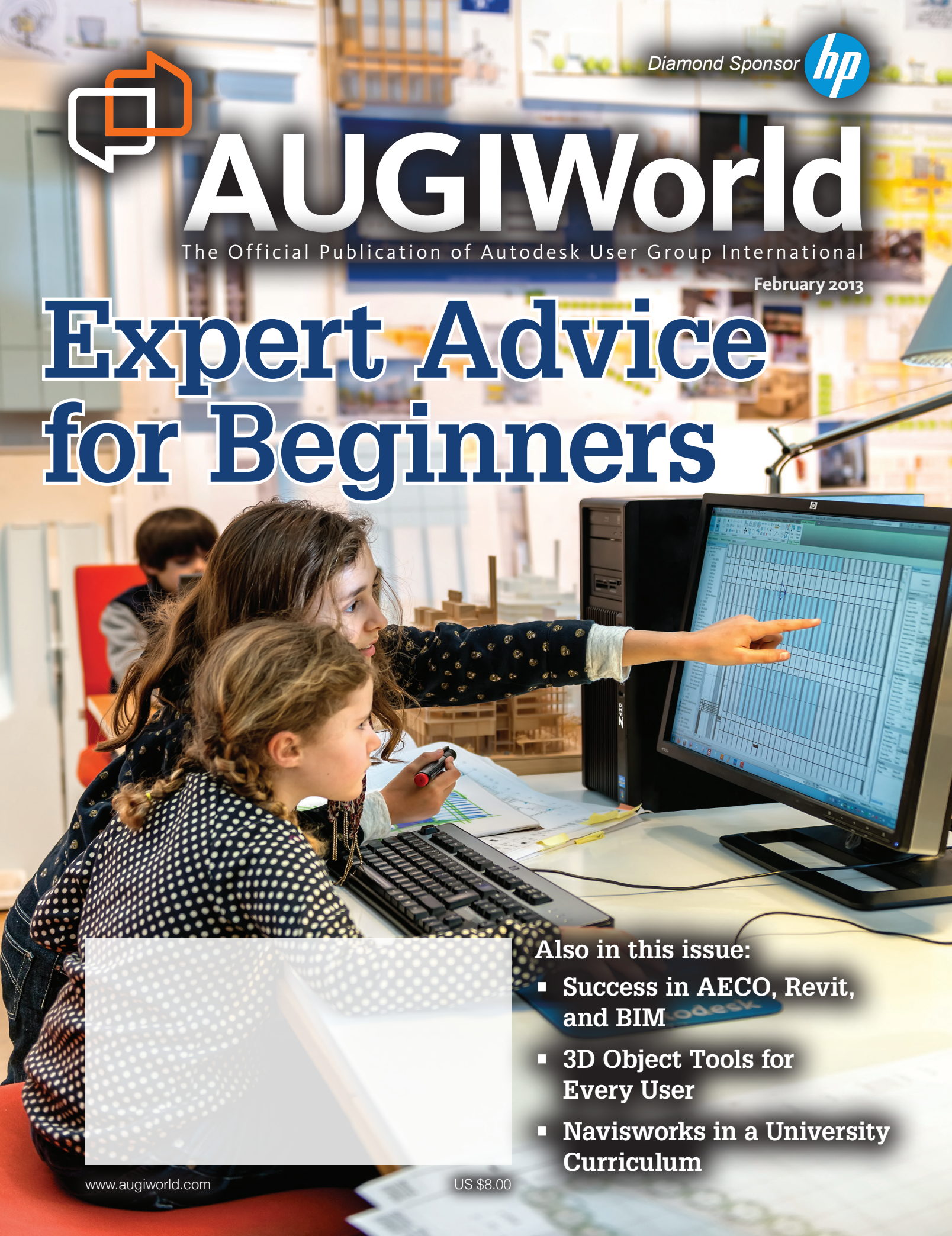
AUGIWorld

The Official Publication of Autodesk User Group International

February 2013

Expert Advice for Beginners



Also in this issue:

- Success in AECO, Revit, and BIM
- 3D Object Tools for Every User
- Navisworks in a University Curriculum

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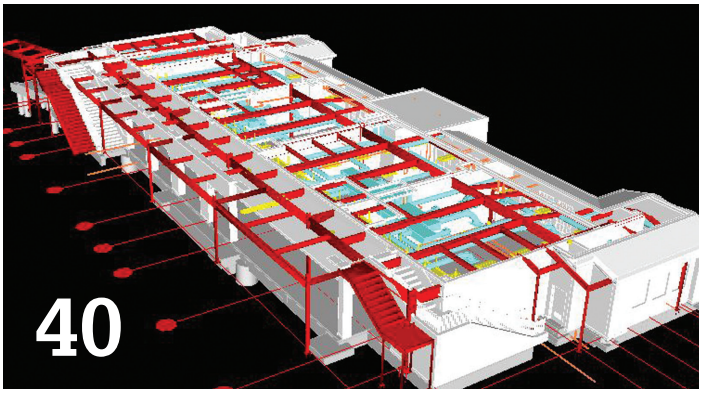

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Cover image: Jeanne & Alice Roscelli at Renzo Piano Building Workshop, Paris, France.

Visit Daniel's website at http://danielhurtubise.com/

Editor's Note

Dear *AUGIWorld* reader,

A funny thing happened in the office today. I became a beginner…again. Really? Now? I've been in this industry since 1987 when I first began to use AutoCAD® v2.6 after hours of self-training. So I certainly don't consider myself a beginner with AutoCAD. But what we often seem to forget is that even with a boatload of experience under my belt, when I fire up an application that is new to me, I am a beginner…again.

How is this happening in today's world? Pretty easily, actually. With the recent push of Autodesk product suites, users like me are suddenly finding themselves with access to totally new applications that do more than ever before. For example, my company had a license of Autodesk® Revit® Structure Design Suite. But that has now been "migrated" to a Building Design Suite Premium license and with that I now have access to Autodesk® Navisworks® Simulate and Showcase—apps I have never used before!

This issue of *AUGIWorld* isn't covering these specific applications, but it highlights the trend in the industry. Users are getting access to more and more applications they have never even heard of, much less used. You would be well advised to begin to play with applications and see how they can interrelate with those applications you do use.

Meanwhile our readership has proven to range from Day 1 beginners to Day 9,300 beginners (like me). There is never a time to stop learning and improving. So get off the social networks during your lunch hour and discover something you don't yet realize can make your life so much easier.

For our cover image, my friend Daniel Hurtubise came through with a shot of a typical Autodesk setup. He's always ready to share a great shot, not to mention being a Revit Architecture consultant and guru.

And finally, would you like to get your hands on a real copy of *AUGIWorld* magazine? You know, like on printed paper? If so, it's simple—just upgrade yourself and join AUGI as a Professional member. It is just $100 per year and comes with *AUGIWorld* and a membership to Autodesk Developer Network (ADN) for free!

Take care,

David Harrington

AUGIWorld

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by: Adam Muñoz

Livin' the Dream

Twenty years ago tonight, I had a dream I was flying. It was a lucid astral-projected dream—I believe a visit to a possible alternative reality.

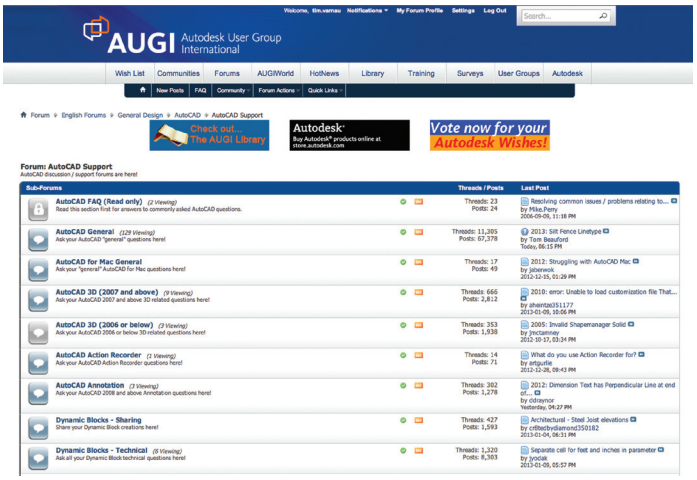
I was visited by a goofy looking, long-haired guy who said he was me in 20 years from a future parallel universe! He gave me a magazine with messages from the future containing images of inventions in two and three dimensions. It was called *Cadalyst*.

"Open it," he told me, laughing. "I wrote you a letter." So I opened the magazine.

BEGINNING OF LETTER

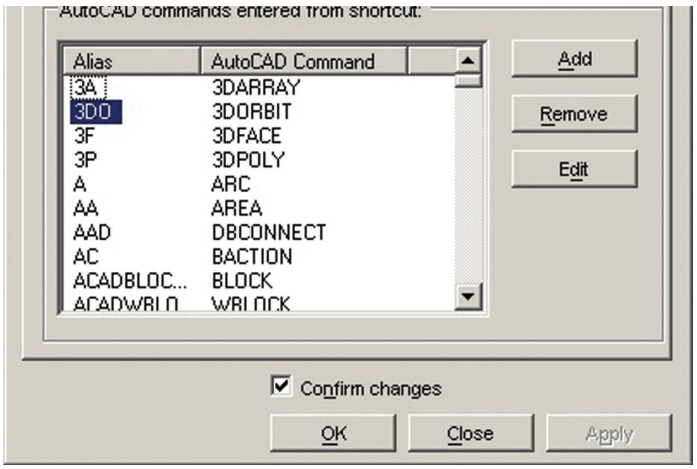
You're just starting a journey that will last a lifetime … AutoCAD®! Get excited knowing that you will help design and draft many AutoCAD drawings and produce "how to" documents assisting many others in making their dreams reality. Throughout this letter I will CAPITALIZE some important AutoCAD commands for you to research later.

Twenty years into the future you're lucky to be still practicing and learning AutoCAD. It will connect you to drafters and designers all around the world.



