor model for the finished grade.
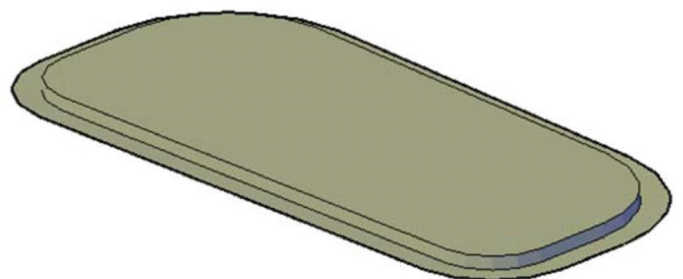
Figure 9

4. As you add additional baselines, you can see your parking lot take shape! You can allow the surface to tin from island to island, or even target using an asphalt subassembly.

5. If the surface/corridor seems to be upside down, you simply need to select the feature line and use the reverse tool from the contextual ribbon.

Curb Baselines

Surface!
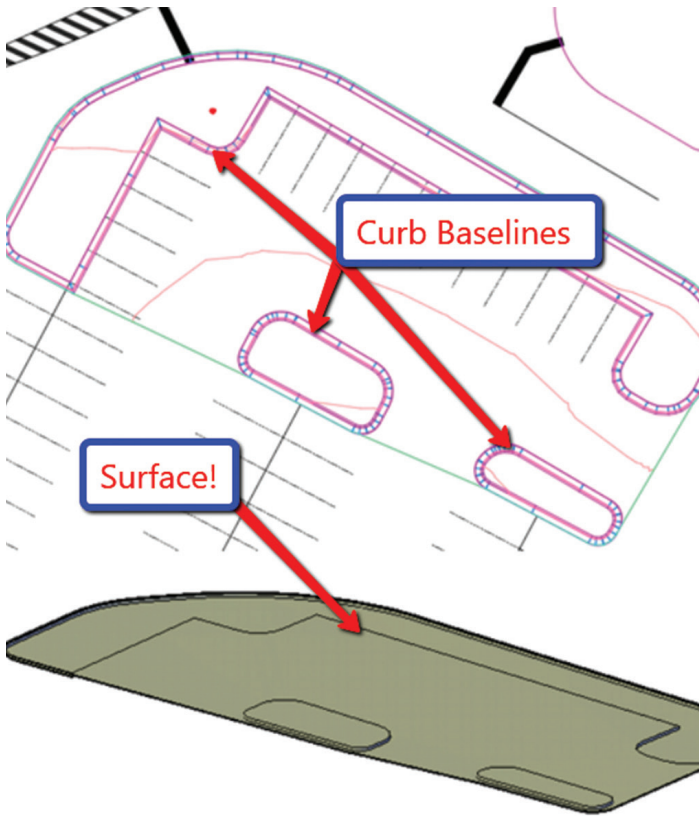
Figure 10

6. One common issue in corridor modeling is inside and outside corners. Avoiding "bowties" and "non-mitered" issues has always been painful. Inspect some of the island and parking areas to see how Civil 3D 2017 has now fixed the majority of those issues.

Try this on your next site design to really see the benefit of using corridors in this situation. I would love to see your final product!

CONCLUSION

There are many ways to model a corridor and corridor intersection. Some like to create alignments and profiles, some like to use the intersection tool and modify from there, and some just ignore the intersection (I have from time to time). It was my attempt to display a workflow that you may try and see if it fits your needs. Hopefully this gives you a little direction to at least give the feature line as baseline a shot within your corridor modeling workflows.

As always, I am interested to hear what you think and see how we can improve upon this topic.

Good luck and happy modeling!

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.
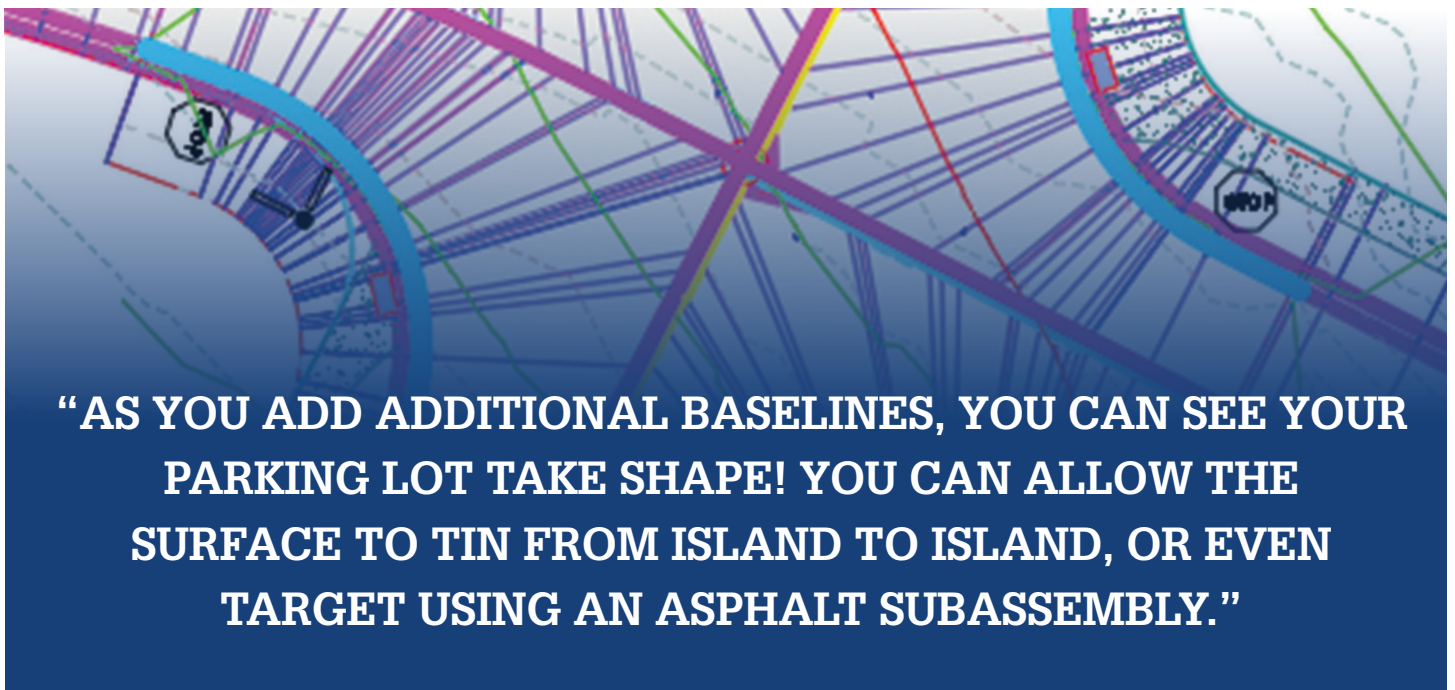
"AS YOU ADD ADDITIONAL BASELINES, YOU CAN SEE YOUR PARKING LOT TAKE SHAPE! YOU CAN ALLOW THE SURFACE TO TIN FROM ISLAND TO ISLAND, OR EVEN TARGET USING AN ASPHALT SUBASSEMBLY."

MTower CX 100% FASTER THAN THE COMPETITION

As just tested by Desktop Engineering, the XEON® based **Xi MTower CX** compact workstation, "blew away" the competition by almost 100% on the AutoCAD render test, delivering, at the same time, great modeling and simulation performance; with 25%+ higher clock speed and still being at least 25% less expensive than any comparably configured HP®,Dell® & Lenovo® XEON Workstations. These performance & price advantages mean superior productivity and longer life-span, especially when **using ISV CAD Certified Quadro® video cards.** For Notebooks, engineering.com quotes: "another hands-down win for the **PowerGo XT**" against both the Lenovo ThinkPad™ W540 & HP Zbook™ 17 in the SolidWorks® and other tests. Our XT laptop workstation is a true desktop replacement using the latest generation Intel i7 Core 6700K with CAD Certified Nvidia® M1000/3000/5000M Quadro® video cards. For the HPC dual Xeon and Tesla® HPC users, we have recently introduced another **small foot print** (~13x17x17), **yet expandable & quiet** desktop box: the **Xi Render-RT**. It is scalable to **2x XEON v4 CPU 44 Cores**, 512GB DDR4 ECC and two Nvidia® Tesla K40 or Titan X GPU coprocessors for the ultimate desktop simulation and rendering power. With over a decade of over-clock experience, our award winning **Xi MTower PCIe** workstation is a sure champion of reliability and performance, based on **the latest i7 6700K water cooled at 4.5GHz**, in a small quiet box at an incredible price. By visiting our website each of the above models as well our powerful rack-mount servers and HPC simulators can be configured with an extensive options selection that is superior to any other on line offering. **Quantity-Eucational-Govt-Resale discounts are available on our website: xicomputer.com.** Proudly US built and supported.

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MTower PCIe	PowerGo XT	MTower CX
- Intel® Core™i7-6700K to 4.5GHz	- Intel Core i7 4.0-4.2GHz TB	- Intel Xeon®Processor to 4.2GHz
- Intel Z170 C.S. PCIe 3.0	- 6/8MBCache 4Cores/8Threads	- 15/20MB Cache, 6/8 Cores
- 16GB-DDR4 2666 to 3000MHz	- 8GB DDR4 2133MHz to 64GB	- 16GB DDR4 2666MHz to 64GB
- **NVIDIA®Quadro® M2000 4GB**	- **New NVIDIA®Quadro® Mx000M**	- **New NVIDIA®Quadro® Mx000**
- 256GB SSD Samsung® EVO	- 500GB SATA6 Hybrid 8GB SSD	- 256GB SSD Samsung® EVO
- 74 in 1 Card Reader, USB 3.1	- 15.6/17.3" 1920x1080NR LED	- Quiet Water Cooling, USB 3.1
- Xi®MTower Silent Compact Tower	- Speakers, Camera,Mike & Wi-Fi	- Xi®MTower Compact Cube
- MS Windows® 7/10 Prof. -Linux®	- Microsoft® Windows® 7/10-64Bit	- MS Windows® 7/10 Pro-Linux®
4-Core i7-6700K 4.2GHzTB $ 1,759	I7-6700 3.9GHz M1000M $1,849	6-C E5-1650 4.2GHz M2000 $2,699
4-Core i7-6700K 4.5GHz $ call	i7-6700K 4.2GHz M3000M $ call	8-C E5-1660 4.1GHz M5000 $ call

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Thank you

Thank you to the over 4,200 members who took the time to contribute to this resource for-users-by-users!

Lets dig in and see what has been happening in our industry since last year's survey.

I have to start out by thanking so many of our members for taking time out of their days to volunteer the information that makes this report possible. You can be assured that the higher the number of responses received, the more accurate the report. Just as with all of the AUGI programs, volunteers and these survey participants are what make the magic happen in our community.

In 13 years overseeing this report, I do constantly receive and consider feedback from the membership. So, as always (once you've read the FAQ), feel free to send me any suggestions for Hot Topic issues you'd like to see gauged, or other important statistics which may have been neglected.

The first course of discussion is, as usual, the differences in cost of living in various areas. Thirty percent of survey participants are from outside of the US, and the metro areas and rural areas can be costly or affordable no matter the country, so be sure to check local resources for those variances. I am a big fan of www.Indeed.com/Salary and the ETC Salary Calculator can help, as well as industry- or role-specific surveys from other professional organizations. The salaries reported here (in US dollars, as participants were given a link to a currency converter) reflect salary and bonuses for those who work 40 hours a week; they are calculated to exclude overtime pay.

Negative factors (job insecurity, layoffs, reduced pay) continue to decline slowly, while those starting new jobs are on a slight increase. Market share for industry specialties hasn't changed much since last year. Keep reading to see which market segments pay the most, and which are busiest now.

Wages in larger companies average 14 percent higher than those in the smallest firms. Regular use of cloud services has increased from 3 percent of respondents to 5 percent since last year, though most are still resisting due to company policy and other concerns, though use on a limited number of a company's projects has jumped from 12 percent to 15 percent (when we first asked this question, only 5 percent were using cloud services on a limited basis).

Although 74 percent of our users are still in the same job they were last year, only a record low 44 percent intend to stay that way. We see in the March job search poll that 22 percent of users are currently searching for a new job due to dissatisfaction with their current role, and a further 10 percent plan to start looking soon. Without a doubt, most folks get their jobs through personal connections (45 percent), so be sure to reach out to your professional connections and start networking. And, when you get that new job offer, don't forget to negotiate your salary.

Please keep an eye on AUGI HotNews, email blasts, and our social media channels next summer so you can participate, too!

DEMOGRAPHICS

Employee Gender

Male	82%
Female	18%

Pay by Gender

Overall	$65,088
Male	$66,253
Female	$59,692
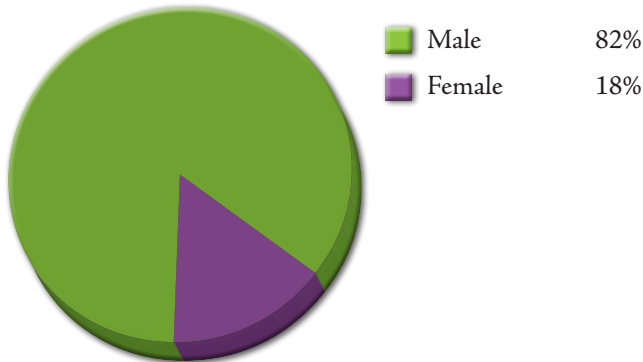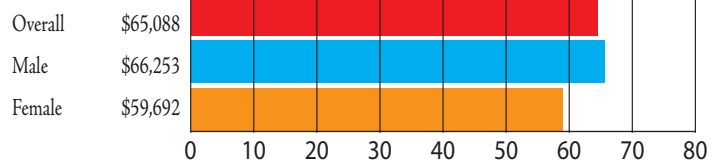
45% of respondents have a Bachelor's degree or higher, compared to 27% when this annual survey began in 2002.
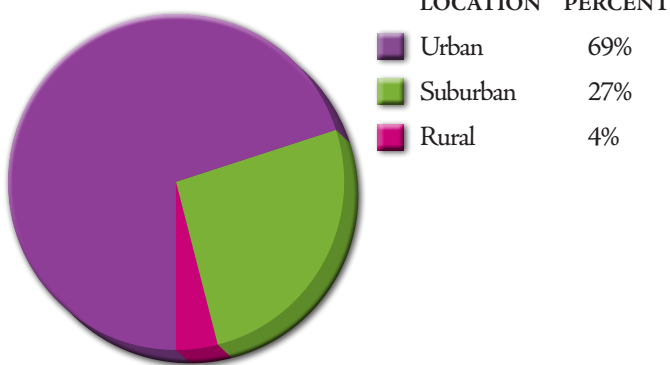
Average Pay by Years of Experience

0-2 years	$47,828
3-4 years	$47,109
5-6 years	$58,078
7-8 years	$58,164
9-10 years	$62,262
11-14 years	$64,816
15-20 years	$62,580
21-30 years	$69,714
31-50 years	$72,372
51-60 years	$74,210

Work Location

LOCATION	PERCENT
Urban	69%
Suburban	27%
Rural	4%
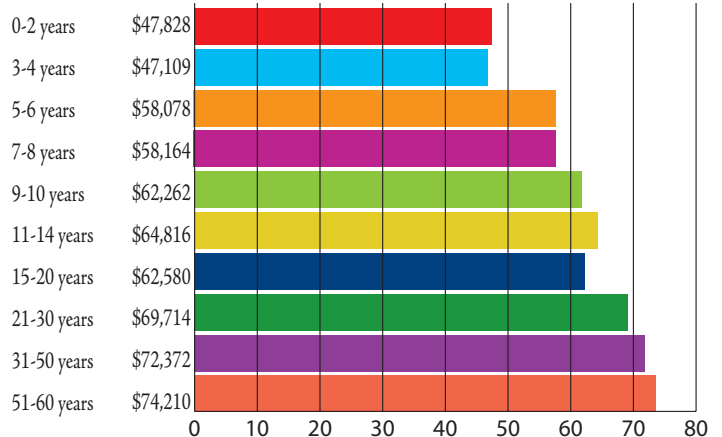
Education Level/Degree Attained

High School/GED	6%
Technical/Vocational	18%
Associates Degree	29%
Bachelors Degree (4-5 years)	31%
Masters	14%
Doctorate	<1%
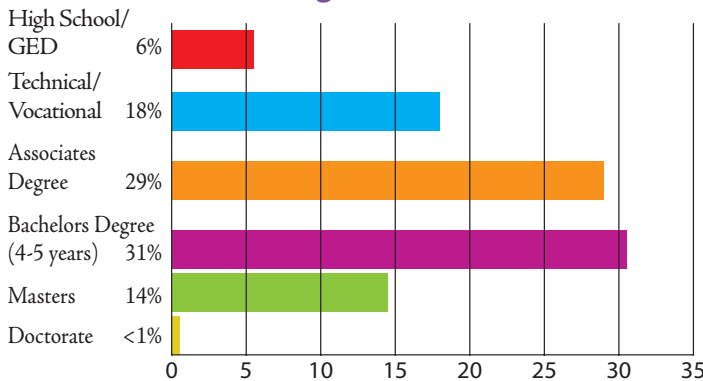
Average Pay By Education Level
(for those with 5 or fewer years of experience)

High School/GED	$67,131
Technical/Vocational	$64,162
Associates Degree	$63,651
Bachelors Degree	$66,579
Masters	$74,952
Doctorate	$65,058
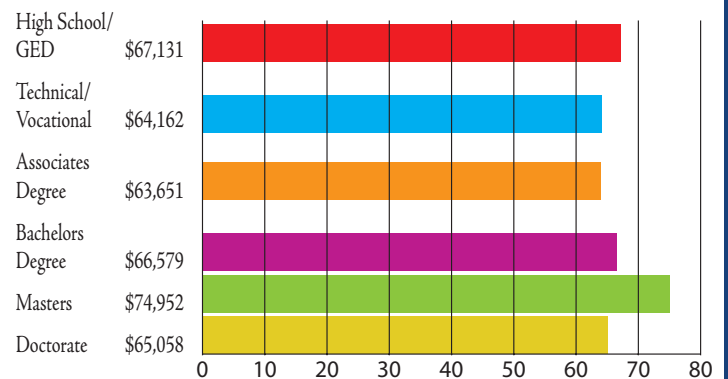
Respondents' Years of Experience

0-2 years	5%
3-4 years	5%
5-6 years	6%
7-8 years	6%
9-10 years	10%
11-12 years	6%
13-14 years	4%
15-20 years	25%
21-30 years	22%
31-50 years	10%
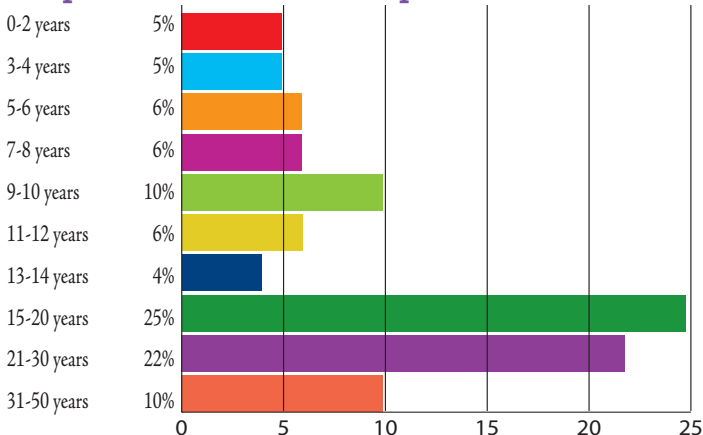
Check out these resources for additional information on pay:
- Indeed.com/salary
- Salary.com
- Payscale.com
- ETC Salary Calculator
- Glassdoor

Search for other professional organizations related to your market to get more niche data.

AUGI 2016 Salary Survey

COMPANY DATA

Change in Employment?

No, still the same job	74%
No, but my workload has increased	9%
No, but my hours were reduced	1%
Yes, same company, different job	4%
Yes, left for a new company	10%
Yes, I was laid off	2%
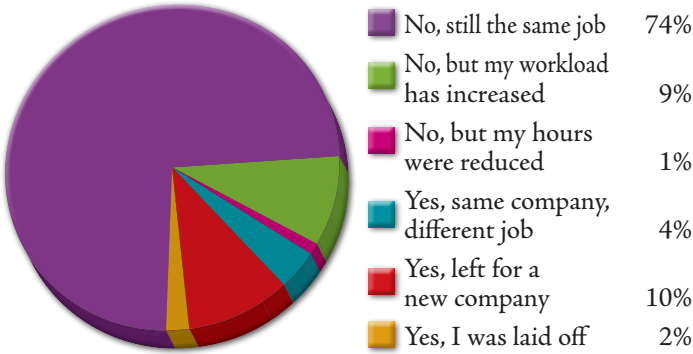
What Benefits are Available To You?

Paid Time Off	91%
Medical Insurance	84%
Retirement	76%
Dental Insurance	71%
Flexible Hours	59%
Continuing Education	47%
Telecommuting	21%
Childcare Assistance	8%
None of the Above	3%
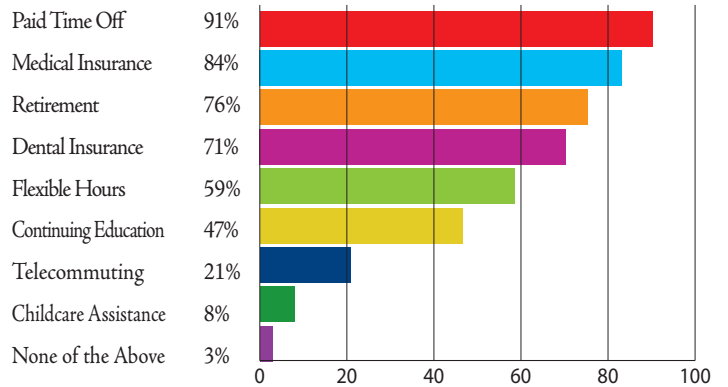
Does Your Company Have a Human Resources Department?

Yes	69%
N/A	2%
No	28%

Age of Respondents

Under 30	10%
30-39	31%
40-49	29%
50-59	22%
Over 60	7%
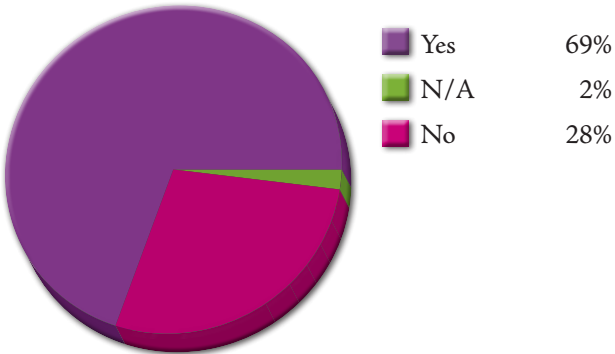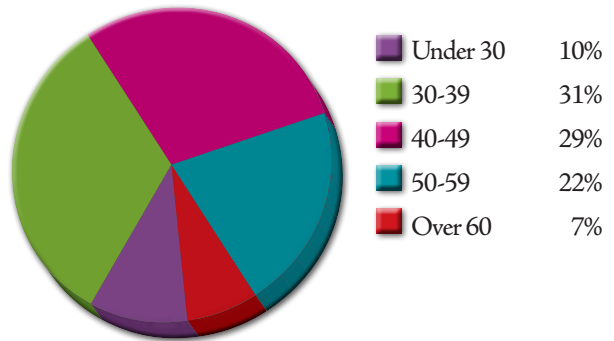
Years with Current Company

0-5	48%
6-10	22%
11-20	21%
21-30	7%
Over 30	2%
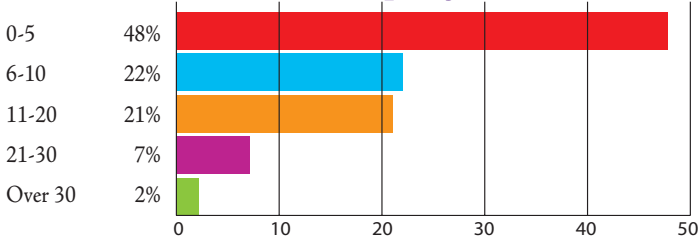
Lack of benefits reduces average job satisfaction scores by more than 16%.

The ability to telecommute translates to job satisfaction 8% higher than the average worker.

Number of Employees in Company

10 or fewer	12%
11-25	12%
26-50	13%
51-100	13%
101-200	11%
201-500	12%
Greater than 500	26%
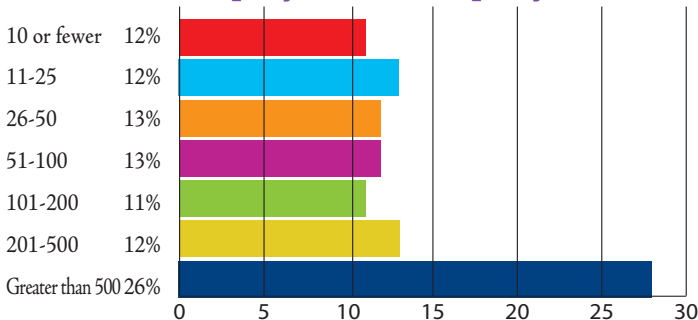
Average Pay by Company Size (Number of Employees)

10 or fewer	$61,689
11 - 25	$58,382
26 - 50	$62,712
51 - 100	$63,369
101 - 200	$64,316
201 - 500	$66,404
Greater than 500	$71,479
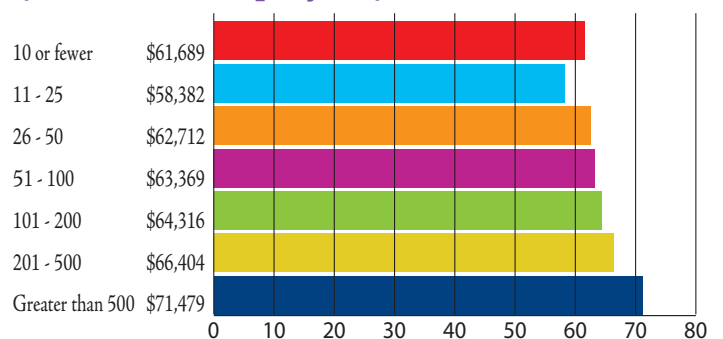
JOB TITLES

Survey Participants

Designer	21%	
Drafter	11%	
Architect	9%	
Manager - BIM	9%	
Manager - CAD	9%	
Engineer	8%	
Technician	6%	
Manager - Project	5%	
Coordinator - BIM	4%	
Manager - Other	2%	
Coordinator - CAD	2%	
Specialist	2%	
Coordinator - Other	1%	
Instructor/Trainer	1%	
Intern	1%	
Account Executive	<1%	
Application Engineer	<1%	
Land Surveyor	<1%	
Programmer	<1%	

Average Pay by Job Title

Account Executive	$91,708
Manager - Other	$78,418
Land Surveyor	$77,641
Programmer	$73,017
Manager - BIM	$72,984
Manager - CAD	$71,324
Architect	$69,984
Other	$68,989
Application Engineer	$68,464
Manager - Project	$68,126
Engineer	$67,404
Coordinator - Other	$66,535
Specialist	$66,266
Instructor/Trainer	$65,337
Designer	$64,281
Coordinator - CAD	$64,266
Coordinator - BIM	$58,385
Technician	$53,636
Drafter	$52,557
Intern	$48,487

Jobs with the Highest Mobility
(Percentage of Each Who Reported Leaving for a New Role)

Intern	21%
Coordinator - BIM	18%
Manager - BIM	16%
Project Manager	13%
Architect	13%
Coordinator - CAD	13%
Engineer	12%
Application Engineer	9%
Coordinator - Other	9%
Specialist	9%
Designer	9%
Drafter	9%
Technician	7%
Manager - Other	6%
Manager - CAD	5%
Programmer	5%
Land Surveyor	3%
Instructor/Trainer	3%
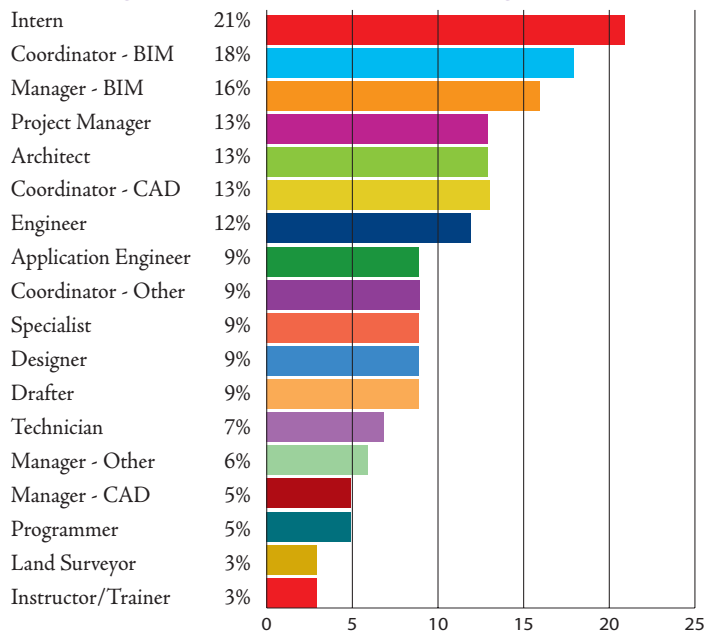
Reminder: All reported average pay is based upon a 40 hour workweek. It would include base pay and potential bonuses, but not overtime pay for hourly workers.