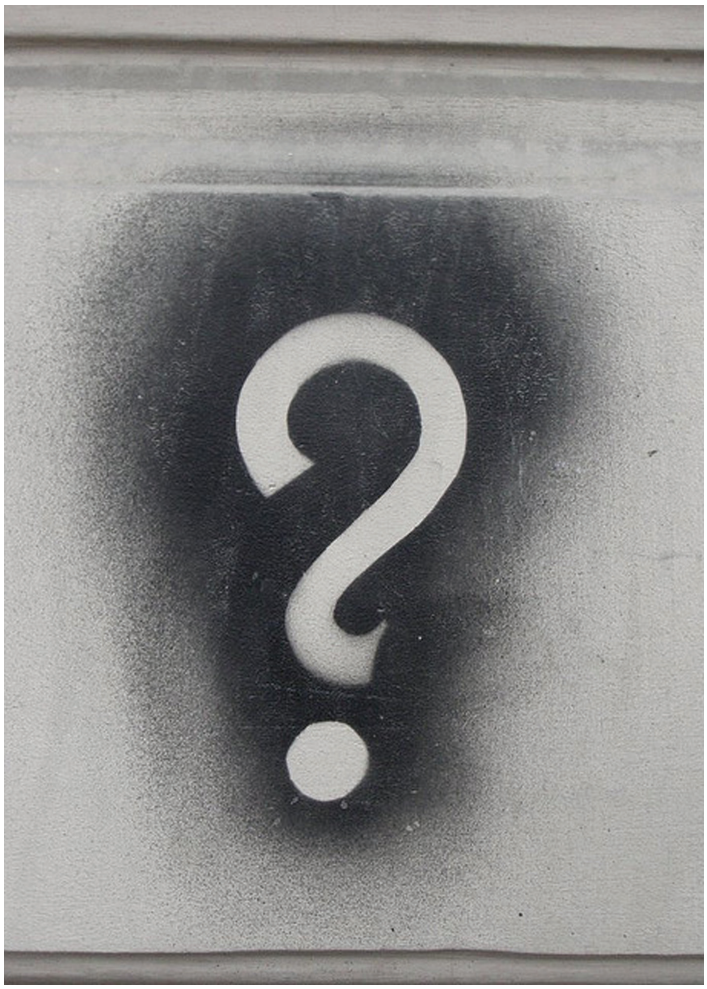
Be prepared for change as the look and control of AutoCAD will change with each release, every year. New releases may be exciting at first, but over the years it can be a challenge to relearn some of your favorite tools and commands. One way is to learn your favorite AutoCAD variables. SYSVDLG will help with that. And load your favorite LISP routines using the "Startup Suite" in your APPLOAD dialog box.

Read your command line when pushing those buttons, hit the F2 key, and remember some of those interesting commands. Creating your own shortcut keys using the ALIASEDIT tool will eliminating having to remember or learn commands. This will help as tools move from pull-downs to toolbars, buttons, auto-hiding palettes, and now interchanging ribbons (which you will slowly begin to like).



You can prepare for these new features by learning about them ahead of time. You will find experts on the *Cadalyst* team and the many Autodesk websites. Friendly people at the AUGI discussion boards and various CAD blogs will also be ready to help when you have questions. Don't forget about YouTube, your local user groups, and Autodesk Authorized Training Centers for training help.

Becoming more social will help you learn many AutoCAD tips and tricks. Shadow fellow drafters as they work with AutoCAD. Notice the things they do differently and don't be afraid to ask questions. There are many ways to skin a cat in AutoCAD, so you



must be patient and open to new ideas or commands. Some things might take you longer to accomplish at first, but become easier to execute over time.

Try to share and help everyone—tips and tricks are everywhere. Many people can teach you methods and shortcuts that should not be overlooked. Learn to look at your drawings in 3D views to see what happens to an element with a THICKNESS or ELEVATION. Find out why I try to use BURST instead of EXPLODE and all the differences between the two. What are the results you get when using the FLATTEN command and how can OVERKILL help? Why is it sometimes not enough to use PURGE and why might LAYDEL or WBLOCK work better when you need to scrub clean or minimize file size?

Throughout your journey don't miss opportunities to ask as many questions as you can. You don't want to overwhelm or bother one person, so ask when would be a good time to get together. Spread your questions out to many team members and make sure to learn from people in different regions. Along with questions about a project, be sure to learn the company standards and workflows. It is good to approach all AutoCAD users as teachers and students—learning and sharing when possible. Wait until you have multiple questions in order to minimize the number of times you're interrupting your teammates' workflow.

AutoCAD 2013

I like to use blue highlighters on hard copies for questions, highlighting completed remarks in yellow to assure all the engineer's edits are accounted for. A couple of great drafters ingrained in me that I should always know every object I draw and what it is doing in the engineered detail. Similarly, a great engineer told me to always ask and understand the load path of the designed detail.

When you begin a new job, the company CAD standards are typically the first thing you'll want to learn. In college you'll learn ASME Y14 Drafting Standards, which are a good baseline set of drafting standards that cover a wide variety of topics. On each project, be sure to inquire if there are similar or sample projects that can be referred to for utilizing details, notes, and ideas to stay consistent with the company or project standards and requirements. These can be tough to learn, so first verify if the CAD manager or company standard consists of standard specific templates, layer translators, or custom AutoLISP routines that may be available.

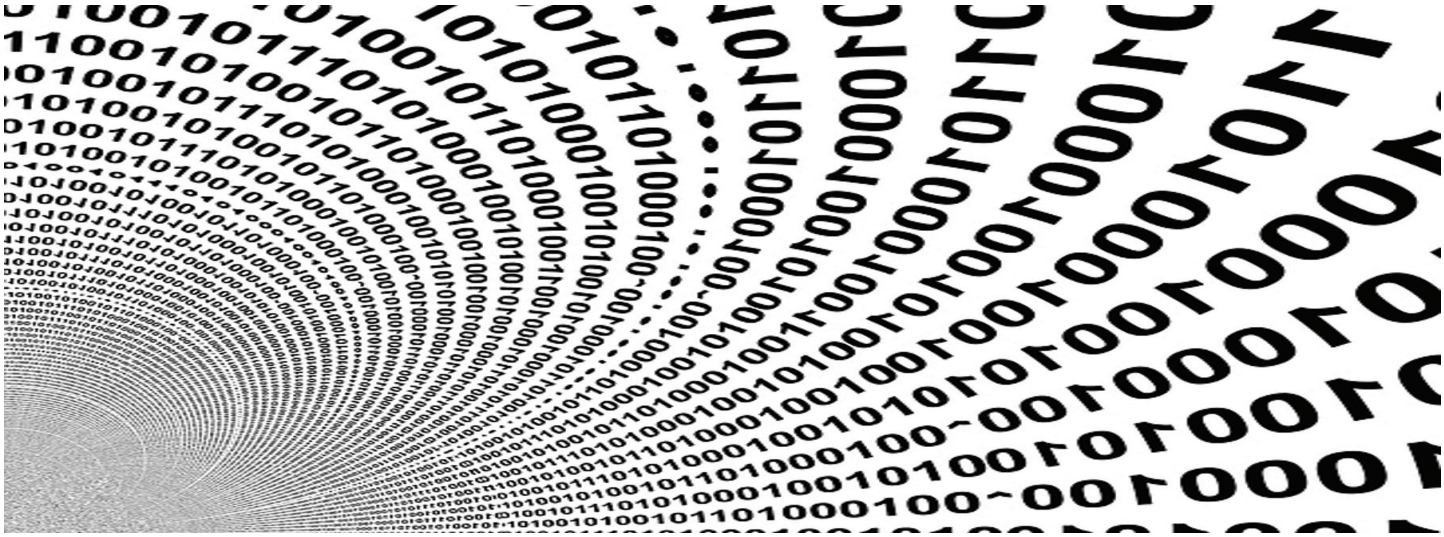
Be sure to keep in contact with past team members from companies you've worked with. You'll meet many people who share your excitement for learning and are more than willing to help others keep up with the latest AutoCAD design and drafting trends. Building your own contact list will be useful as you remember working with helpful, interesting, and inspiring folks. Meeting AutoCAD artists, drafters, and designers in other states and countries is one of the most exciting experiences ahead. Learning design techniques of the past, present, and future from people in different regions of the world and how they all can be researched, tested, and integrated has endless possibilities.

Learning programming languages such as AutoLISP, C++, or .NET can seem overwhelming, especially if you're not excited or aware of the possibilities. After researching ideas and taking a few classes from other experts you'll decide what percentage of your life you'll want to spend as a user versus a developer. I tend to create just enough programming to make me dangerous, but I should push myself more. Much of the AutoCAD geometry can be driven and displayed many ways through live circular use of external references, clipping planes, Excel linking using DATALINK,

TABLE, and TABLESTYLE. The use of FIELDS, and much of this hierarchy linking of geometry, is making it easier to drive AutoCAD geometry in multiple ways.

You should never stop learning and being aware of all your continued education options. Autodesk University is one of my recent favorite techniques of learning, which involves taking multiple classes at a large convention held annually for three days in Las Vegas. You'll be learning what other experts are doing around the globe, sharing ideas across disciplines, across oceans, and across platforms. Also consider attending your local junior college to learn and share industry trends with other instructors. I also try to attend at least one or two webcasts a week regarding work-related techniques and then share relevant research and development with my team.

You'll slow down playing video games, possibly getting overwhelmed with button combinations and AutoCAD variables, but you will need to pick up video games again. I see those roads will run closely together and become even more intertwined into the future. AutoCAD will open many possible pathways and doors for careers from helping with inventions, to buildings and bridges, to special effects for movies, and video game design. You can even

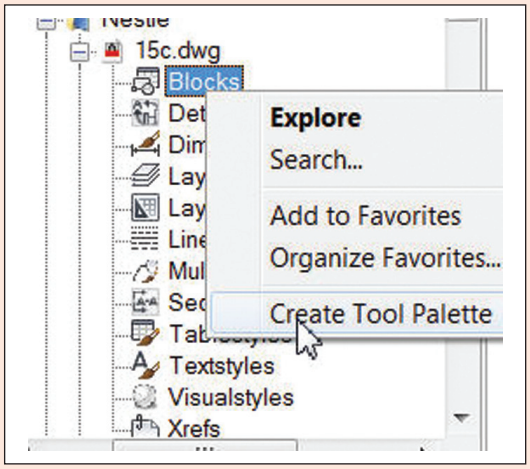


And Here's How To…
Create a Tool Palette from a Drawing's Blocks

The DesignCenter was introduced in AutoCAD® 2000 and remains a great interface to access many of the named objects in any AutoCAD drawing. If you have blocks in a drawing that you would like to make available to other drawings, the optimum solution would be to create a Tool Palette.

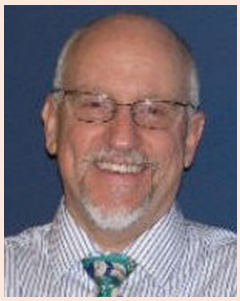
HOW TO CREATE A TOOL PALETTE OF BLOCKS FROM DESIGNCENTER

1. Launch DesignCenter with Ctrl + 2 or from the View tab >Palettes panel >DesignCenter. The interface looks just like Windows Explorer/My Computer.
2. Navigate to the drawing containing blocks you would like to add to a tool palette.
3. Expand the .DWG node to display a lengthy collection of the drawing's Named Objects.
4. Right-click on the Blocks node, then click Create Tool Palette.