Current Workload

Extremely Busy	46%
Same as Always	35%
A Bit Slow	17%
Pretty Bad	2%

While the percentage of Designers has remained steady since the beginning, the volume of Drafters in our ranks has shrunk from 28% in 2002 to just 11% today.

When You Leave for the Day, Are You Really Leaving Work?

Yes, I do not deal with any work until I return	29%
Yes, but exceptions for urgent issues	46%
No, I remain available to those in my company	14%
No, I am constantly connected for anyone to reach me	11%

AUGI 2016 Salary Survey

INDUSTRY/DISCIPLINE

Survey Participants

Field	%
Architecture	27%
Civil/Survey/GIS	18%
MEP/FP	11%
Construction	10%
Manufacturing	8%
Structural	7%
Petroleum/Gas/Biofuels	3%
Facility Management	2%
Education/Training	1%
Interior Design	1%
Electronics	<1%
Landscape Design/Architecture	<1%
Sales/Marketing	<1%
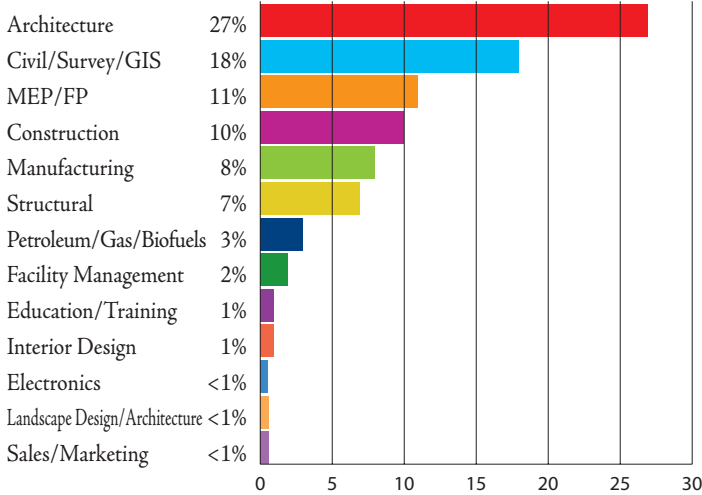
Average Pay by Field/Industry

Field	Pay
Petroleum/Gas/Biofuels	$88,193
Sales/Marketing	$73,334
Facility Management	$68,661
Civil/Survey/GIS	$65,500
Construction	$64,902
Landscape Design/Architecture	$64,771
Education/Training	$63,598
Structural	$63,554
Architecture	$63,489
MEP/FP	$62,808
Manufacturing	$61,685
Interior Design	$59,222
Electronics	$58,448
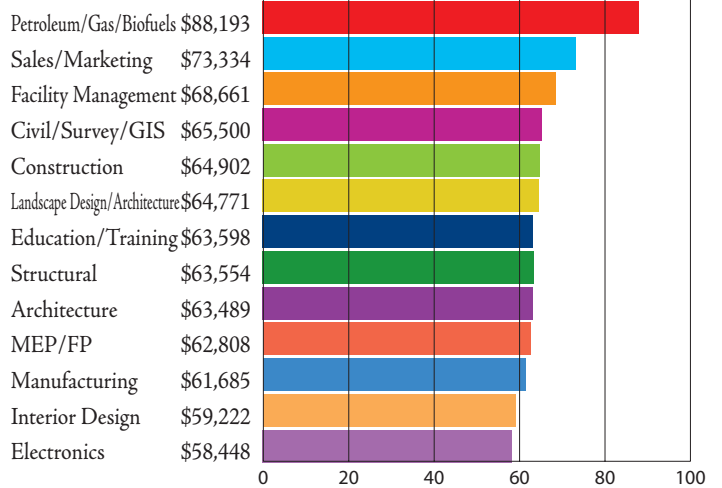
Percentage Extremely Busy Workload

Field	%
Facility Management	56%
Architecture	51%
MEP/FP	47%
Manufacturing	47%
Construction	46%
Structural	45%
Civil/Survey/GIS	43%
Petroleum/Gas/Biofuels	18%
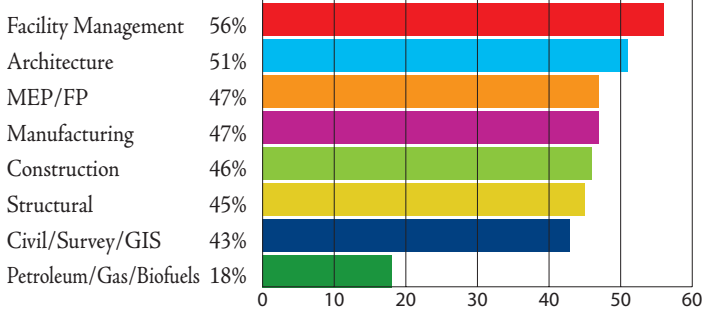
Industries with Highest Percentage of Job Security

Field	%
Landscape Design/Architecture	94%
Sales / Marketing	92%
MEP/FP	85%
Facility Management	84%
Structural	83%
Education/Training	81%
Civil/Survey/GIS	81%
Architecture	80%
Construction	74%
Manufacturing	72%
Interior Design	66%
Petroleum/Gas/Biofuels	54%
Electronics	42%
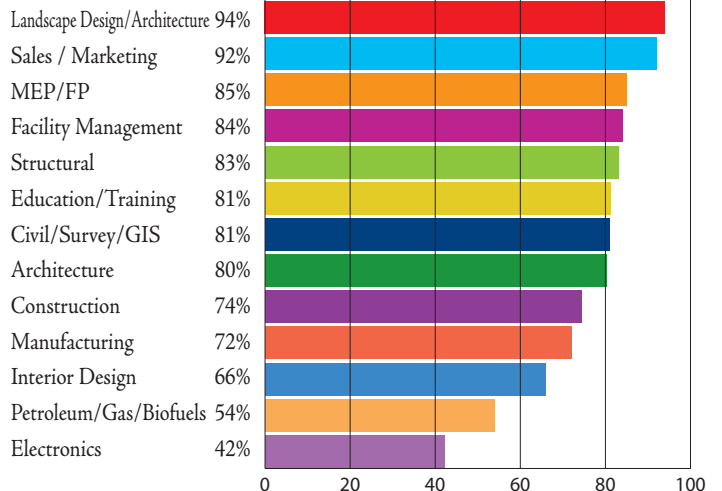
Percentage Reporting Being Laid Off

Field	%
Petroleum/Gas/Biofuels	8%
Interior Design	7%
Facility Management	5%
Manufacturing	5%
Civil/Survey/GIS	3%
Construction	2%
Education/Training	2%
MEP/FP	2%
Architecture Total	1%
Structural	1%
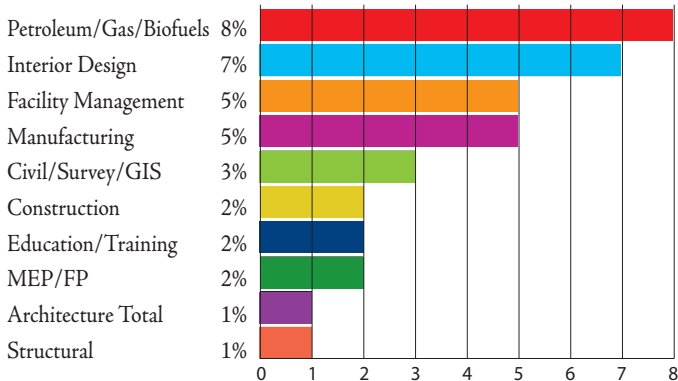
The average age of an AUGI member is 43.

Fields with higher than average ages are education, electronics, manufacturing and fuels.

18% of the industry is female.

Fields with lower than average representation are fuels, manufacturing, structural, construction and civil.

MARKET SERVED - INDUSTRY SPECIAL

Size of Market Segments

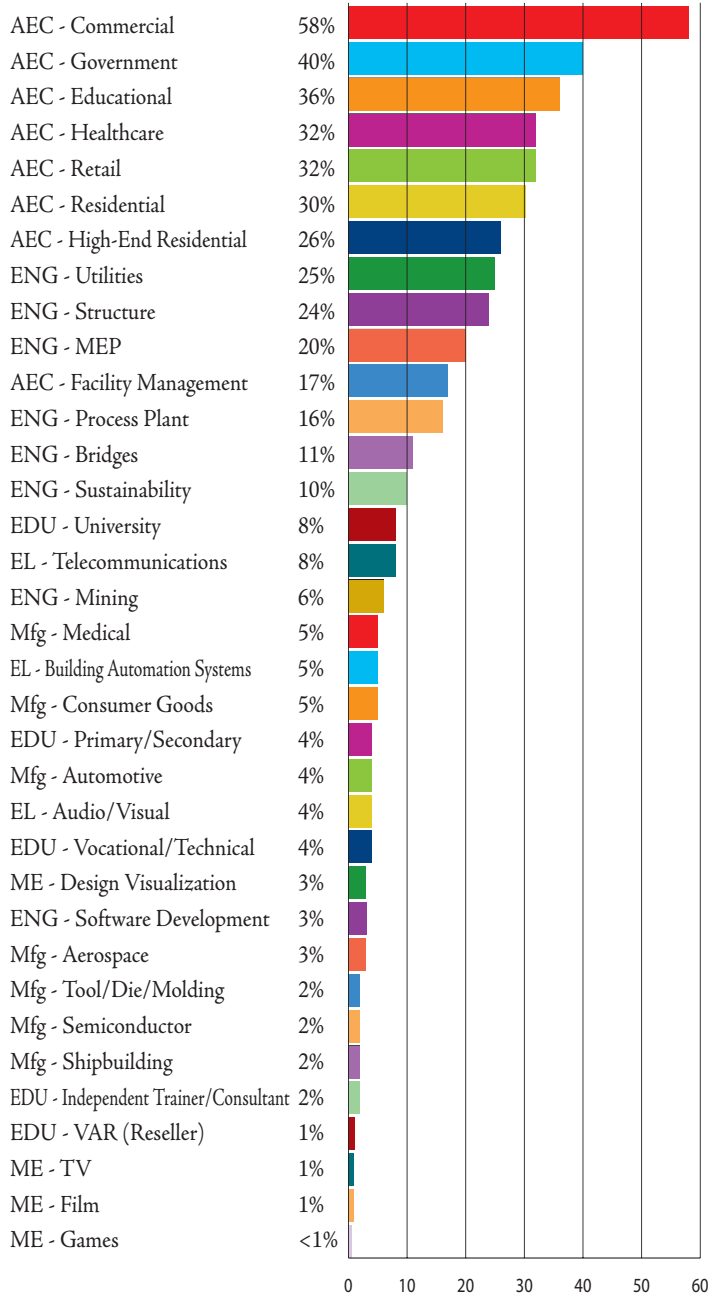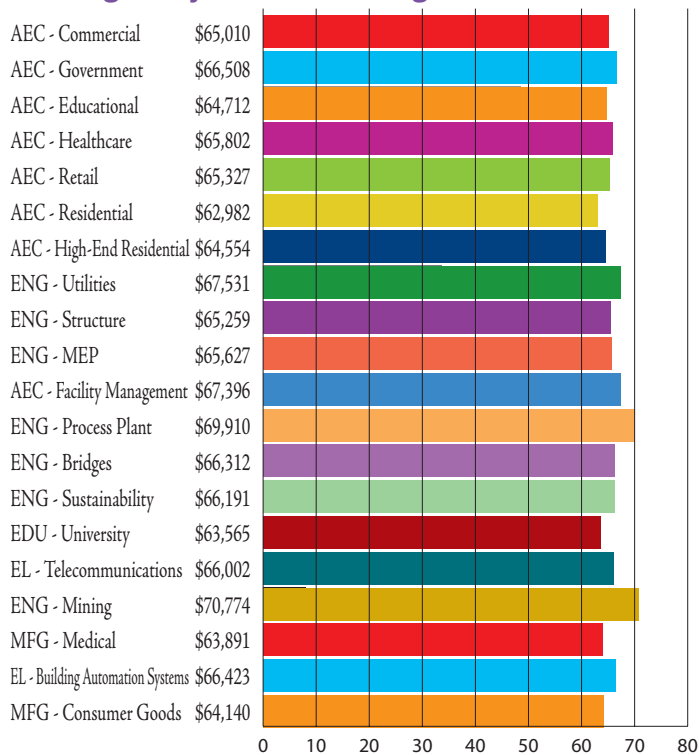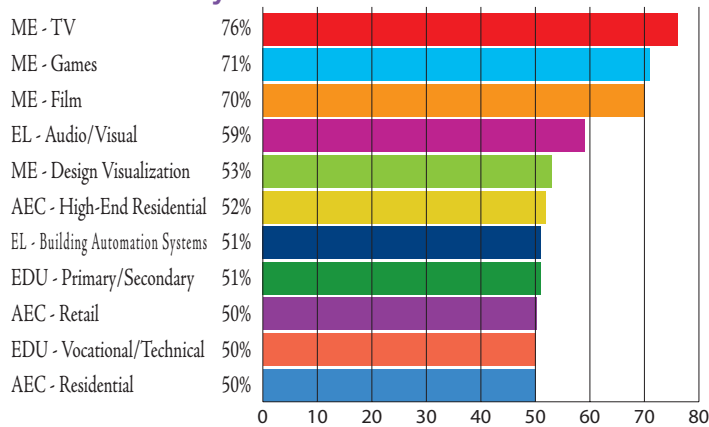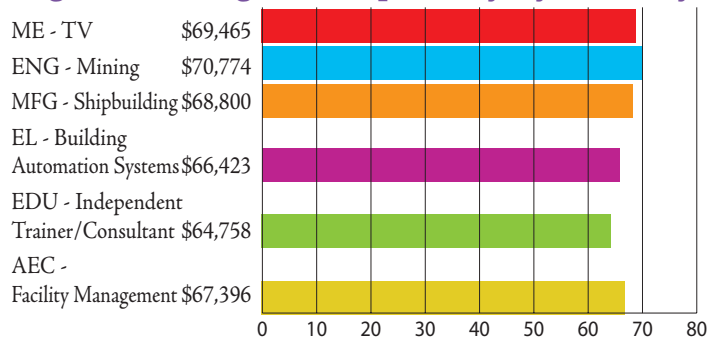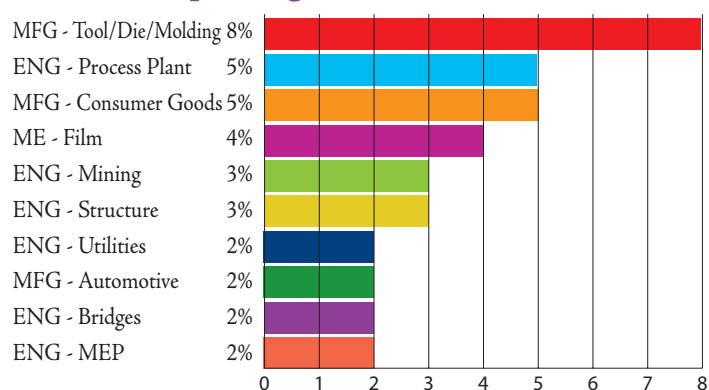| Market	%
AEC - Commercial	58%
AEC - Government	40%
AEC - Educational	36%
AEC - Healthcare	32%
AEC - Retail	32%
AEC - Residential	30%
AEC - High-End Residential	26%
ENG - Utilities	25%
ENG - Structure	24%
ENG - MEP	20%
AEC - Facility Management	17%
ENG - Process Plant	16%
ENG - Bridges	11%
ENG - Sustainability	10%
EDU - University	8%
EL - Telecommunications	8%
ENG - Mining	6%
Mfg - Medical	5%
EL - Building Automation Systems	5%
Mfg - Consumer Goods	5%
EDU - Primary/Secondary	4%
Mfg - Automotive	4%
EL - Audio/Visual	4%
EDU - Vocational/Technical	4%
ME - Design Visualization	3%
ENG - Software Development	3%
Mfg - Aerospace	3%
Mfg - Tool/Die/Molding	2%
Mfg - Semiconductor	2%
Mfg - Shipbuilding	2%
EDU - Independent Trainer/Consultant	2%
EDU - VAR (Reseller)	1%
ME - TV	1%
ME - Film	1%
ME - Games	<1%

Average Pay of Market Segments

Market	Pay
AEC - Commercial	$65,010
AEC - Government	$66,508
AEC - Educational	$64,712
AEC - Healthcare	$65,802
AEC - Retail	$65,327
AEC - Residential	$62,982
AEC - High-End Residential	$64,554
ENG - Utilities	$67,531
ENG - Structure	$65,259
ENG - MEP	$65,627
AEC - Facility Management	$67,396
ENG - Process Plant	$69,910
ENG - Bridges	$66,312
ENG - Sustainability	$66,191
EDU - University	$63,565
EL - Telecommunications	$66,002
ENG - Mining	$70,774
MFG - Medical	$63,891
EL - Building Automation Systems	$66,423
MFG - Consumer Goods	$64,140

Percentage of Each Market Reporting Extreme Busyness

Market	%
ME - TV	76%
ME - Games	71%
ME - Film	70%
EL - Audio/Visual	59%
ME - Design Visualization	53%
AEC - High-End Residential	52%
EL - Building Automation Systems	51%
EDU - Primary/Secondary	51%
AEC - Retail	50%
EDU - Vocational/Technical	50%
AEC - Residential	50%

Highest Average Paid Specialty by Industry

Market	Pay
ME - TV	$69,465
ENG - Mining	$70,774
MFG - Shipbuilding	$68,800
EL - Building Automation Systems	$66,423
EDU - Independent Trainer/Consultant	$64,758
AEC - Facility Management	$67,396

Markets Reporting Poor Workload

Market	%
MFG - Tool/Die/Molding	8%
ENG - Process Plant	5%
MFG - Consumer Goods	5%
ME - Film	4%
ENG - Mining	3%
ENG - Structure	3%
ENG - Utilities	2%
MFG - Automotive	2%
ENG - Bridges	2%
ENG - MEP	2%

HOT TOPICS

SPECIAL FEATURE

Has Your Company Done Any of the Following in the Past Year?

Reduced wages or changed benefits	10%
Increased wages or improved benefits	46%
Reduced Staff (layoffs or not replacing those who leave)	24%
Increased Staff	54%
Closed locations/offices/sites	8%
Opened locations/offices/sites	18%
Allowed subscriptions to lapse	5%
Purchased new software and/or hardware	60%
Increased outsourced/contracted work	18%
Decreased outsourced/contracted work	4%
No such changes	9%

Has Your Salary Changed in the Past Year?

Decreased	3%
No Change	25%
Increased 1 - 2 %	27%
Increased 3 - 4 %	21%
Increased 5 - 7 %	9%
Increased 8 - 10 %	7%
Increased 11 - 15 %	3%
Increased more than 15 %	5%

Do You Run CAD/BIM in the Cloud?

No, and we never will	12%
No, the technology needs to improve	16%
No, unless company policies change	40%
Yes, on a limited number of projects	15%
Yes, we are currently evaluating	11%
Yes, we use it regularly	7%

(If applicable) What Percentage of Your Company's Projects Are BIM?

1 - 25%	23%
26 - 50%	10%
More than half	20%
All	11%
None	26%
Unsure	10%

How Did Your Find Your Current Job?

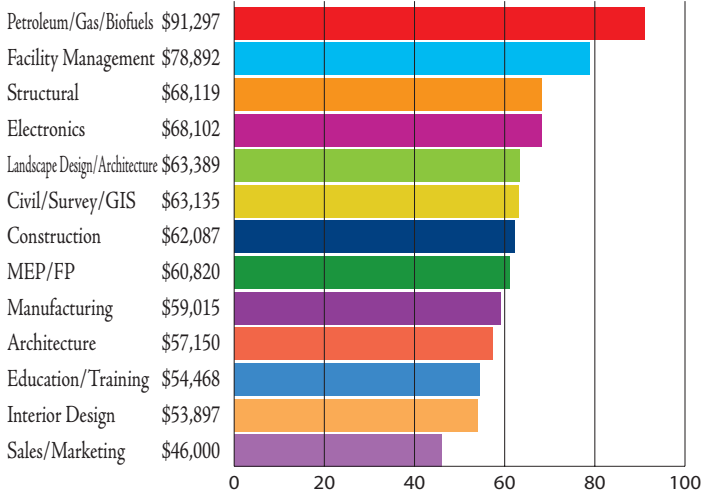|	
Word of mouth/personal referral	45%
Advertisement	20%
Recruiter	14%
Contacted company to inquire about openings	11%
Promotion	7%
Owner (Created Company)	3%

The average pay for firms that do more than half of their applicable projects in BIM is 5% higher than those who use it on less than a quarter of their projects.

Today, 26% of applicable companies are not using BIM, down from 36% when we first asked this question in 2012.

In 2007, 1.6% of respondents were BIM Managers; that number is 9% today, plus the 4% of respondents who are BIM Coordinators.
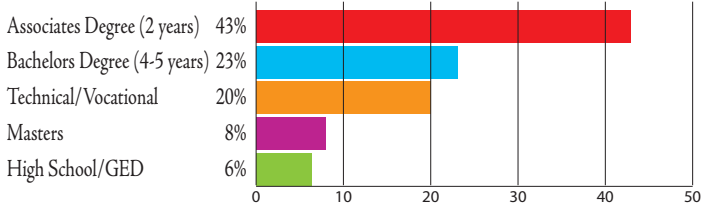
The fields paying out the largest raises this year were Construction, Architecture and Electronics.

The positions receiving the highest pay increases this year were Programmers and BIM Managers.

DESIGNER CLOSE-UP

A LOOK BACK

The following charts reflect even years only

Average AUGI Designer Salary by Industry

Industry	Salary
Petroleum/Gas/Biofuels	$91,297
Facility Management	$78,892
Structural	$68,119
Electronics	$68,102
Landscape Design/Architecture	$63,389
Civil/Survey/GIS	$63,135
Construction	$62,087
MEP/FP	$60,820
Manufacturing	$59,015
Architecture	$57,150
Education/Training	$54,468
Interior Design	$53,897
Sales/Marketing	$46,000

Percentage of Gender Pay Difference

Year	%
2004	10.3%
2006	11.5%
2008	10.0%
2010	9.2%
2012	11.5%
2014	10.0%
2016	10.0%

* these numbers reflect a 40 hour workweek

The average age of Designers is 44 years. They have approximately nine years with their current employer, and a median 18 years of experience in the industry.
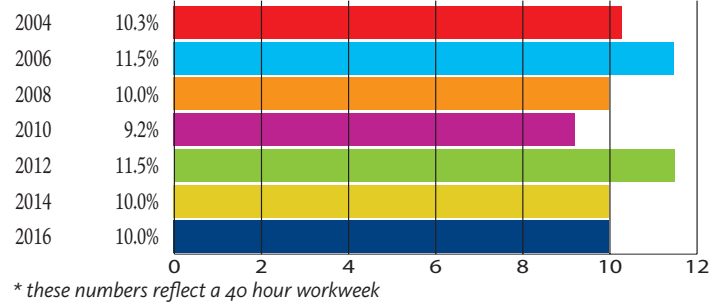
Percentage Who Experienced a Pay Decrease

Year	%
2006	3%
2008	3%
2010	15%
2012	7%
2014	5%
2016	3%
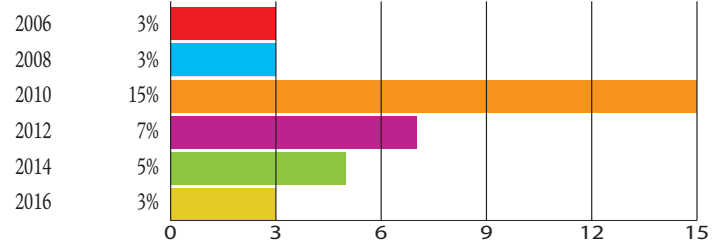
Percentage of Respondents Who Received No Raise

Year	%
2002	28%
2004	28%
2006	20%
2008	19%
2010	39%
2012	30%
2014	25%
2016	28%

What Is Your Level of Education?

Education	%
Associates Degree (2 years)	43%
Bachelors Degree (4-5 years)	23%
Technical/Vocational	20%
Masters	8%
High School/GED	6%
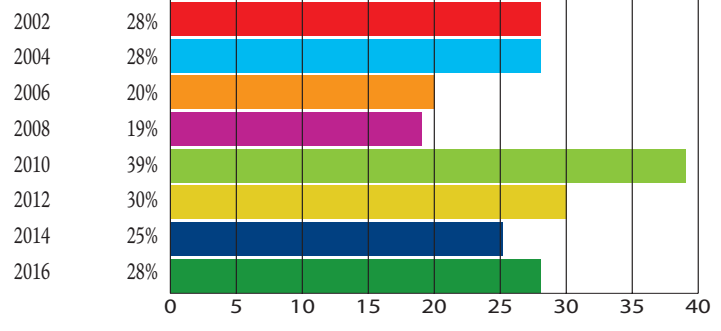
Average Designer Salary

Overall	$64,281
Female	$59,148
Male	$65,339

19% of Designers report the ability to telecommute.
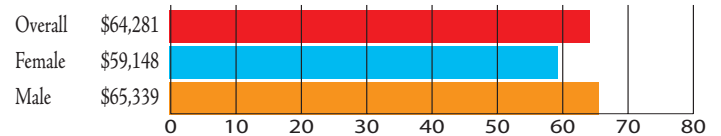
Melanie Perry is a CAFM Solutions Architect in St. Louis, MO. She is currently serving her second term as an Officer on the AUGI Board of Directors. Melanie can be reached at mistressofthedorkness@gmail.com or found on Twitter as @MistresDorkness

Shared Coordinates Help Achieve Project Success

Shared Coordinates is not a new feature in Autodesk® Revit®, and yet design professionals may not be fully realizing the potential benefits of leveraging this simple to use and powerful tool. While using Shared Coordinates is not required if working in only a couple of models and if all of the work will remain within the Revit platform, its use is undeniably helpful in situations when combining several Revit models, disciplines, and/or Autodesk platforms.

Simply put, properly using Shared Coordinates ensures alignment of several Revit models. This alignment can be between Revit models only or can be extended for alignment between Revit models and AutoCAD® site/civil content. A previous article written by Jonathan Massaro in the December 2015 issue of *AUGIWorld* highlighted the power of using Shared Coordinates and alignment with actual State Plane Coordinates. The question is, can the power of Shared Coordinates still be leveraged if real-world coordinates are unknown at the start of Revit modeling? What if Revit models have already been started, but not yet set up using Shared Coordinates—can Shared Coordinates still be used?

This article will provide answers to both of these questions and provide simple-to-follow workflows for different scenarios depending on the types of content (all Revit versus a mixture of CAD/Revit), and whether Shared Coordinates was set up from the beginning or incorporated after models were already started. Before getting into what to do, there is a need to explain some fundamental terminology that will be used for locating the projects in an appropriate coordinate system.
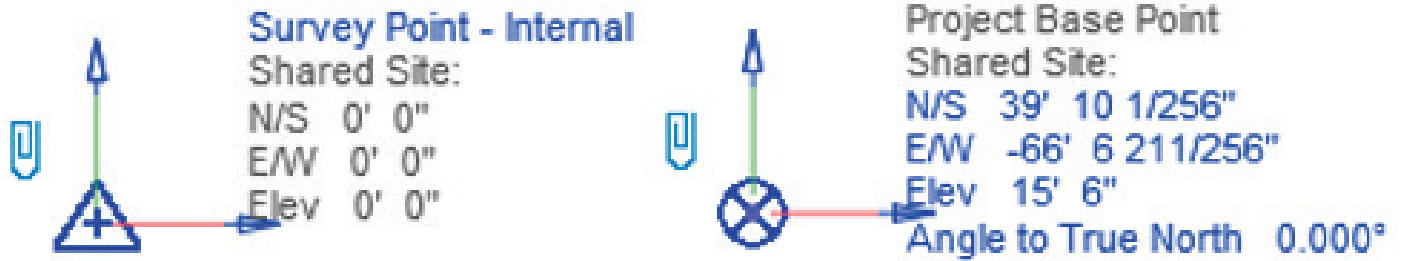
Figure 1: Survey Point and Project Base Point symbology

SURVEY POINT, PROJECT BASE POINT, AND THE MASTER REVIT FILE

The Survey Point and Project Base Point are two fundamental points that define the position of geometry in Revit models. A model's Survey Point marks the origin of its secondary or "shared" coordinate system. Models sharing a coordinate system have the same point of origin, i.e., their Survey Point represents the same point in the physical world. When selected, the Survey Point reads the location of the *icon* of the Survey Point relative to the physical origin of the secondary coordinate system. In most cases, the Survey Point will have X, Y, and Z coordinates set to zero. This does not mean the shared coordinate system originates at the physical location (0,0,0), but rather that the Survey Point icon is fixated on the coordinate system's origin.