INSIGHTS

- If the tool palette window is not yet open, it will open automatically when you click Create Tool Palette. For future reference, that's Ctrl + 3.
- In the above exercise, the name of the tool palette will be the name of the drawing from which it was created.
- After clicking on the Block node in DesignCenter, you can select several blocks, then right-click and make a tool palette from the selection; you will be prompted for a name in this circumstance.
- By default, all blocks on a tool palette have their 'Prompt For Rotation' set to <No>. To edit them all, click in an empty spot on the tool palette, then use Ctrl + A to select all the blocks. Now right-click on one of them, > Properties, then set the Prompt for Rotation to <Yes>.



Michael E. Beall (B. Arch.) is an Autodesk Authorized Author and the owner of CAD Trainer Guy, LLC. He has been presenting onsite CAD training around the planet for more than 30 years. Contact him at michael.beall@cadtrainerguy.com, or give him a call at 502.500.2267.

find AutoCAD in many medical fields—helping to create tissue and bones in 3D.

I will leave you with this: It is important to find a team to work with where you can control a low stress level and have a balanced life.

END OF LETTER

The goofy looking, long-haired version of me finished by saying this:

"Do not mistake lucid dreams for nightmares. Take control of your dreams. These dreams can help you learn from and figure out problems during your waking life. If you do not choose a dream, you may walk through life ignoring coincidence and dismissing déjà vu."

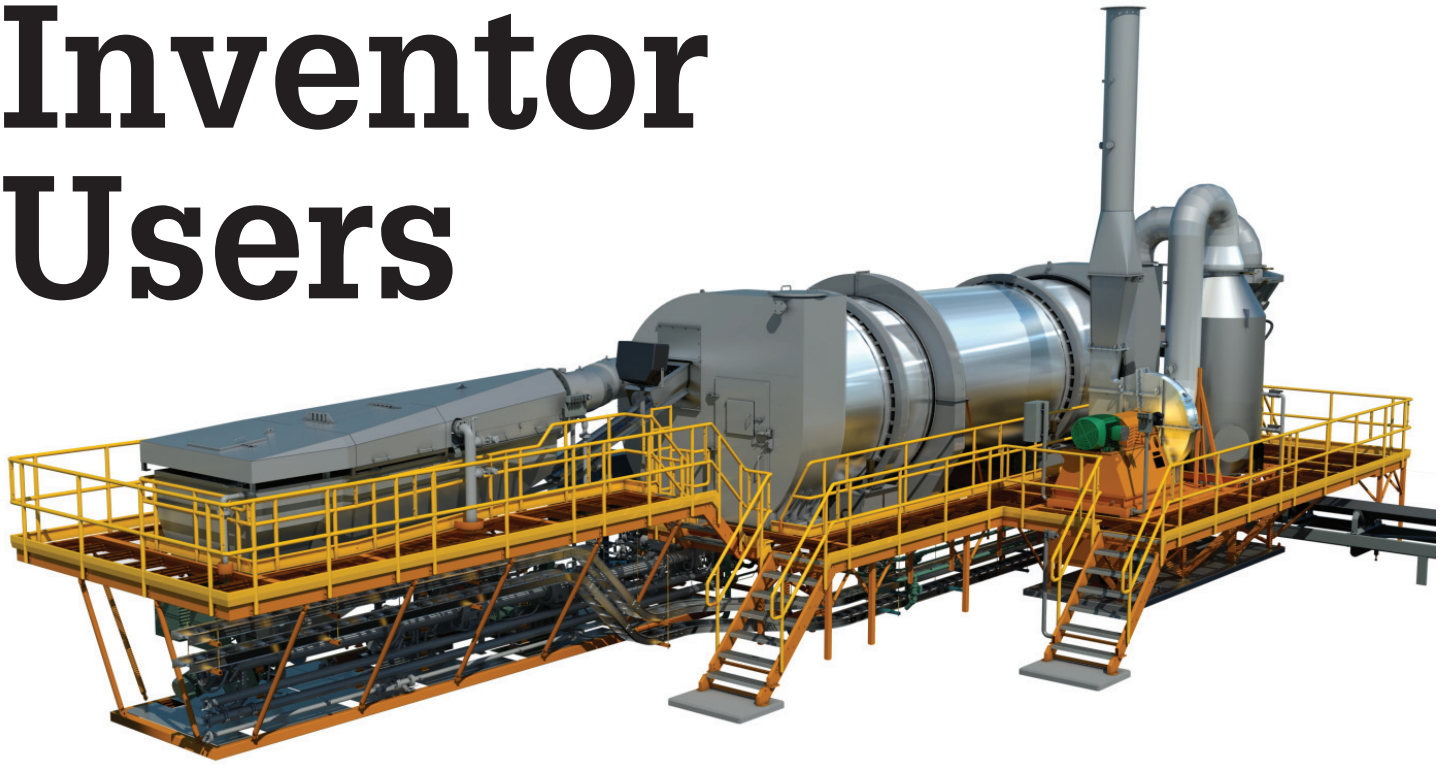
I'm happy to be visiting myself tonight in a dream and I will deliver the message as it was delivered to me 20 years ago. This AutoCAD drafter from the future would like you to remember something Socrates and Confucius both said along these lines: "Knowledge exists in knowing that you know nothing."

Adam Muñoz is a Roseville, California based Structural Drafter with HGA Architects and Engineers. You can reach him at amunoz@hga.com

Inventor 2013

by: Mark Flayler

Basics for New Inventor Users



In today's global market, as manufacturers work to reduce design cycles and cost margins, industry experts are championing digital prototyping as a way to cost effectively validate design ideas and accelerate the development of competitive products. The Autodesk® Suites include numerous tools to help in the design cycle. Autodesk Inventor® is the central component in two of these suites (Factory Design and Product Design) and a supplementary component of another suite (Building Suite Ultimate).

Autodesk Inventor takes engineers beyond 3D to digital prototyping by giving them a comprehensive set of tools for 3D mechanical design that enables them to design, visualize, and simulate products before they are ever built. Digital prototyping with Inventor helps companies design better products, reduce development costs, and get to market faster.

Because the Inventor model is an accurate 3D digital prototype, it helps users to check design and engineering data as they work, minimize the need for physical prototypes, and reduce costly engineering changes discovered after the design has been sent to manufacturing.

Autodesk Inventor has several types of files you must understand before getting started. These include basic modeling file types as well as project files. Unlike AutoCAD®, where there are only two files types to manage (DWT and DWG), Inventor uses separate files for reference management, part, assembly, presentation, and drawing design.

PROJECT FILES (.IPJ)

As you create designs in Autodesk Inventor, file dependencies are created between files of different types. For example, when you create a 3D assembly, a file dependency between the assembly and its part models is created. As your designs grow in complexity, these dependencies can become more complicated. Inventor utilizes project files to locate the required files as they are needed. As a result of using the information contained in the project file, when you open that 3D assembly Inventor can locate the 3D part files and display them properly.

In the context of an introduction to Autodesk Inventor, it is important to realize that you must have an active project before you create any files. This is why the project file is listed in the New and Open dialog boxes. Inventor installs several sample project files, but the default project is initially active. Depending on your particular usage of Inventor, it may be pertinent only to have one

project or you could have many based on your file system and design needs.

PART FILES (.IPT)

This environment is where all part modeling, sketching, and complex design takes place on individual components. Specific tools exist here for sheet metal, plastics, electrical connectors, complex surfacing, editing non-native parts, and more. Several styles of part modeling techniques are used here depending on company guidelines for required output and 3D modeling standards.

Parts are traditionally started with a sketch and then features are created from those sketches (extrusions, revolves, sweeps, lofts, coils, and so on), but geometry can also be added from selecting already placed geometry (holes, fillets, drafts, chamfers, and so on).

ASSEMBLY FILES (.IAM)

Parts are added to assemblies to position and constrain together to form the completed design. Parts are not copied into the assembly when placed (50 1MB part files do not make a 50MB assembly file); instead, their relative location is hyperlinked into the assembly for referencing.

Part modification can still be accomplished inside the assembly to visualize how the change will affect other components when modified. When you make a change to a part, the change is evident in each assembly or drawing that references that part. Assembly files can be referenced by other assembly files (creating subassemblies), presentation files, and drawing files.

PRESENTATION FILES (.IPN)

This file type is used for two purposes. First and foremost, it is used to create explosions that will be used for disassembled views in drawings for easy documentation. Second, it is used for animation tasks for quick visualization of assembly or movement for internal review to different stakeholders. Inventor has a rendering Studio environment and the Design Suites have Showcase and 3Ds Max for more intricate stills or animations.

DRAWING FILES (.DWG OR .IDW)

This file type is responsible for creating orthographic views and annotations for designs. IDW and DWG files are also interchangeable. Depending on your workflow and need for use in downstream applications, you can create your production drawings with either file format, but DWG allows more collaborative and functional uses.

FILE ASSOCIATIVITY

As changes are made to parts, assemblies, and presentation files, their updates will update other files in which they are referenced—whether that it is just a drawing file or numerous other assemblies or subassemblies. For instance, if a part is used in 50 different assemblies, a change made to that part will update how it appears in 50 different assembly files simply by changing it in the part file.

As some of these relationships get more advanced or more components are reused, data management software such as Autodesk® Vault (free with Inventor) becomes important to aid in managing relationships and associations of files to each other. Tools that copy entire designs and sever links to the original files are extremely valuable for iterative designs that you don't want tied to an original file from another job. Data management systems can resolve links that reside within modeling files to new path locations and file names without manually relinking files to their correct references.

HISTORY-BASED FEATURE MODELING

Inventor is a feature-based modeling program, which means that a part evolves by creating features one by one until the design is complete. To start a design, there are several base features from which to choose. Below is an example of four, but there are more.

There are primarily two types of features you can create with Inventor's modeling environment—those that require 2D profiles to create (Sketched Features) and those that require only existing geometry (Pick and Place).