The Project Base Point, however, can be unique to each model in the same shared coordinate system and is simply an internal point of origin from which spot coordinates can be checked against the site/civil AutoCAD file, if available. When selected, the Project Base Point reads the "true" coordinates of the model in the physical world and is often placed in an intentional location on the model to assist in positioning the project on site. The Project Base Point is used extensively for positioning models at the correct coordinates for proper alignment.

Figure 1 depicts the graphical symbols of the Survey Point and Project Base Point. Note the paperclip symbol located left of each symbol which, once clicked, controls whether the object is "clipped" or "unclipped."
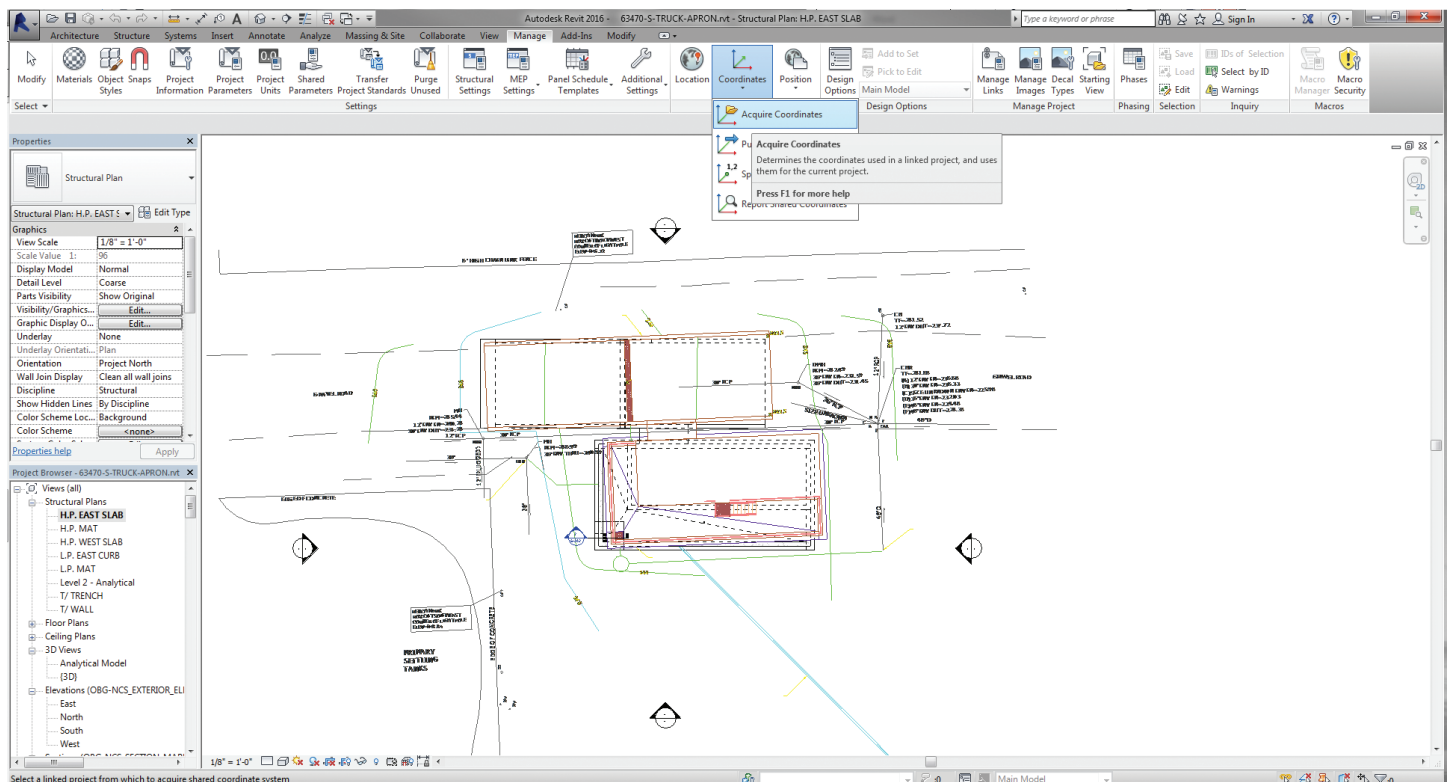

Figure 2: Acquiring coordinates from linked AutoCAD file

Revit Structure 2017

Understanding the effects of moving a Project Base Point in a clipped versus an unclipped state is vital to manipulating models of a dynamic project. Moving the Project Base Point in its clipped state should be used when relocating a Revit model on site, as changing the coordinates of the point moves all modeled and annotative content with it. This command has the same effect as the "Relocate Project" command that is built into Revit. Moving an unclipped Project Base Point, however, does not change the physical location of modeled content. This might be used if the Project Base Point needs to be attached to a different physical element of the building or if the reference corner for the building changes.

The term "Master Revit File" is not an official term, but will be used in the article. The purpose of the Master Revit File is to have one file host the coordinates that will be used for sharing across the project. No matter which scenario is followed to set up Shared Coordinates, the initial steps are performed in the Master Revit File and it is the Master Revit File that will be used by the other Revit files for acquiring the Shared Coordinates. The Master Revit File establishes the location of the Survey Point in the physical world and sets the position of the Project Base Point relative to the Survey Point.

SCENARIO 1: SITE/CIVIL CAD FILE AVAILABLE WITH ACTUAL SITE COORDINATES

This scenario is ideal for setting up a project's shared coordinate system. Prior to even starting a Revit model, a CAD file with an established User Coordinate System (CAD's Shared Coordinate System equivalent) is created and delineates where on the site the future Revit model will be located.

In order to adopt the same coordinate system as the CAD file, the Master Revit File will link the site CAD file into Revit and acquire coordinates from it. When the CAD file is initially linked into the model, likely using the "Auto - Center to Center" option, the coordinate systems are still independent of one another. It is not until the Master Revit File acquires the Shared Coordinates by clicking on the CAD file that the model's Survey Point will jump to the same point as the CAD file's User Coordinate System point of origin. Figure 2 depicts a Revit file with a Site-Civil AutoCAD file successfully linked into the project. By using the Acquire Coordinates command in Revit, the Revit project will now set the Survey Point to match the CAD file's UCS point of origin.

Once the Master Revit File successfully acquires the Shared Coordinates from the CAD file, the Project Base Point can be aligned to the point previously delineated on the site file by manually entering the X, Y, and Z coordinates into the clipped Project Base Point's properties. Doing so secures the model's position on the site plan and provides a starting point for modeling physical content. It is advantageous in model coordination and site layout for the Project Base Point to be attached to a known, referenceable element of the model. For example, the NW exterior corner of the concrete foundation wall.

Now that the Master Revit File has adopted the CAD file's shared coordinate system, all subsequent models need only to interact with the Master Revit File to establish the same system in their own models. Each discipline's Revit model will link in the Master Revit File, acquire its Shared Coordinates, and locate the clipped Project Base Point on the appropriate reference corner of the linked-in model. If these steps are taken for each Revit model in the project, if any given Revit model links in other models using the "Auto - By Shared Coordinates" option, all modeled content will align accordingly without requiring manual manipulation of the linked-in files.

SCENARIO 2: NO CAD FILE AVAILABLE FOR REVIT PROJECT SETUP

Due to the expedited nature of some projects, the Scenario 1 detailed above is not always possible. Sometimes Revit modeling must begin before a geo-located CAD file is available. If this is the case, a very similar procedure can be followed, although one that eliminates the initial step of communicating with a CAD file.

When the Master Revit File is created, the <u>clipped</u> Project Base Point will be given arbitrary coordinates, e.g., (10, 10, 10) off of which the content can be modeled. All other Revit models can then acquire coordinates from the Master Revit File, establish the same Project Base Point on the designated building element, and begin modeling.

SCENARIO 3: ENABLING SHARED COORDINATES WHEN REVIT MODELS ALREADY EXIST

In both of the scenarios outlined above, the decision to use Shared Coordinates was made before the Revit models were created. As can be imagined, making the decision in favor of Shared Coordinates at the start of the project leads to the most straightforward way of correctly implementing the feature on a project.

Unfortunately, real life gets in the way of ideal project conditions more often than not. Is there any way to implement the benefits of Shared Coordinates if models have already been created that were not set up to use them? Fortunately, not only is the answer to the question a resounding "yes," but the method for implementing Shared Coordinates post-model creation is actually pretty simple with the following four-step procedure.

1. Prior to the start of acquiring coordinates from the Master Revit File, each model needs to have its unclipped Project Base Point moved to the same designated element of the linked Master Revit File.

2. Note that this step assumes that each model has already linked to the Master Revit File by other means (Center to Center or Origin to Origin) and is already properly aligned with it. Also note that the Project Base Point's coordinate values are irrelevant at this stage because the coordinate system is yet to be shared between models.

3. The Master Revit File now establishes the coordinate system by following the instructions of either Scenario 1 or 2, which were described earlier. The previously placed clipped Project Base Point will have its coordinates changed at this stage to match the desired physical coordinates.

4. Once the Master Revit File's position is saved, other Revit models can then reload the link to the Master Revit File and acquire its coordinates as previously described. Note that the Project Base Point must be clipped prior to using the Acquire Coordinate command.

5. Without requiring any manual manipulation, the coordinates of the clipped Project Base Point in each model will then be automatically updated to match those of the Master Revit File.

Since the position of the linked models relative to one another has already been established prior to sharing coordinates, acquiring the coordinates does not affect how the models align; rather, it simply changes the value of the Project Base Point to read its position relative to the new location of the Survey Point.

Figure 3 graphically demonstrates the steps described above.
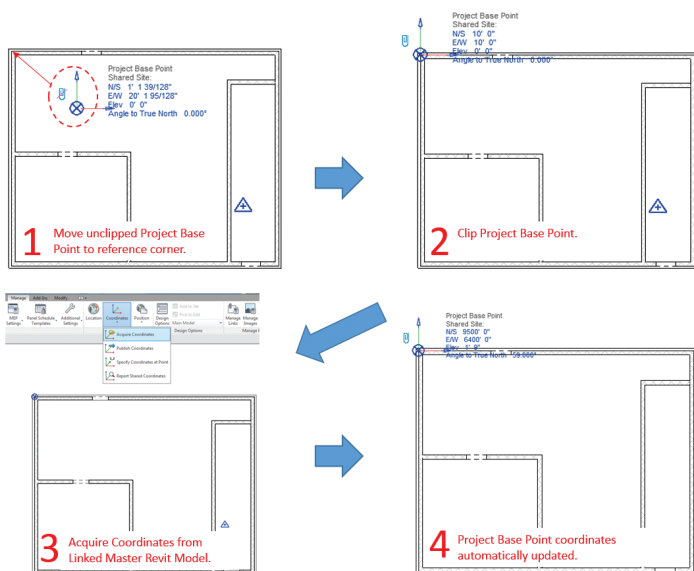
Figure 3: Process to acquire coordinates in an existing Revit model

TAKING THE MODELS BEYOND REVIT

With properly implemented Shared Coordinates, issues with alignment of multiple Revit models should be a problem of the past. Following the instructions outlined above for one of the three scenarios or developing a similar workflow to meet the needs of particular projects should help to eliminate problems with multi-model projects.

Importing Revit models into model coordination platforms such as Navisworks® is a very simple and straightforward procedure if the imported models are already aligned with each other. In fact, most users who have tried using platforms such as Navisworks without properly aligned models have likely found it nearly impossible to use the software without first aligning each of imported models to some set of coordinates.

Exporting Revit models into an AutoCAD file for inclusion in a Site/Civil file is also much simpler if the models are already aligned to each other and to the coordinates used by the CAD file. Note, however, there is one key step that must be done during the export procedure to assure that the shared coordinate system it communicated through the CAD file. For each view to be exported, change the Coordinate System Basis to "Shared" in the DWG/DFX Export Setups window. Figure 4 shows where to change this setting.
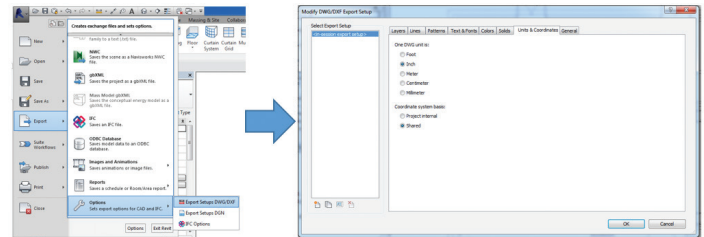

Figure 4: How to change CAD export setting from Revit

SHARED COORDINATES: EASY TO IMPLEMENT AND POWERFUL TO USE

Hopefully after reading this article, the concept of using Shared Coordinates should be a little less daunting to those who are unfamiliar with it. In fact, hopefully Revit users will see not only how useful Shared Coordinates can be, but also how relatively easy it is to set up.

In a world where designers and engineers have finite schedules and budgets in order to get projects designed and delivered, spending less time with the semantics of project setup and subsequent adjustments will allow more effort to be exerted on the key design processes of collaboration and coordination, thus leading to better designs and more successful projects.

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Tim Kivisto, P.E., is a Technical Manager within the structural group with OBG located in Syracuse, New York. He has been working with AutoCAD since 1999 and has been a Revit user since 2008. He can be contacted at Tim.Kivisto@obg.com.

by: Melinda Heavrin

Working with Roofs

Roofs are AEC objects that you can use to model an entire multiple-face roof surface. You can create roofs independently of other objects or you can place a roof on a shape defined by a polyline or by a closed set of walls. After creating the roof, you can change its overall dimensions and slope or edit its edges and faces individually. For more flexibility in customizing a roof, you can convert it to a collection of individual roof slabs.