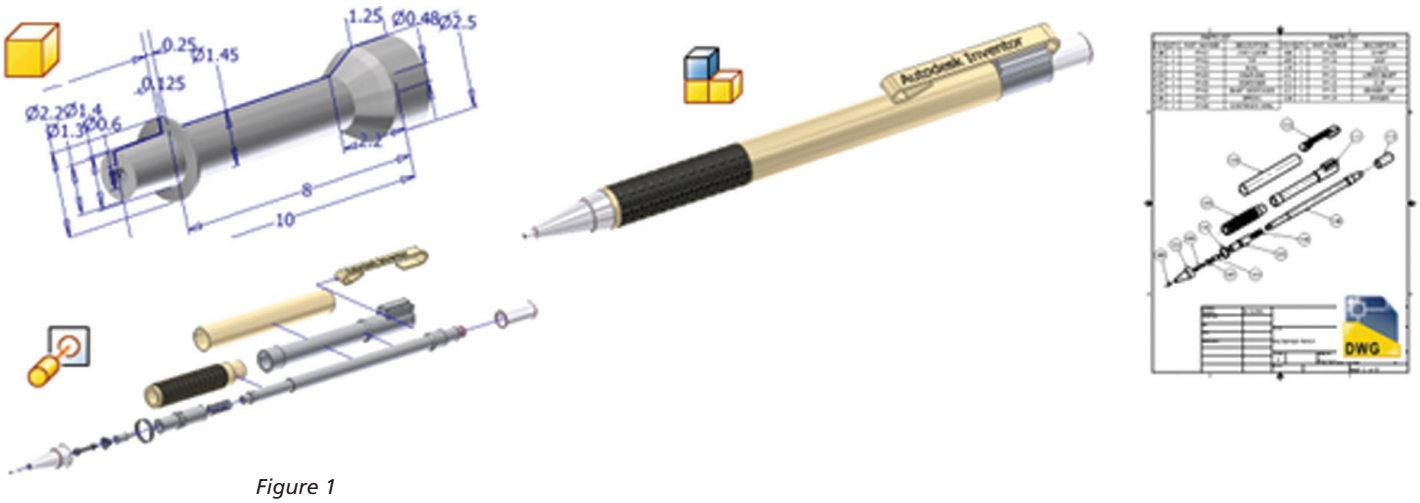


Figure 1

Inventor 2013

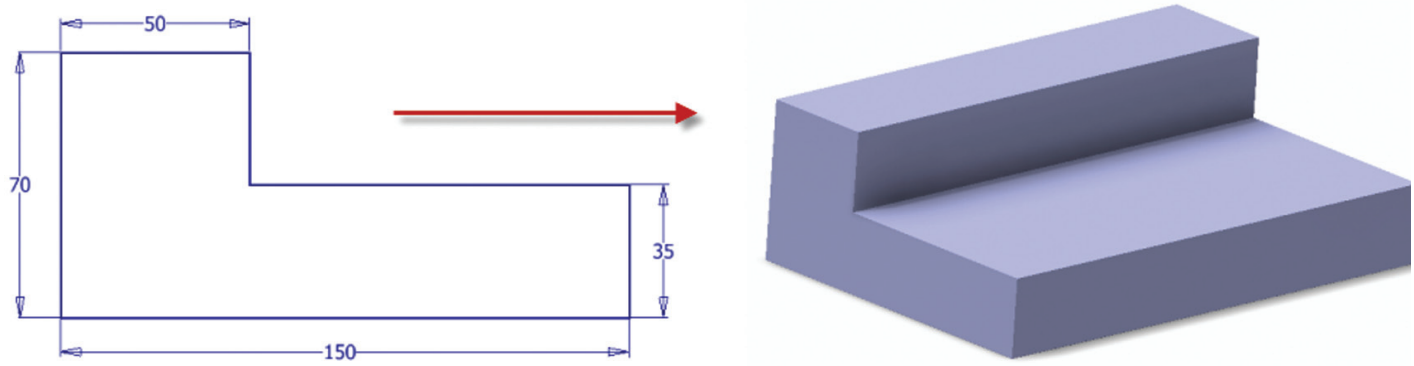


Figure 2

Sketched Features are created by sketching its shape or profile and can be any shape or size. To create a sketched feature, you must sketch a 2D cross section on the placement surface or plane and add dimensions and constraints to define and locate the sketched geometry with respect to the model.

Pick and Place features are those for which a shape has been predefined. To create a pick and place feature you must define the location of the feature and the references required to locate it with respect to existing geometry. Examples of some pick and place features are fillets, drafts, chamfers, shell, and some holes.

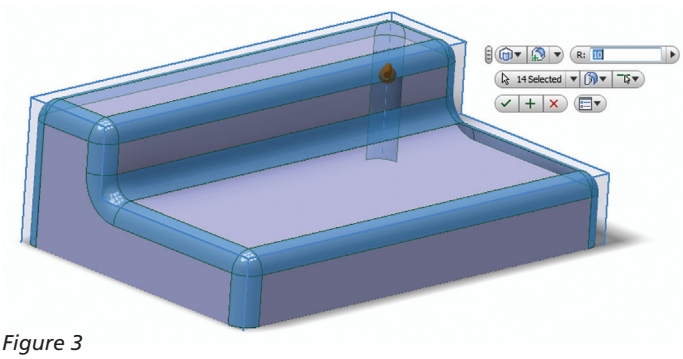


Figure 3

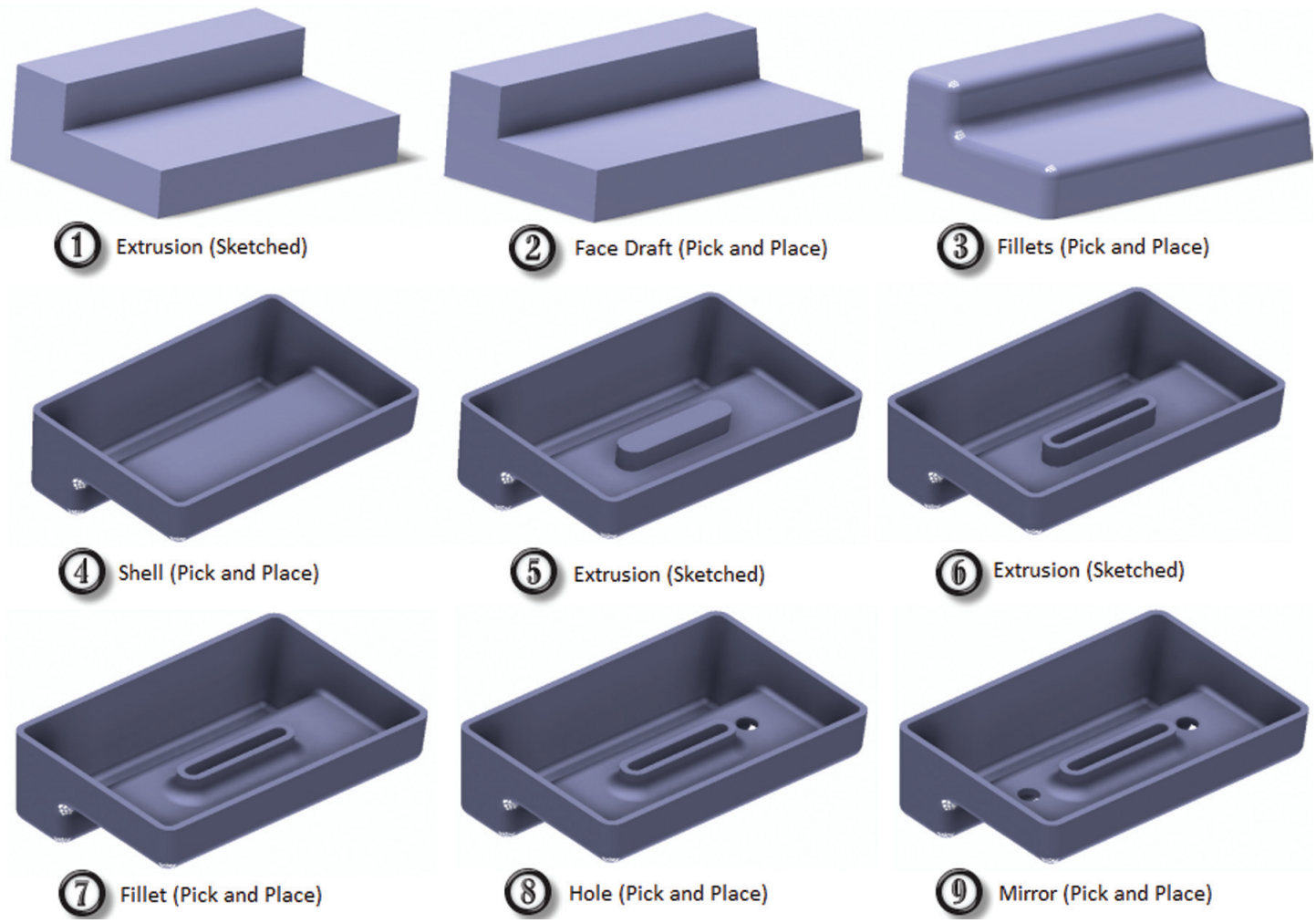


Figure 4

The history of these features—whether they are sketched or pick and place—is stored in the model browser of the modeling file. Consider the set of features and their order in Figure 5.

From this model the tree on the right is automatically created for this history. Modifications can be made to the earlier features to affect changes to the latter features in the history. Any change to Extrusion 1 will affect change to the entire part, because it is the Base feature, as well as positioning of latter features, depending on how they were created.

The same power that grants this highly functional type of design can also be a pitfall for new users. For instance, what if one of the features were deleted? What would happen to the model in Figure 4 if the Shell in step 4 or Extrusion in step 5 were deleted from the history? Anything dependent upon those features such as steps 6 through 9 would either become sick or destroyed.

Relationships that are created by referencing already created geometry or features are known as Parent-Child relationships. For Example, Hole1 is parent to Mirror1. Modification of Hole1 directly affects Mirror1, but modification of Fillet2 does not directly affect Hole1 or Mirror1 since it was not referenced for either subsequent feature.

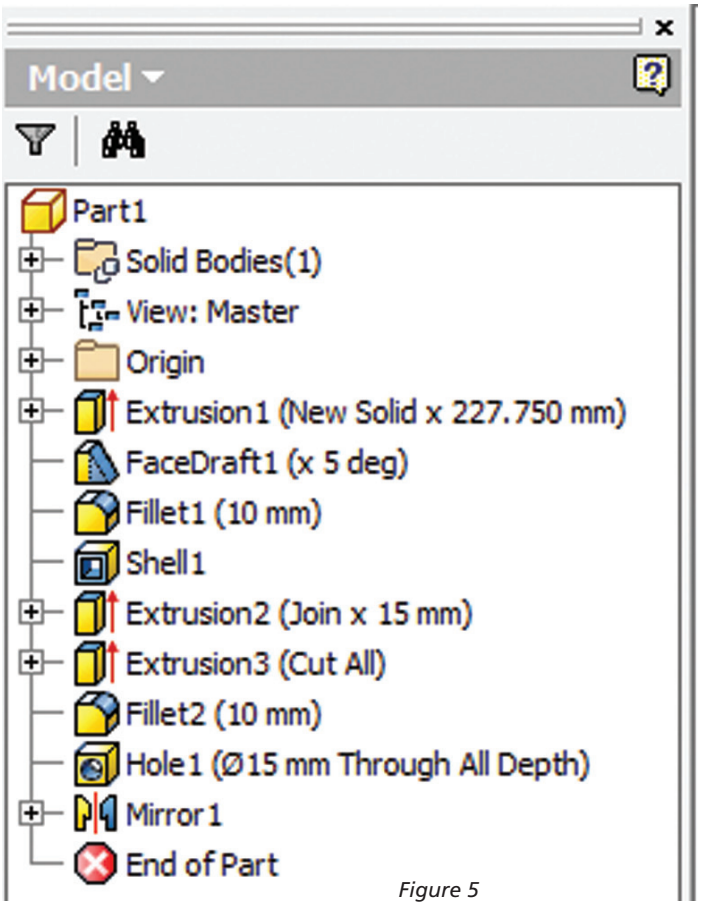


Figure 5

PARAMETRIC DESIGN

The majority of the features you create on your parametric part models start with constrained 2D sketches. Intelligent and predictable part designs require a thorough understanding of how to create 2D sketches and how to capture design intent by applying geometric and dimensional constraints. Precise sketches created with AutoCAD by default have no parametric intelligence. A change in a dimension does not force the geometry to update to reflect the new dimension value.

Parametric sketches in Inventor enable you to click and drag the geometry in directions allowed by the existing constraints while all conditions controlled by the constraints are maintained. For example, if you drag the outer arc to a different size, the horizontal lines remain tangent, horizontal, and their defined length. This is called flexing the degrees of freedom of a sketch.

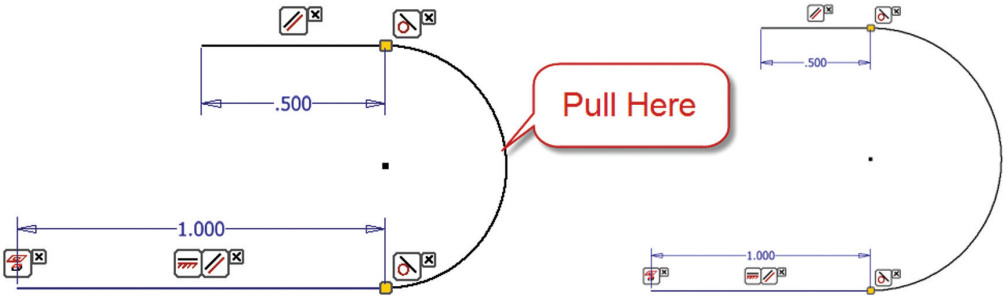


Figure 6

A parametric sketch consists of 2D geometry on which constraints are applied to control the size and potential behavior of the 2D geometry. The two types of constraints are geometric constraints and dimensional constraints. As you create geometry in Autodesk Inventor, some geometric constraints are applied automatically.

The symbols next to the geometry in Figure 6 are known as "constraint glyphs" and represent 2D constraints. The use of 2D constraints is one way in which design intent is automatically captured as you are creating your sketch geometry.

Inventor 2013

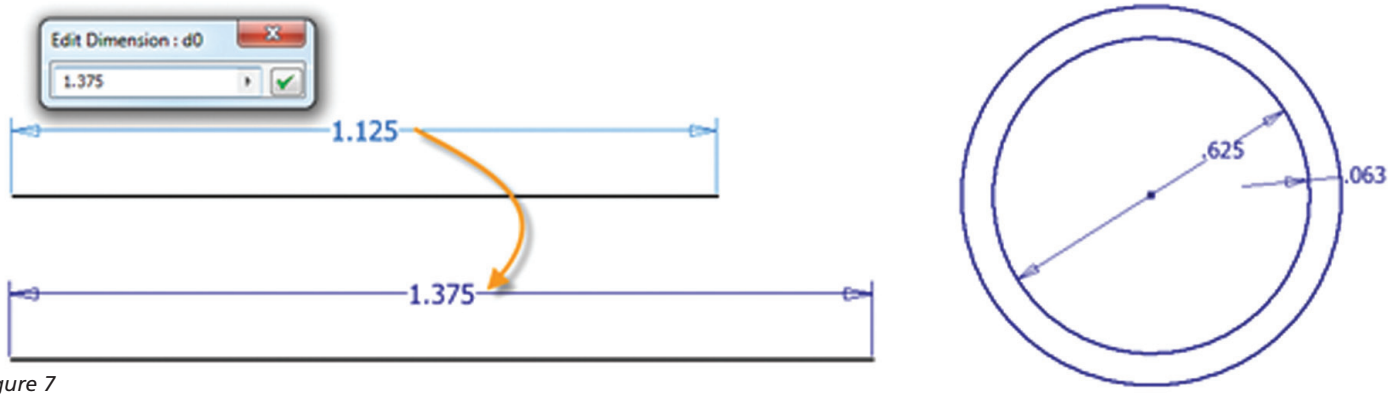


Figure 7

Dimensional constraints, on the other hand, control the size of the objects. The diameter dimension controls the size of the circle, while the linear dimension controls the length of the horizontal line. There is only one command to create many different types of dimensions based on the user selection. Dimensions will control the size of the geometry; the geometry does not control the value of the dimension.

Dimensional constraints used later in design on secondary features really show off the ability to change values to have features move based on the intent of the user.

PARAMETERS

As Dimensional constraints and inputted values are added to a model, their values are stored in the Parameters box for equations

Parameters

Parameter Name	Unit/Type	Equation	Nominal Value	Tol.	Mod	Key		Comment
d45	in	0.125 in	0.125000		0.1...			
d46	in	0.5 in	0.500000		0.5...			
d47	in	1 in	1.000000		1.0...			
d48	in	0.0625 in	0.062500		0.0...			
d49	in	0.805 in	0.804820		0.8...			
d50	in	d40	0.187500		0.1...			
d51	in	0.125 in	0.125000		0.1...			
d52	deg	0 deg	0.000000		0.0...			
d53	in	0.375 in	0.375000		0.3...			
d54	in	0.438 in	0.437732		0.4...			
d55	in	0.25 in	0.250000		0.2...			
d56	in	2 in	2.000000		2.0...			
d57	in	2 in	2.000000		2.0...			
d58	in	cabinet_width - cabinet_thickness	23.500000		23....			
d59	deg	0 deg	0.000000		0.0...			
d60	ul	10 ul	10.000000		10....			
d62	in	3 in	3.000000		3.0...			
d63	ul	2 ul	2.000000		2.0...			
d65	in	9.5 in	9.500000		9.5...			
User Parameters								
cabinet_depth	in	14 in	14.000000		14....		✓	
cabinet_heigth	in	35 in	35.000000		35....		✓	
cabinet_width	in	24 in	24.000000		24....		✓	
cabinet_thickness	in	0.5 in	0.500000		0.5...		✓	
cabinet_small_overhang	in	0.25 in	0.250000		0.2...		✓	
cabinet_large_overhang	in	1.0 in	1.000000		1.0...		✓	
cabinet_support	in	1.5 in	1.500000		1.5...		✓	

Add Numeric | Update | Reset Tolerance | << Less
Link | Immediate Update | Done

Figure 8

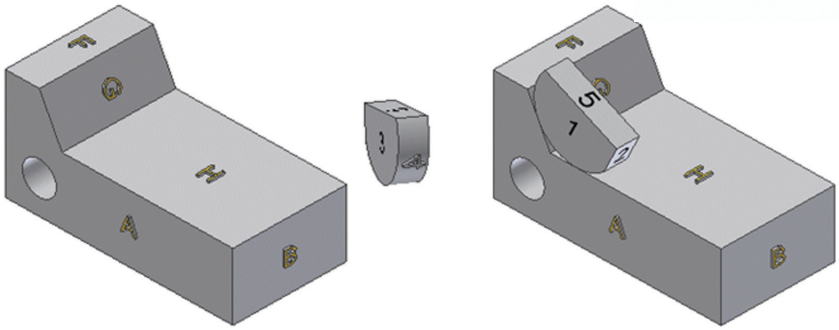
and management. Unique identifiers are given to each dimension used in sketches or feature creation (d0, d1, d2, etc). These values can be renamed and formed into equations for which to drive design variation and relationships in modeling files. Modification of the values here can also change the model directly.

ASSEMBLY

Models built in part mode can be used as components in an assembly file. Assemblies are created by constraining components with respect to one another. The addition of constraints creates feature relationships between components and builds intelligent assemblies. Similar to features in part mode, constraints in assembly mode are assigned a unique identification value for their offset values (d0, d1, d2, etc) to be used in equations if desired.

Initially when a part or subassembly is added to a new assembly file, the first component placement will be grounded in place and will not move around. Components added after the first one will have six degrees of freedom (DOF) of movement (three translational, three rotational). In order to restrict that movement, assembly constraints are used to lock down any undesired movement. Either Constrain or Assemble can be used to create assembly constraints.

Examine the example in Figure 9 with the base component (letters) and the secondary component (numbers).



Type	References	Offset	DOF removed
Tangent	Faces H and 4	0.00mm	One **R** and one **T**
Flush	Faces 1 and A	0.00mm	One **R** and one **T**
Tangent	Faces G and 4	0.00mm	One **T**
Angle	Faces F and 5	25deg	One **R**

Figure 9

Open degrees of freedom will allow users to check desired motion in designs before locking them down. In Figure 10, the yellow linkage piece is too short to allow the red link to go a full 360 degrees (1 and 2). But activating the part in the assembly and changing the length of the yellow link to allow for full rotation can be done without ever leaving the assembly (3).

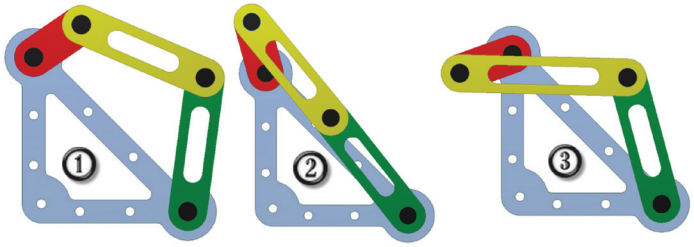


Figure 10

Once components are assembled they can also be checked for interference in design. In Figure 11, the red shows a PCB board (green) overlapping into the plastic walls of this part. Corrective measures for design flaws can be taken care of before parts ever hit the mold or the physical prototype stage. In traditional 2D drafting, these types of interferences could be very hard to see and often times missed before a prototype is created.