A roof slab models a single face of a roof. Roof slab objects also differ from roof objects in that each roof slab is a separate entity with no direct connection to other entities. When you use multiple roof slabs to model an entire roof surface, you have more flexibility in editing the roof, but the combined topology (3D geometry) of the roof is not calculated automatically. For this reason, it is recommended that when you design complex roofs, you start with a roof object. Then, when the design is substantially complete, but you need more flexibility for customizing edges and other details, you can convert the roof to individual roof slabs. While roof slabs do not dynamically interact with each other, they do allow significant control over the roof geometry. For example, you can trim roof slabs individually, extend them and miter them with other roof slabs. You can also cut holes in roof slabs, add or subtract mass elements, and apply detailed fascia and soffit profiles to any edge at any angle and orientation. Because roof slabs are style-based, you can apply design changes globally.

You can assign materials to a roof. Materials are displayed in wireframe and working shade views or when rendered. Materials have specific settings for the physical components of a roof such as slab. AutoCAD® Architecture provides predefined materials for common design purposes. These materials contain settings for roof components. You can use the predefined materials as they are or modify them for your designs. You can also create your own materials. Object styles provided with the software have appropriate materials already assigned to them.

SLABS AND ROOF SLABS

Slabs and roof slabs are AutoCAD Architecture objects that you use to model floors, roof faces, and other flat surfaces where edge conditions need to be specified. They are found on the Design tool palette (see Figure 1). The slab or roof slab object is a three-dimensional (3D) body bounded by a planar polygon (perimeter) of any shape and has multiple edges. The object is defined by its perimeter, edge conditions, and style. Though they share many of the same properties, slabs and roof slabs represent separate style categories and tool types. For instance, you cannot apply the properties of a slab tool to an existing roof slab object.

Using slab and roof slab tools, you can create slabs and roof slabs independently or you can create them from existing objects such as walls and polylines. Slabs and roof slabs created from other objects do not maintain a link to the original object. Pitched roofs are usually designed by specifying a plate line and a slope angle. Roof slabs are designed so you can use the same approach in laying them out. To add a roof slab, you simply specify two points and an angle. If you have a traditionally designed roof created from a two-dimensional (2D) plan showing ridge, hip, and valley lines, you can trace over that plan with roof slabs, specifying the desired height and slope. From these values and the specified points, the software creates the correct three-dimensional (3D) model.

You can customize each slab or roof slab edge individually, applying styles and making other adjustments as required by your design. A slab or roof slab edge style defines the fascia and soffit design from profiles that you create for these components. You can specify whether the style uses a fascia, a soffit, both, or neither. You also specify how the fascia and soffit are positioned relative to the slab or roof slab.

Slabs and roof slabs have their own distinct style categories in which individual styles specify the default properties for specific types of slabs or roof slabs. These properties include dimensions, edge styles for the fascia and soffit, and entity properties for layer, color, and linetype. Slab and roof slab styles allow you to use a different edge style for each edge. You can assign materials to a slab or roof slab. For example, a floor slab can be assigned a material representing tiles with concrete edges. These materials are displayed in wireframe or rendered views. Materials have specific settings for individual components of slabs or roof slabs such as the body, fascia, and soffit.

In addition to the control provided by slab or roof slab styles and edge styles, AutoCAD Architecture includes a variety of tools for editing slabs and roof slabs to fit unique conditions. For example, you can add holes to slabs for structures such as chimneys and vent pipes. You can also use roof slabs to create dormers.
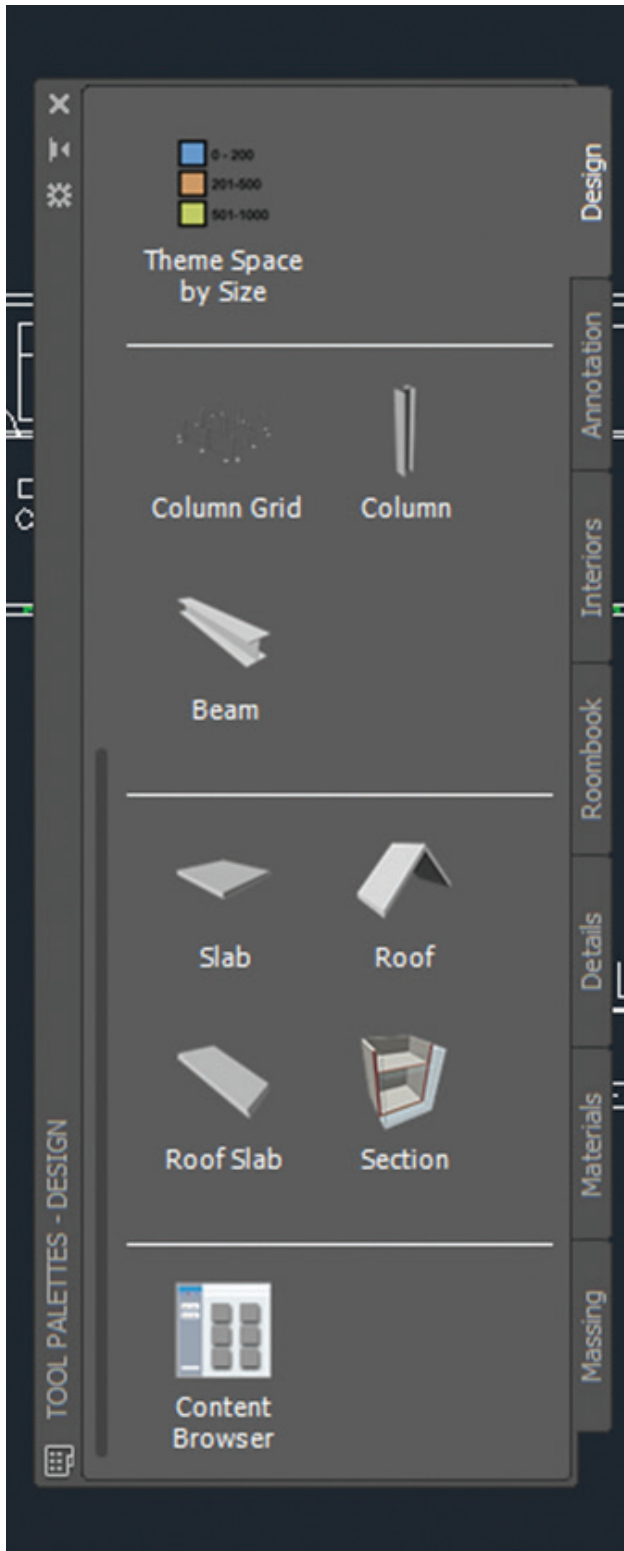
Figure 1: Design tool palette

SLAB AND ROOF SLAB STYLES

A slab or roof slab style is a set of parameters that determines the appearance and other characteristics of the slab or roof slab object to which it is assigned. By editing a style, you can control the prop-

erties of all objects that use that style, without having to change the properties of each such object in a drawing. For slabs and roof slabs, the style controls the following properties:

+ default dimensions, including thickness
+ default edge conditions, including fascia and soffit styles
+ default display properties, including fascia and soffit
+ physical components (concrete, metal deck, and so on)
+ materials assigned to components of slabs

The default slab and roof slab tools provided with the software use standard styles (see Figure 2). You can use these as provided, edit the standard styles in the Style Manager, or create your own styles and use them to make new tools.

You can create a slab or roof slab tool from a slab or roof slab style by dragging the style from the Style Manager onto a tool palette. The default settings provided by the style are then applied to any object created with that tool.

To create, copy, edit, or purge styles for slabs and roof slabs, you use the Style Manager. The Style Manager provides a central location in AutoCAD Architecture where you can work with styles from multiple drawings and templates.
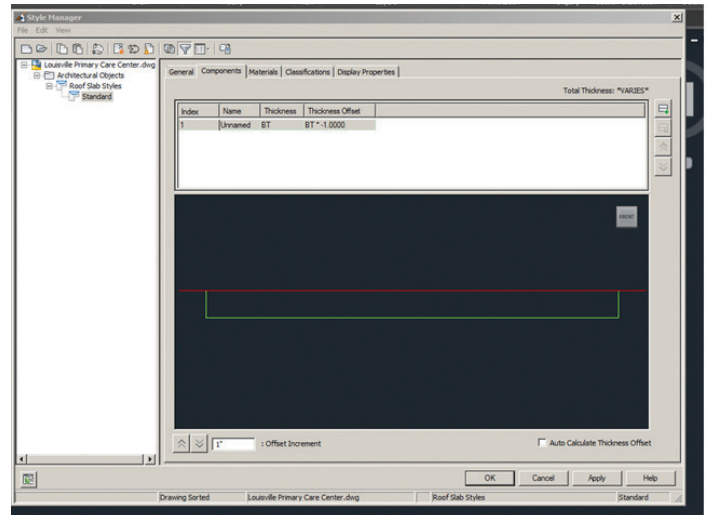
Figure 2: Style Manager

EDITING SLABS AND ROOF SLABS

After placing a slab or roof slab object, you can change its style, location, size, shape, slope, edge styles, and other characteristics. You can miter its edges and trim or extend it using another object as a reference. You can also modify slabs and roof slabs using other objects as interference conditions or body modifiers.

Depending on the type of editing you want to perform, various methods may be available:

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- After selecting a slab or roof slab, you can click any non-grip point along the perimeter and drag the entire object to a new location. You can also move the object by clicking a grip, pressing the space bar, and then moving the object to the new location and clicking again.

- You can drag the grips that are displayed on a selected slab or roof slab to reorient it, resize it, or change other physical characteristics (see Figure 3).

- For grip edits where you are changing a dimension or an angle, the Dynamic Input feature lets you enter a precise value instead of dragging a grip. (This feature is activated by default.)

- You can apply the properties of a slab tool to an existing slab or the properties of a roof slab tool to an existing roof slab.

- You can change settings on the object's Properties palette. You can also use the Display tab of the Properties palette to change the display property settings for a selected object display component in the current display representation.

- You can use editing commands from the object's contextual ribbon tab.
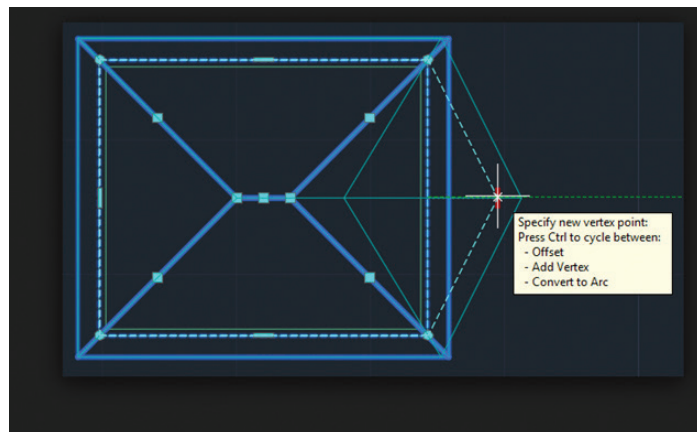
Figure 3: Roof grip edit

CREATE A ROOF TOOL

You may want to create your own roof tools if you are placing multiple roofs that have the same properties. For example, say you are creating an office building that has a multi-peaked roof. Although the entire roof is single sloped, each peak has a different slope. To work efficiently, you can create a roof tool for each slope and select the appropriate tool to place the roofs with the correct slope on each area of the building.

Open the tool palette where you want to create a tool. If you want to create a tool from a roof in the drawing, then select the object and drag it to the tool palette. If you want to copy a tool in the current tool palette, then right-click the tool and click Copy. Right-click and click Paste. If you want to copy a tool from another tool palette, then open the other tool palette, right-click the tool, and click Copy. Reopen the palette where you want to add the tool, right-click, and click Paste. If you want to copy a tool

from the Content Browser, then click the Home tab, Build panel, Tools drop-down, Content Browser and locate the tool you want to copy. Position the cursor over the i-drop handle and drag the tool to the tool palette.

Now right-click the new tool and click Properties (see Figure 4). Enter a name for the tool. Click the setting for Description, enter a description of the tool, and click OK. Expand Basic and expand General. Click the setting for Description, enter a description of the roof created from this tool, and click OK. Specify a layer key and any layer key overrides if you do not want to use the layer assignments specified in the layer key style used in the drawing. Specify roof settings. Expand Dimensions and enter a value for Thickness and select a new setting for Edge cut. Expand Next Edge, select a new setting for Shape, and enter a value for Overhang. Expand Lower Slope and enter a value for Plate Height. Expand Upper Slope and enter a value for Upper Height. Expand Lower Slope or Upper Slope for a double slope roof and enter a value for Rise or Slope. Click OK.
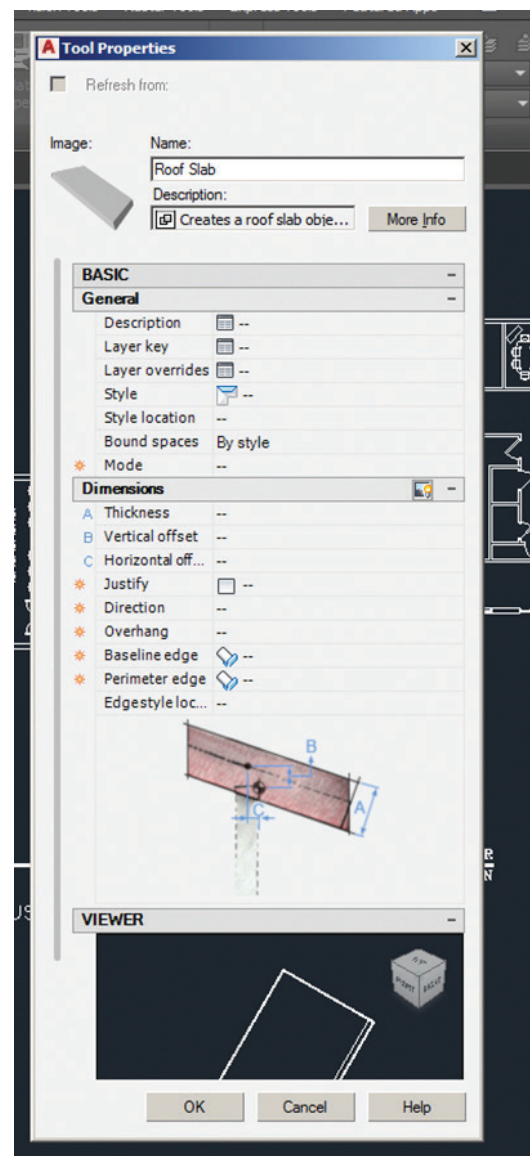

Figure 4: Roof slab tool properties

CREATE A ROOF

You can create a single slope or double slope roof object. You can add additional slopes to a roof face by right-clicking a roof object and clicking Edit Edges/Faces. Open the tool palette that contains the roof tool you want to use and select the tool. You can also click the Home tab on the ribbon, Build panel, Roof Slab drop-down, and select Roof. On the Properties palette, select Single slope or Double slope for Shape (see Figure 5). In the drawing area, specify points for the corners of the roof. When you are finished specifying points, press Enter.