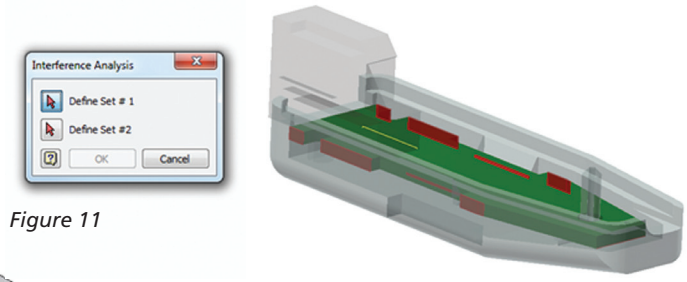


Figure 11

The Automatic Bills of Material tracking for designs makes sure all components are accounted for and that the design criteria for each part is being correctly populated for data tracking. If not, changes can be made here to enact change to the part files material selection, BOM structure, and other tracking data known as iProperties.

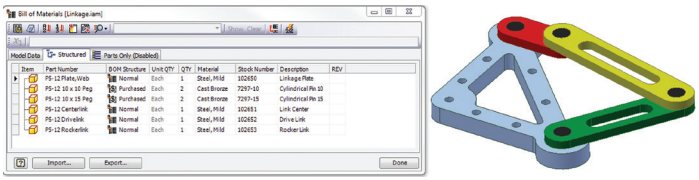


Figure 12

VISUAL COMMUNICATION

Autodesk Inventor has numerous tools for showcasing designs. While it is true that some of the ancillary products in the Design Suites as well as other products such as Inventor Publisher do a much better job for direct marketing of consumer data, the Inventor tools are quite useful for internal company discussion and training. For instance, Drive Constraint in assemblies and standalone presentation files are great for showcasing movement, while Inventor's realistic visual styles and material library with Studio are great for higher end work.

Inventor 2013

Drive Constraint or Presentation (*.ipn) files can be used to create videos (AVI or WMV) of what is on the screen. Drive Constraint will capture offset values as they change and animations in the presentation environment (*.ipn) will capture steps to assemble or disassemble a design. The videos can be shared internally for discussion or externally for clarification of design intent in the supply chain.

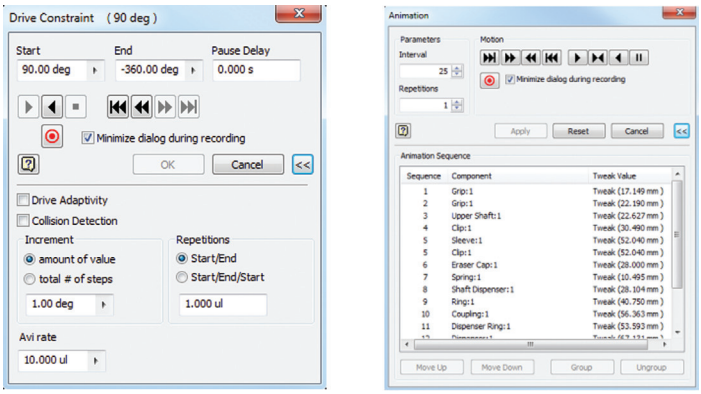


Figure 13

When it comes to higher quality visualization, Inventor has a few tools that have performed quite well in the past: Inventor Studio for high-quality, photorealistic stills and animations as well as fanciful technical sketches, and the Realistic Color Styles and Environments (IBL) for faster still imagery. Both of these images are taken from the Inventor interface

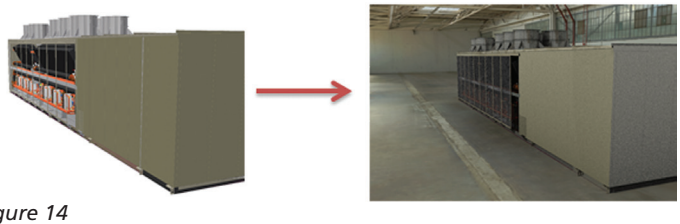


Figure 14

2D DOCUMENTATION

The tools available in the drawing environment enable you to quickly create production-ready drawings for manufacturing. Drawings are created from part, assembly, and presentation models. The shape, dimensions, and orientation of the parts or assemblies have already been defined in the part or assembly mode. Inventor uses this information to create the required views in a drawing file very quickly without the need for manual orthographic projection techniques.

Drawing models are not actually self-contained in a drawing file. There is a link between the drawing file and the source model. If a change is made to the source model, all drawing views that reference it automatically update. The reverse is also true—a change made to a modeling dimension in the drawing also reflects change in the model.

Adding details and annotations to your drawings enables you to communicate additional information to other designers working on a project. You can also apply styles and standards to control the appearance of your model and drawing annotations.

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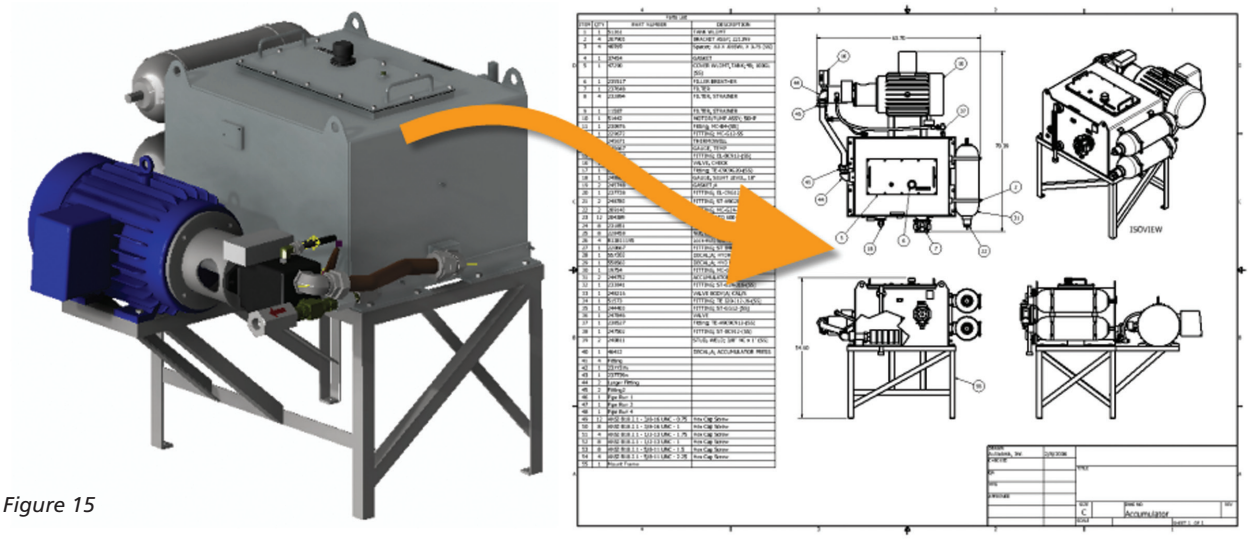


Figure 15

Reconstructing the Architectural Practice: Success in AECO | Revit | BIM

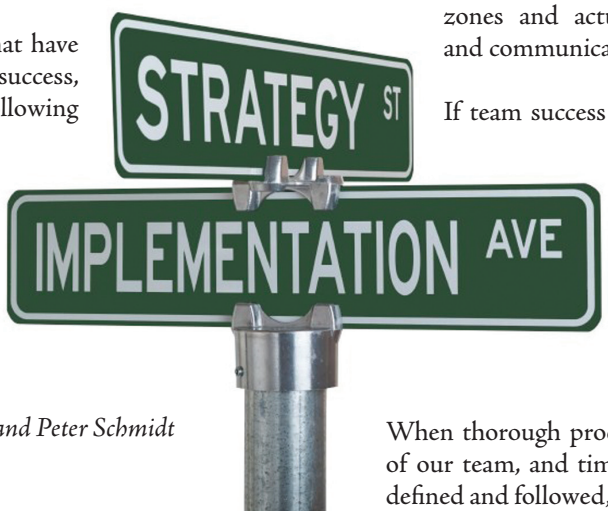
The transition into BIM is now a foregone conclusion for AEC firms large and small. Once past the initial choice to leave CAD Drafting and implement BIM, firms are left with new software and old processes.

Creating and developing new BIM processes and restructuring existing CADD and Business strategies are fundamental steps to endeavor for a successful transition in the modern AECO marketplace.

WHY WE NEED TO RESTRUCTURE

CAD work doesn't "require" a good architectural practice in and of itself, whereas BIM does.

BIM teams and firms large and small that have been 'doing BIM' for a while have found success, in large part due to creating and following clearly defined, rigorous, and robust processes. A highly organized practice is required to get the right work done and to get it done at the right times. BIM project success requires much more than simply excelling at software.



"Honour thy error as a hidden intention"
–From the Oblique Strategies, *Brian Eno and Peter Schmidt*

"Without follow-through, intentions are inadequate"
–Jay Zallan

BIM project teams can be thought of in the same manner as sports teams. For example, let's look at the architectural team. Each person, from the owner (associate, let's say), to the manager (PM), to the players (design and production) has very specific tasks and responsibilities. When everyone is on the same page, then "championship here we come." But if, for instance, there is a designer who does not deliver within the planned timeframe, leaving no time for production to incorporate the designs, then the team can expect a negative, costly impact.

BIM requires that people step out of existing comfort zones and actually and continuously learn, grow, and communicate.

If team success depends on everyone doing his part, at the right time, then team members need to practice. That is not a double entendre, it is meant literally. There is a reason we "practice" our crafts—we need to stay sharp and at the very top of our game, if we want to be as successful as possible, that is.

When thorough process plans are created for each aspect of our team, and timelines and responsibilities are clearly defined and followed, then teams will be afforded a winning

environment. There are always outside forces acting against our plans, so flexibility is necessary, too, but with great team communication, active management, and coordination efforts, then "the promise of BIM" can truly be achieved.

JUST THROW PEOPLE AT IT (BUT NOT IN BIM)

In CAD many of the workflows often employed are now viewed as inefficient. One that masks even its own inefficiency is the "just throw extra staff at it to get it out the out the door" workflow. BTW: That one is fundamentally not a production-fail; rather it is a management-fail.

Responsibility must be taken for successes as well as failures or the processes will never be improved. Struggles on projects need to be captured and used to benefit future projects, not simply hidden away and ignored.

If that kind of "throw staff at it" approach is used on BIM projects, for whatever reason, that inefficiency becomes a glaring indicator that effective management processes weren't followed. Throwing extra staff at BIM production "cold"—without the new team members understanding the project—can be extremely dicey at best. Many times the result will be an enormous amount of extra time spent fixing absolutely avoidable mistakes.