You can create a single sloped roof and set each edge to gable as needed. You can specify a slope for the gable ends to create a hip. You can even create a gable on an existing roof by gripping any ridge line point and stretching it past the roof edge. Open the tool palette that contains the roof tool you want to use and select the tool or use the Build panel on the Home tab of the ribbon. On the Properties palette, select Single slope for Shape. In the drawing area, specify the first point for the first roof edge. Specify the second point to complete the first sloped roof edge. On the Properties palette, select Gable for Shape. In the drawing area, specify the next point to create a gable roof edge. Select Single slope for Shape. Specify the next point to create a sloped roof edge. Select Gable slope for Shape. Specify additional points as needed to define the roof and press Enter. To create a clipped gable roof, you first need to convert the gabled roof to roof slabs.

You can create a roof that is based on a selected closed set of walls and has the properties of the roof tool you select. You can edit these properties after creating the roof. The roof takes its plate height from the top of each wall segment. Open the tool palette that contains the roof tool you want to use. Right-click a roof tool and click Apply Tool Properties to Linework and Walls. Select the walls to convert and press Enter. If the walls you select are not closed, a roof is added to the top of each wall segment. When prompted to erase the original geometry, press Enter to keep the wall, or enter y (Yes) to erase it. Edit the properties of the roof on the Properties palette, if needed.

You can create a roof that is based on a 2D polyline and has the properties of the roof tool you select. You can edit these properties after creating the roof. Draw a closed 2D polyline in the shape of the intended roof in the location where you want to place the roof. Open the tool palette that contains the roof tool you want to use. Right-click a roof tool and click Apply Tool Properties to Linework and Walls. Select the polyline to convert and press Enter. When prompted to erase the original geometry, press Enter to keep the linework or enter y (Yes) to erase it. Edit the properties of the roof on the Properties palette, if needed.
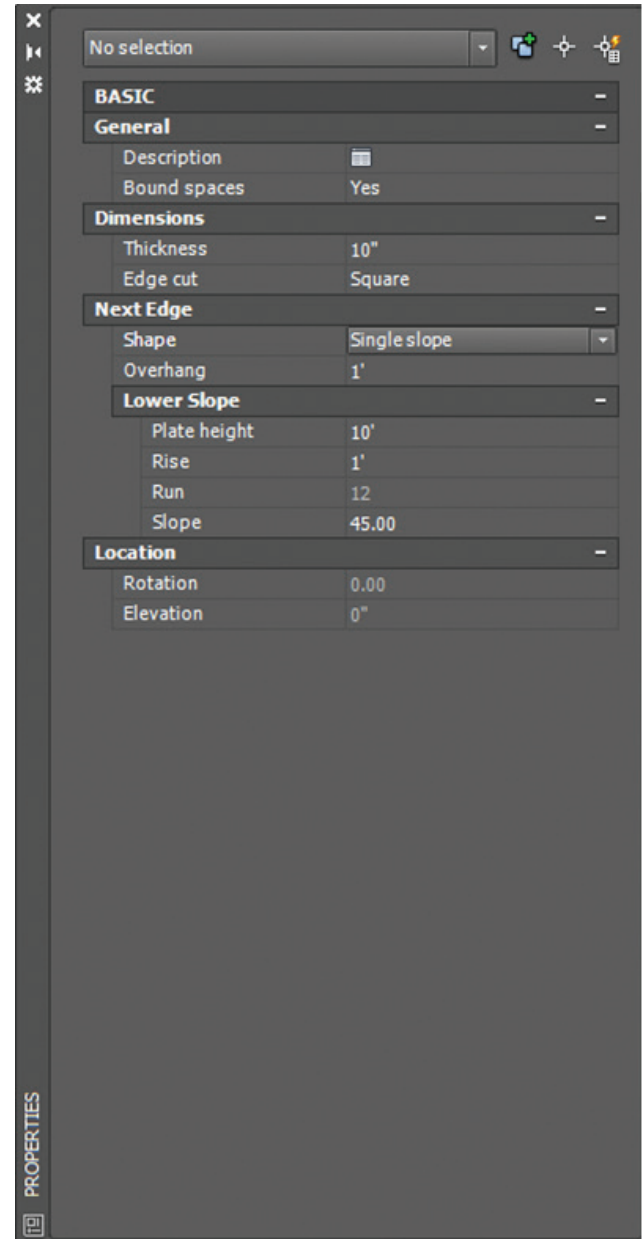

Figure 5: Single slope roof properties

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PRODUCT FOCUS

Putting the Q in the QAT

T he Quick Access toolbar (QAT) can be found in many software products including Microsoft Office and Autodesk design software including AutoCAD® and its verticals. Figure 1 shows the QAT in Autodesk AutoCAD (1) and then again in Microsoft Word (2). The Quick Access Toolbar is a customizable toolbar that contains a set of commands grouped together. The QAT, by default, is found in the upper-left corner of the application window. Many people use the QAT for printing, saving, and opening files—the basic commands we all need. AutoCAD gives us the ability to customize the QAT to a new level. You can right-click to add a command, create a custom command, or even add a macro with a custom button to launch from the QAT. In this article we are going to explore how to turn the QAT from a part-time user to a full-blown productive application.
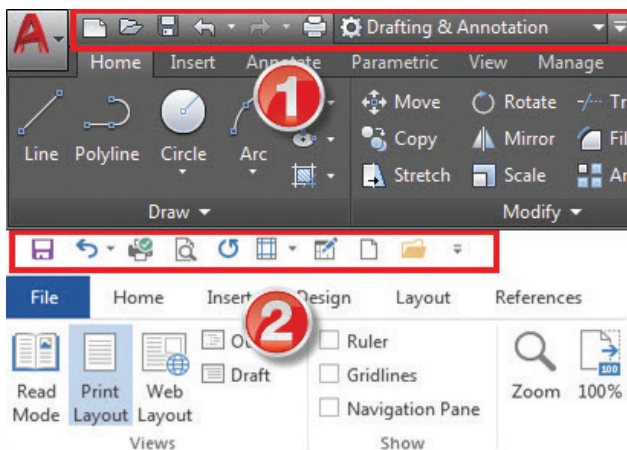
Figure 1: Quick Access toolbars

THE BASICS

Most of the default tools located in the QAT are related to CAD drawing and management tasks such as New, Open, Save, Undo, etc. Basic commands can be added to the QAT by selecting the application arrow and checking any of the default items on the list shown and they will be added to the current QAT. You must also be aware that the QAT is linked to your current workspace. We will review how to create multiple QATs later in this article.

Note: Show the menu bar on this list (Figure 2) will display the menu bar above the ribbon. I am not sure why this is there since it does not have much to do with the QAT. This setting can be controlled by typing menubar at the command prompt and changing it from 0 to 1. Let's talk about adding more commands.

SHOW ME MORE

When selecting more commands from the drop-down you will bring up a command list window. This window is the CUI editor showing only the command list area. We are going to add Dimension, Match Properties, and the Circle commands. Start typing within the command list area and AutoCAD will find the commands matching your letters (notice how I typed match and the CUI found 3). Then with your mouse, select the command and drag directly into the QAT area. When finished, hit Apply-OK and your new commands will be added.
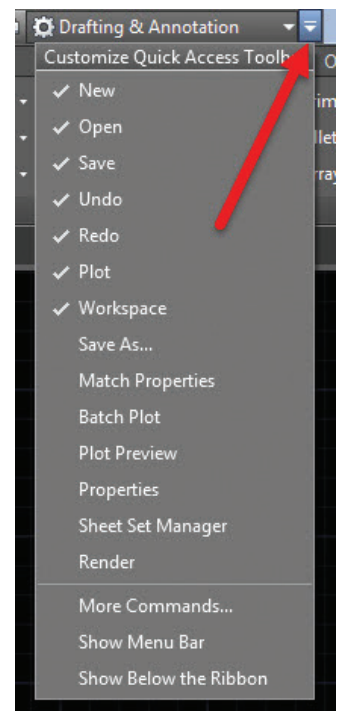
Figure 2: Adding basic commands

A RIGHT-CLICK AWAY

One of the more preferred methods of adding a command is to right-click the command and select Add to Quick Access toolbar. This time we will right-click the layer combo control box. A dialog box will pop up and we will select Add to the Quick Access Toolbar as shown in Figure 4. Notice how the combo box is added right
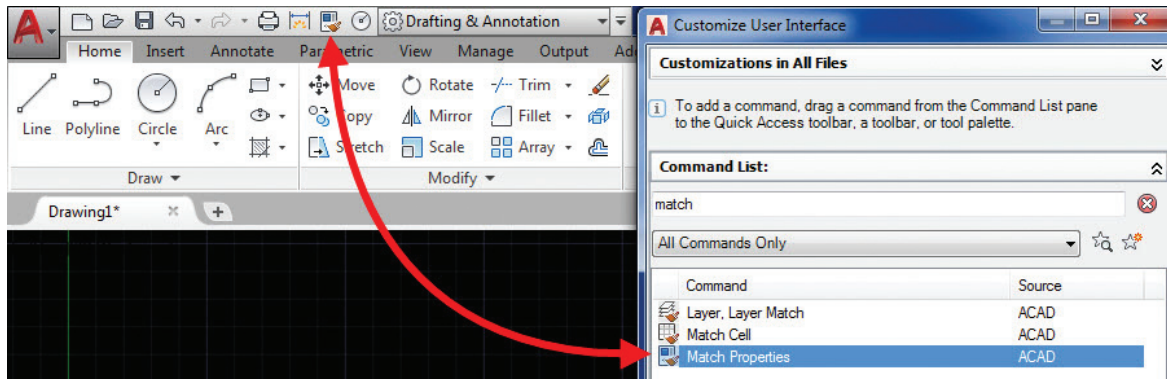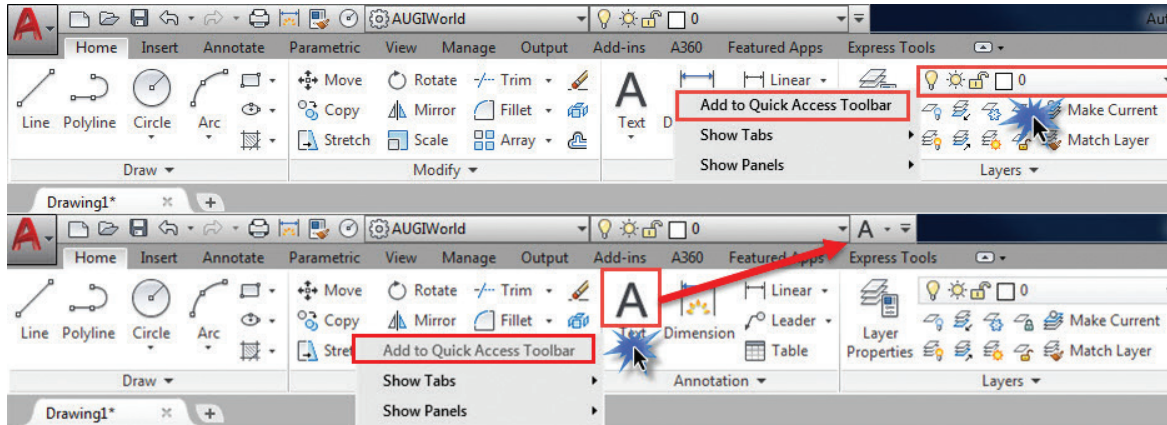
Figure 3: More commands to drag

Figure 4: Right-click to add commands

next to your workspace. Continuing on with the same method, we will now add the text command to the bar as shown. We have just added two separate commands to our current QAT.

CREATING CUSTOM QUICK ACCESS TOOLBARS

Now that we have covered the basics we are going to create several QATs and link those to different workspaces. In the previous exercise we added tools to the current QAT, which in many cases is named Quick Access Toolbar 1 and is linked to all default workspaces in AutoCAD. Let's copy that QAT and rename it, then create a new workspace and attach that new QAT to the new workspace.

On the Manage Tab – Customization panel on the ribbon, choose user interface to display the Customize User Interface editor (see Figure 5). In the Customization pane we are going to pull out our Quick Access Toolbars section and right-click and select Copy (1). Then we will select the Quick Access Toolbars heading and select Paste (2).

Right-click your copied QAT (named Quick Access Toolbar 2 by default) and rename to AUGIWorld as shown in Figure 6. We have now created our own QAT, which we can connect to a workspace.

We are next going to attach our new QAT to our workspace (Figure 7). On the Manage tab go to the CUI Editor or type CUI at the command prompt. Make sure your AUGIWorld workspace is current; select that and drag over to the Customize Workspace pane right under your Quick Access Toolbar 1 (will be shown) and notice it will change to AUGI-World. Close the CUI editor and now your customized QAT is current with your workspace.

USING THE CUI TO ADD A NEW COMMAND TO THE QAT

Now that we have our QAT connected to our Workspace we are going to change a command then add a new custom command. Open up the CUI and pull out the AUGIWorld QAT as shown in Figure 8. The section shown with the vertical red arrow is the order of the commands that are in your QAT. This is where you can drag the commands around to what you are comfortable with.

We will explore this further with the layer combo control box. Touch the layer combo control box and notice how the Properties pane appears to the right. Many people ask, "Now that I have that up there, how do I increase the width so I can see the entire layer name?" The default value is 208 as shown in Figure 8. Change that value to 300 and watch your layer combo box change within the QAT (this number will react differently depending on your monitor). This affects only the QAT attached to your current workspace and not the general combo box on your ribbon. A very cool trick!