In BIM there are pitfalls as well, like when modeling, for instance. Modeling can be a hypnotic endeavor; teams can find themselves meandering back and forth in the model losing sight of the bigger picture: schedules, time, and money. Following rigorous processes can keep that in check.

The point of BIM and the extended approaches of IPD, after all, can be thought of as processes that enable more efficiency and better executed projects, with fewer RFIs, etc. AEC not only wants this; it can be argued that it needs it.

A CLEAR UNDERSTANDING

So, how does a firm become successful at transforming its processes for BIM? Well, first get clear about what works and what doesn't. Adopt willingness for change and search out and then embrace new ways of production, coordination, and presentation. Second, create project guidelines and systems that will help teams manage the project objectives and overall firm goals.

Change can come in many forms, like that of allowing existing processes to evolve—production and design schedules, management styles, and output are all affected.

THE CHASING CAD DILEMMA: A "FOR-INSTANCE"

To my knowledge, the shape of a tag never made a firm any money, but blindly chasing them around sure has lost firms money.

What to focus on is important; doing so at the proper time is equally important.

Chasing CAD symbologies is not always recommended; rather, allowing an evolution of symbols, etc. in BIM is much more desired. This is especially true because tags, keynotes, and such can be associated to actual building elements, giving the project much better data with less need for QA/QC when compared to CAD. Output is another evolution that, while it can be distinct from the look of CAD in many ways, can also be extraordinarilly better in the look as well as informational and coordinational value. BIM can tell a better story than CAD.

The past may inform part of our future processes, but be cautious and skeptical of ideas such as: "Why? Because we have always done it that way." Those types of reasons are pitfalls to avoid at most every turn.

THE "YOU CAN'T DO THAT IN BIM" FALLACY

People will often say things like that and while it seems natural for humans to resist change, it is invariably a mindset that needs to be navigated around. These roadblocks are simply excuses for people to continue on the same inefficient path they currently travel.

Anything done in CAD can be done in BIM, just better. If anyone ever tells you that you can't do something in a BIM authoring software, then they are simply either unaware of how to do it or they are lying to you. Nothing else.

Yes, anything that can be done in a CAD-drafted project can be done in BIM projects and usually done better. Firms may need to learn new approaches for BIM, but that is what will allow growth of our industries and allow better projects to be built. BIM authoring tools work just fine and it is mainly inexperience that creates issues and confusion.

GETTING OVER THE CAD ADDICTION

The addiction to CAD is perhaps the single most difficult obstacle that BIM adopters will encounter when transitioning.

CAD addiction needs to be acknowledged and actively mitigated if a full BIM transformation is to take place. It may seem cold-hearted, but where are all the hand-drafting AEC firms today?

They are either using computers or are in other lines of work.

CAD may be around in many industries for a long time to come, but in AEC it will be replaced by BIM. For many, it already has.

Some people either consciously or unconsciously use CAD like children use security blankets. Existing workflows can be held on to very tightly and cause a lot of problems for the transitioning firm.

There can be factional talk among staff, usually under the radar, where they try to build consensus for their "Pro-CAD/Anti-BIM positions," which is nothing more than subverting the firm's intentions and goals. Some have even created scenarios where they subvert the BIM processes to ensure failure; that way they feel thay can go back to using CAD.

These people may even ask for training and advice, get the training and advice they've asked for, then not used it. Then they say, "See? BIM doesn't work" even though BIM would have worked perfectly if they followed procedures. It can be easy to hide these types of sabotage if there is an environment of unwanted change.

ENVISIONING TRANSITION

There are four main components to a restructuring plan: Assessment, Planning, Creation, and Validation.

ASSESSMENTS

Assessments will give quite a bit of insight into what is necessary to change or refine during the transition and restructuring. Assess the staff, existing systems, and infrastructure, as well as project procedures. The assessments will be used to give a good baseline of the "state of the firm," its capacity to absorb change, any fiscal impacts, everyone's mindset, etc.

We cannot effectively create a better future if we don't honestly understand the past and present.

Assessing Staff: What do we feel about our practice and process? Create a 10-question (+/-) interview, given to all staff—management included. Ask about what works in the current process, what doesn't, who they think are the best teammates, how do they like the infrastructure, who they feel may hold the process back, etc. Be sure to ask "Who is 'that' person, and why?" There is always a 'that' person (or people) in every firm. Several names may come up in the answers, but there will usually be some consensus.

	Question	Answer	Action
1.	What works best in the company's current processes?		
2.	What are some of the difficulties of the company's current processes?		
3.	What are the current barriers to achieving your project goals?		

Make the interview setting safe and confidential—do not tie answers to names. We do not want to interrogate, we simply want to get the staff's honest feelings about the state of affairs. These staff assessments will inform potential champions as well as gatekeepers, etc. by connecting "actions" to issues/answers.

Assessing Goals: What do you want and when do you want it? Because we define the goal of this project as being "restructuring our AEC processes for BIM," then the next step is to define the objectives. The point to take a good, hard and objective look at current processes and map them out visually so the current approaches can be used to inform BIM approaches.

STORYBOARD YOUR PROCESS

Providing an interactive, live assessment can be done in several ways. Digital tools such as traditional process map or mind-mapping software can be used to create process maps, although I suggest starting off by using 3x5 cards posted on a wall if there is ample room. A digital set of process maps will be created later on, but the storyboard approach has the benefit of immediate collaboration where people can add all varieties of documents, notes, drawings, and so on. Include the entire staff in divining the process maps, so expertise at all levels is included and every possible measure is addressed.

Set up the storyboards and refine your "map" until you feel it addresses the entirety of your current process; once completed you can begin to map out the new processes. When each process is fully vetted, then input them into digital process maps to be used in later phases of the restructuring and documenting.

Process Maps will include all the steps taken to complete an AEC project in your firm, practice area, or team structure. Provide time to review these; add color-codes for prioritization and distinguish things such as "what works" and "what have the pain points been?".

The BIM process map can be started by using copies of some of the items from the current process map: use colored strings to define critical paths or connections, etc. Those paths can be translated to the digital copies as well.

BIM process plans require different input than CAD processes. This time you must include people who have extensive knowledge of BIM production as well as Project execution. The team that creates the new processes wants to incorporate all levels of project execution, including technical and managerial. If no one on staff has BIM leadership experience on the kinds of projects your firm produces, then go get some. Not knowing what you don't know can create failure; bring in new staff or consultants if that is necessary to help you understand unknown or new BIM processes.

TRANSFORMATION

Restructuring a practice to incorporate new processes requires many levels of buy-in and transformation: both personal and professional. Transformation and willingness to change "looks" different on everyone and needs to be figured into the restructuring plans.

Anyone who has studied transformation understands that it is primarily important to figure out what goals are truly desired, then to create plans intended to accomplish those goals, and finally commit to and complete the necessary actions in those plans.

Gaining buy-in can be increased by working with the staff to agree that what they want is what's best for the firm, since that can become what's best for them as well.

If staff members openly and publicly agree that they want to be part of the firm's success, and the firm openly and publicly states that it wants to refine its processes for BIM, then it becomes obvious and natural for the staff to do what it takes to accomplish that goal: namely buy-in and follow the plans that are to be created.

If there is no implicit, open, and public agreement between ownership, management, and staff, then the restructuring itself may not be efficient and will probably speak to how projects will run.

The public nature of these agreements can provide an environment of empowerment and self oversight. Conversely, if people say they buy-in, yet don't follow through on their agreement, that is necessary to know as well because it provides an opportunity to honestly deal with whatever the issues may be and rectify them—not be held hostage by them.

If it comes to pass that there are any parts to the plan that have not been completed as planned, these objectives either need to be re-committed to and completed, or, if found to be unnecessary, dropped from the plans. Either way there is a mechanism for responsible and managed follow through.

PLANNING FOR SUCCESS—WHAT WILL BE DONE, WHEN, AND BY WHOM

A structured plan is necessary for success in anything and BIM is no exception. An implementation plan is used to provide on-demand insight into where the project is at any moment and can be developed to become recipes for project performance. These plans should run the gamut of necessities—from an overall strategic plan (the 10,000 foot view, or macro) all the way to task lists for every possible consideration (micro). The plans should include infrastructure, staffing, training, implementation timelines, fiscal plans, and so on. Basically all of the "whats, whens, and whos."

Successful BIM projects have team members with intimate knowledge of the design, production, and documentation processes. By documenting the project execution tasks, management can predict staffing needs and budget impacts proactively with more predictable results. As we saw earlier, unplanned up-staffing can throw unnecessary trouble into the mix and should be avoided.

THE PLAN

Knowing the end result is everything—or at least being aware of most of the desired end product. With comprehensive assessments informing our understanding of what to plan for, we can create a host of documentation that can both explain what needs to be done and when/by whom, as well as provide management tools to keep items from falling through the cracks.

Good planning documents will enable prioritized workflows, tighter timelines, and overall project health because knowing what still needs to be done at any one time is critical.

BIM and IPD projects benefit from, and quite often require, process maps and thorough/granular plans that are generated throughout the project lifecycle—from preliminary submissions on. The better we get at planning, the better our potential for success will be.

The "AIA E202™ Building Information Modeling Exhibit" is one of the great starting points for helpful, if not necessary, documents used by BIM teams. Developing similar types of metrics can be used to create overall project checklists as well as the team-specific plans all the way to production staff plans, and so on. These can be thought of similar to the "Cartoon Set" and can/should be tied in to one another.

Creating a toolset for teams that use task lists interlinked with project schedules will offer even greater opportunities to manage projects and teams and keep everything running smoothly. Capturing the finite elements of a project and linking that with time and staff will give management clear understanding of what needs to be done and when.

§ 4.3 Model Element Table

Identify (1) the LOD required for each Model Element at the end of each phase, and (2) the Model Element Author (MEA) responsible for developing the Model Element to the LOD identified.

Insert abbreviations for each MEA identified in the table below, such as "A – Architect," or "C – Contractor."

NOTE: LODs must be adapted for the unique characteristics of each Project.

Model Elements Utilizing CSI UniFormat™					LOD	MEA	LOD	MEA	LOD	MEA	LOD	MEA	LOD	MEA	LOD	MEA	Note Number (See 4.4)
A SUBSTRUCTURE	A10	Foundations	A1010	Standard Foundations													
			A1020	Special Foundations													
			A1030	Slab on Grade													
	A20	Basement Construction	A2010	Basement Excavation													
			A2020	Basement Walls													
B SHELL	B10	Superstructure	B1010	Floor Construction													
			B1020	Roof Construction													
	B20	Exterior Enclosure	B2010	Exterior Walls													
			B2020	Exterior Windows													

A portion of the AIA document E202 BIM Protocol Exhibit

There are many available resources that can help in understanding and creating process maps; therefore, a list of links is provided at the end of this article.