Next up we are going to create a custom command and add it to the QAT. Go back and open the CUI as we have done before and pull out the AUGIWorld QAT. Move down to the bottom left pane to the command list area and select the star (create a new command) as shown in Figure 9. This will launch the editor to create a new command.
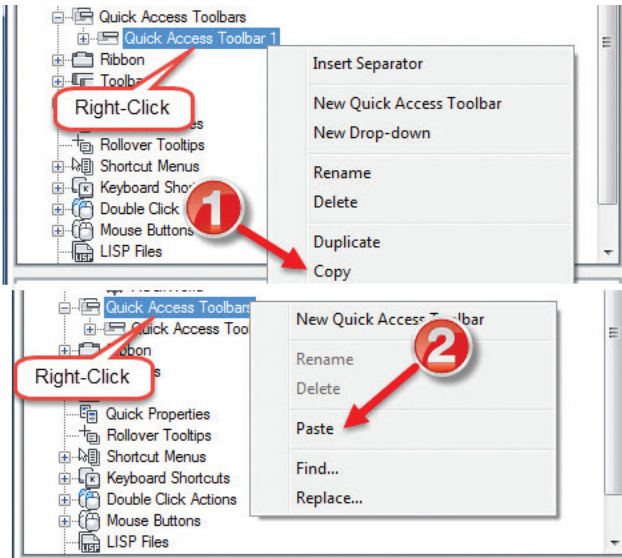
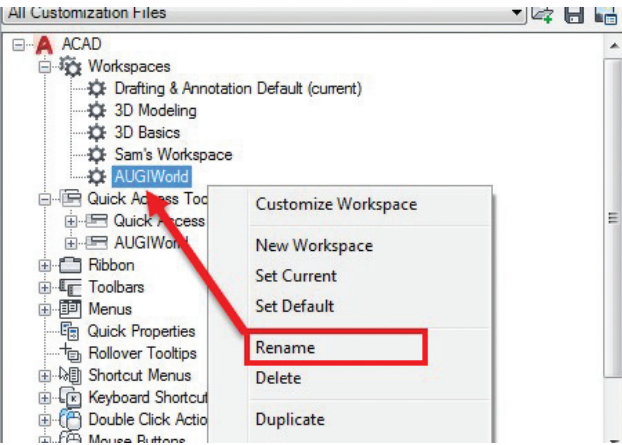# AutoCAD 2017

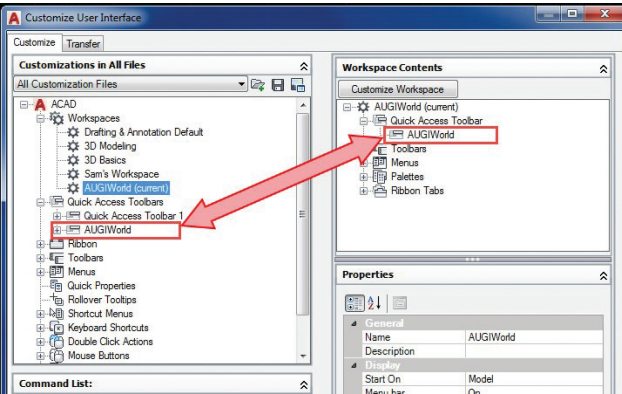Figure 5: Copy and Rename your QAT

Figure 6: AUGIWorld QAT

Figure 7: Attach the QAT to your workspace

We are going to move over to the right panes of the CUI and use both the top and the bottom sections. Notice how I started with Step 1, the command; we will get to the button at the end. We are going to create a macro to change the text case from lower case to upper case. Under section one, name the Command TUP (for TUP).

1. Section 2 contains the area where we will create the macro. First I will introduce you to a few macro syntax names. Macros are a sequence of commands that will run a command at the command prompt. Do a test and look at the command line when
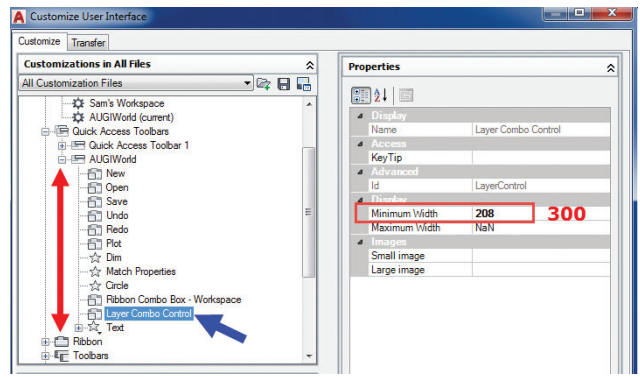
Figure 8: Changing the Layer Combo Control width

you type tcase and select objects to change the case of text. The macro to change text from lower case to upper case reads as:

^C^C-tcase;\;U;

Let's take a closer look at the code and use color and numbers to help us out with macros.

1. The ^C^C represents a cancel of a command. Not only once but twice, because we all know in AutoCAD it takes 2 to cancel a command.

2. The hyphen (-) suppresses the dialog box. We need to have the command be driven from the command line; bringing up a dialog box will halt the process.

3. Launch the command from the command line.

4. The semicolon represents pressing an enter or return on the keyboard.

5. The forward slash represents a pause for user input. Note: When using macros to access a path to locate a file, you must reverse the slash in the path to represent the path.

6. Another semicolon to hit a return on the keyboard.

7. The u will tell the user that we are going to choose uppercase for our text.

8. Finally, one more return to complete the command.

We have now entered our command name and macro. It's time to choose and/or create our button.

2. In section 3 we are going to create our button. Still within the CUI, move over to the button section. You have more than 600 images to select from or you can start from scratch to create your button. Find one that looks like a piece of text. Keep in mind you can search for the change text command and find something similar, but make sure you save as a new name or export the image and import back in when you need it.
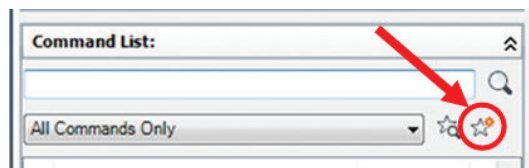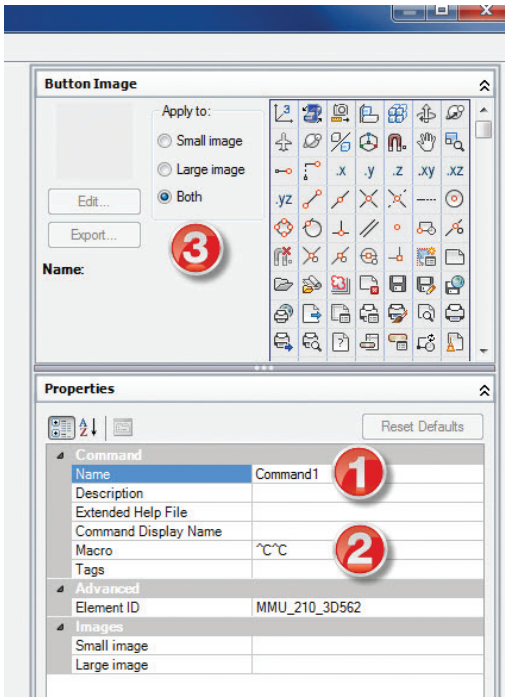

Figure 9: Create a new command
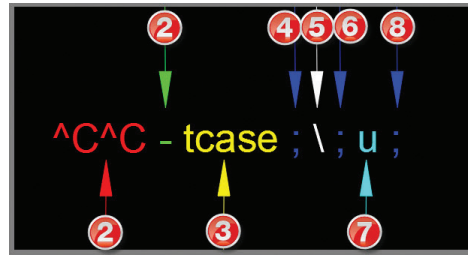
Figure 10: Name, macro, and button

Figure 11: The macro, broken down

So, you ask, what is putting the Q in the QAT? The Q is quality; adding custom commands to the QAT is not only quick, but also provides a quality product and efficiency as we draft and design. Add your commonly used commands and custom commands to the QAT and work quicker while being productive. Take it one step further and link several QATs to different workspaces, providing you quick access to many different tools while working on different elements of the project. Everyone works differently; it's up to you to put the Q in the QAT and make that toolbar work for you full-time.
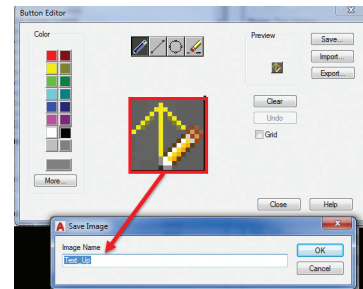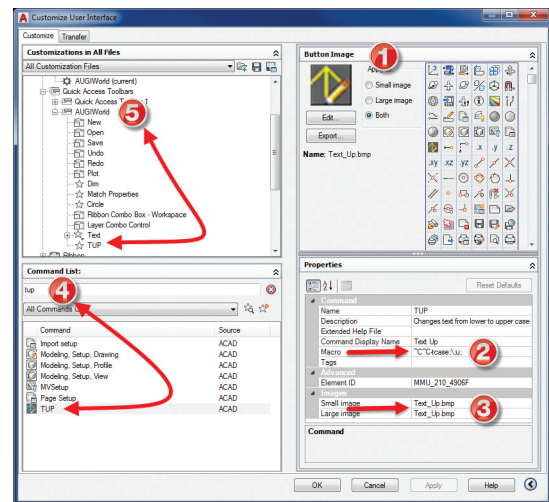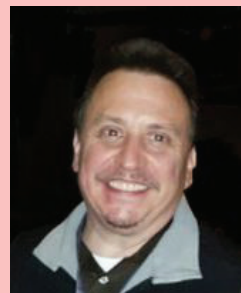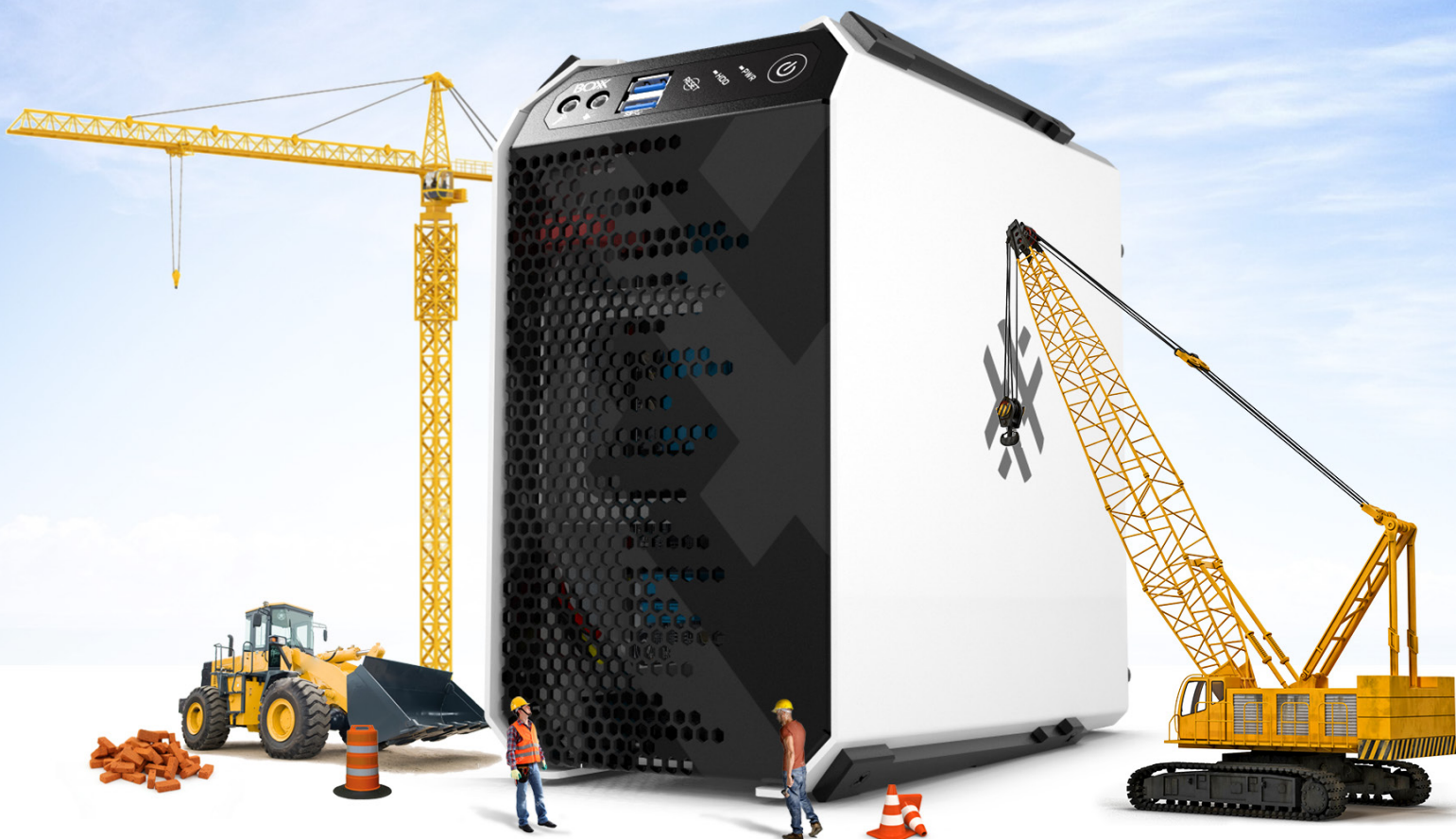

Figure 12: Button editor

For this example, we are going to select an existing text button and modify, then do a save. In the Save Image dialog box shown in Figure 12, type Text_Up in the name box and click OK. This image will be saved in the current customization file. It is good practice to export your image to a secure location. When you upgrade your software, your image will be available for import. Note: If you just edit an existing image and save, you will alter the original image that is connected to that command.

We have our command name, macro, and button created. Now we just drag and add our new command to our AUGIWorld QAT as shown in Figure 13. Let's take a closer look at the items we changed and/or added.

1. Created a new button image

2. Applied a macro using the tcase command to start

3. Saved the new button image (and exported to a secure location)

4. Named the new command TUP

5. Dragged the new command to our AUGIWorld workspace

Hint: If you want to learn more about macros join me at Autodesk University 2016 where I will be teaching a hands on lab titled "Pumping up Productivity in the Lab with Macros, One Character at a Time." Join me as we will explore how to modify old, create new, and have some fun with macros at #AU2016.

Figure 13: Let's add a button

CONCLUSION

Macros can be very efficient in AutoCAD. Once you start looking at the CUI you will notice that many of the commands are driven by macros and the code is there for you to explore. The possibilities of you customizing the QAT to your needs have become a reality. The goal for many of us is to be quick while continuing to maintain quality in our design deliverable.

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