Once the plan is in place, it is time to implement, making sure the staff understands what the goals are, etc. Then validate the plan for future repetition and you're on your way to restructuring old processes to new.

PLAN IDEAS

- What is the goal?
- What are the objectives?
  - What will be done the same?
  - What will be done in new ways?
  - What infrastructure is already in place?
  - What infrastructure is needed anew?
  - What staff is already in place?
  - What staff may be needed anew?
- What are the timeframes?

CREATION PHASE IDEAS

Do the things you've planned.

- Methods
- Templates
- Standards
- Documenting the Process
  - Toolsets
  - Checklists
  - Project binder
  - Staff responsibilities

VALIDATION CONSIDERATIONS

QA and QC of the entire process

- What went well?
- What were the pain points?
- Adjust the plan for future projects

Many firms initially believe that they can learn BIM simply by buying the authoring software and trying it out a project or two. This usually yields inefficient results, even with software training.

BIM IS NOT SOFTWARE

BIM is a process of data modeling where associations are created between building objects, their real informational values, project timelines, and teams. BIM is not simply a 3D model of a building—that is a sculpture. BIM combines all of the data from concept to final construction.

Detailers, for instance, cannot begin late in the DD or CD timeline and hope for success. Detailing needs to be involved with the project throughout. Design is another main area where teams can lose time and money: If there is no "pencils-down" or if it is too late, then there is no time for the production team to do its work work, let alone providing coordinated and quality controlled work.

The restructuring of an entire firm is no different than restructuring a small part of the delivery process—just bigger, with more variables. The following is an example of a restructuring approach for one part of an overall project process: detailing. Extrapolate the ideas herein for recreating a BIM workflow that enables your firm a better chance at efficiency and success.

TASKS, PROJECTS, AND PRODUCTION

When project or "task-based" schedules are created, they must be inferred to include every possible factor, beyond simply the individual task itself. These factors include the project or task's deadline, design time, QA/QC, production, and transmission.

The following list is an abstracted analysis of what to schedule for and the potential factors involved.

Project = (Design + QA/QC) + (Production+ QA/QC) + (Submission + Contingency)
Design = (Phase specific Completion Date – Pencils Down)
Production = Modeling + QA/QC + Documentation + QA/QC
***Pencils Down** = Completion Date – (Design QA/QC + Final Production + Final QA/QC + Submission)
QA/QC = (Review + Markup) + (Revision + Re-Review…)
Contingencies = Estimated percent of Project time for unforseen delays, etc. (judgment call)
Submission = Check Print + (Final QA/QC + Final QA/QC Revisions) + Printing + Transmittal

PENCILS DOWN

"Pencils-down" should be considered one of (if not "the") most honoured factors in a project. If a project is to be delivered as coordinated and complete, then allowing production, revision, and verification time after the design is finished is vital (read as: VITAL).

The third example of negative impacts to schedules is "The Meandering Production Team." If a team is allowed to work without a concise plan of attack derived from the comprehensive project schedule and broken out into more and more granular 'task-to-date' sub-plans, then the project can expect similarly undesired results.

One large stumbling block to budget is when the project is not properly executed within the schedule.

A recurring impediment to completed, coordinated, and on-budget projects in AEC is when one part of a team does not leave enough time for necessary future work, like if a design team is not completed by the end of DD. Remember: that is what DD is for… Design Development.

There are always items that need to change after they are planned and although this may need to happen once in a while, if unplanned changes are too numerous and become the status quo, then success is tenuous at best and definitely not the desired way to run a business.

Another example of negative impacts to a project is in the design of Details. This is a part of a project that needs to have a pencils-down date (or dates).

Details are to be designed progressively throughout a project, but each phase's details need a schedule that allows for both creation and production (including all the QA/QC and revisions, etc.).

The first-pass details are best designed early on in a project—beginning about 30-50 percent SD and progressively developed through DD and optimally having a detail-design, final Pencils-Down before 75 percent CD.

THE EFFICIENCY BOTTOM LINE

- Create an environment of efficiency to deliver success.
- Create good plans and manage them closely for all aspects of the process: Design, Detail, and Production; Coordination; Submission.
- Execute the plans and make people accountable and empowered. Do exactly what is planned—no more and no less (unless the plan is changed).
- Keep teams on point by eliminating unnecessary meandering and overworking; ensure that the team holds to tight, rigorous, and agreed-upon managed timelines.

Every submission of a project has known items to be included and with appropriate planning, accurate performance and success can be managed.

CONCLUDING THOUGHTS

This article focuses on restructuring processes for BIM projects. This restructuring is broken out into several overarching themes that all work toward the bottom line: Success. The philosophy of "planning the work and working the plan" is a fundamental principle to follow for overall project success.

Being built on good planning, teamwork, and management as well as communication and follow-through, a BIM process will realize successes for the entire AECO team, when properly administered.

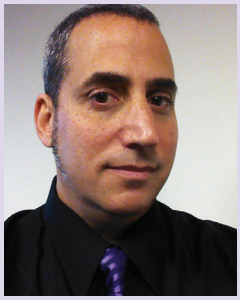
HELPFUL LINKS

BIM Standards
NIBS Resources:
http://www.nibs.org/index.php/resources/
AIA E202 BIM Exhibit:
http://www.aia.org/contractdocs/training/bim/AIAS078742

BIM Execution, Planning:
http://bim.psu.edu/ http://bim.psu.edu/Intro/Resources/default.aspx
COBIE Tools:
http://www.wbdg.org/resources/cobie.php

Process Mapping
IDM:
http://iainstitute.org/tools/

IPD
IPD Guide:
http://www.aia.org/contractdocs/AIAS077630



Jay B. Zallan is a designer, artist, and an AECO strategist. He is currently the VDC Director of BIM at Perkowitz+Ruth Architects & Studio-111. Jay is President of the Los Angeles Revit Users Group (LARUG), developing an expanding reach of BIM expertise and support with a Consortium of BIM leaders encompassing (at present) Los Angeles, Orange County, and San Francisco California; Cleveland. Ohio; and the Netherlands. He is also AUGIWorld *magazine's Revit Content Manager and sits as a Graphic Standards' BIM Advisory Board Member. Jay often lectures on Creativity, BIM and Virtual Design & Construction at Autodesk University, Revit Technology Conference and institutions such as the University of Southern California, LACMA and other AECO industry, AIA & CSI events. He is the author of the Fear & Loathing in a CAD vs BIM World blog and the LARUG blog. Links and more can be found at: http://about.me/JayZallan Or tweet Jay up: @JayZallan*

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by: Melinda Heavrin

Working with Spaces

Spaces are 2-dimensional or 3-dimensional, style-based architectural objects that contain spatial information about a building, including floor area, wall area, volume, and surface information. Spaces have a multitude of uses, spanning the conceptual design through construction documents phases of a project. Among other things, spaces can begin to define the layout of a building's internal rooms and areas. They can also define rooms and areas for scheduling purposes and for area calculations and evaluations.

OVERVIEW OF SPACE TYPES

Both Associative and Non-Associative spaces can be modeled in AutoCAD® Architecture. Associative spaces are generated from boundary objects. When the boundary objects change, the space updates accordingly. In addition to associative spaces, you can also create non-associative spaces with user-defined geometry. A non-associative space can stand alone in the drawing, but you can also use it to generate calculations just like you would use an associative space. Non-associative spaces can be connected to boundary objects after their creation; similarly, associative spaces can be disconnected from their boundary objects.

2D spaces display spatial information in two plan dimensions. The Z direction is, by default, set to 0 and ignored during creating, editing, and scheduling the space. 2D spaces can be rectangular or polygonal and they can either be non-associative or associative. A 2D space can be bounded by 3D objects and linework. 2D spaces are typically used for plan views, where 3D information is not needed.

An extruded 3D space is similar to a 2D space, but has a user-defined extrusion height. Extruded spaces are useful for regularly shaped 3D spaces such as uniform-height rooms in a building. Extruded spaces can have floor and ceiling components and space above the ceiling and below the floor. The space above the ceiling is often used to place ductwork, cables, and electrical installations in a room.

Extruded 3D spaces can be associative to 3D objects and linework, but they are bounded only in the X and Y directions. The Z direction is defined by the extrusion height. If you need a space that is fully bounded by objects in all three spatial dimensions, you need to generate a 3D freeform space. 3D freeform spaces are generated from boundary objects such as walls and slabs and are associative to them. Associative 3D freeform spaces must be bounded in all directions to form a valid boundary shape. A 3D freeform space is a complex 3D geometry with any number of surfaces needed to generate the space shape.

SPACE STYLES

A space style is a set of parameters that determines the appearance and other characteristics of the space object to which it is assigned. Depending on the scope of the drawing, you may want to create different space styles to represent different types of spaces, such as different room types in an office building.

You can use styles for controlling the following aspects of spaces:

- **Boundary offsets** –You can specify the distance that a space's net, usable, and gross boundaries will be offset from its base boundary. Each boundary has its own display components you can set according to your needs.
- **Name lists** – You can select a list of allowed names for spaces of a particular style. This helps you to maintain consistent naming schemes across a building project.

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- **Target dimensions** – You can define a target area, length, and width for spaces inserted with a specific style. This is helpful when you have upper and lower space limits for a type of room you want to insert.
- **Displaying different space types** – You can draw construction spaces, demolition spaces, and traffic spaces with different display properties. For example, you might draw all construction areas in green and hatched, and the traffic areas in blue with a solid fill.
- **Displaying different decomposition methods** – You can specify how spaces are decomposed (trapezoid or triangular). If you are not working with space decomposition extensively, you will probably set it up in the drawing default.

Spaces can have a "Name" property assigned. These are derived from a List Definition. The list definition should be assigned to the style so you have a valid list of names to select from when establishing the space object's properties. Space style names should be indicative of the type of room or area that the space style is meant to address. Space styles should have materials assigned to their "Floor" and "Ceiling" components.

To create a space style, begin by clicking the Manage tab on the ribbon, select the Style & Display panel, and then select Style Manager (see Figure 1). The Style Manager will display with the current drawing expanded in the tree view. Expand Architectural Objects and then expand Space Styles. You can create a new space style by right-clicking on Space Styles and selecting New (see Figure 2). You can also create a space style from an existing style by right-clicking the space style you want to copy and select Copy. Next you will right-click and select Paste. Enter a name for the new space style and hit Enter. Now you will need to edit the new space style according to how the space should appear—it's size, etc. Once finished, you can add the new space style to your tool palette for easy access.

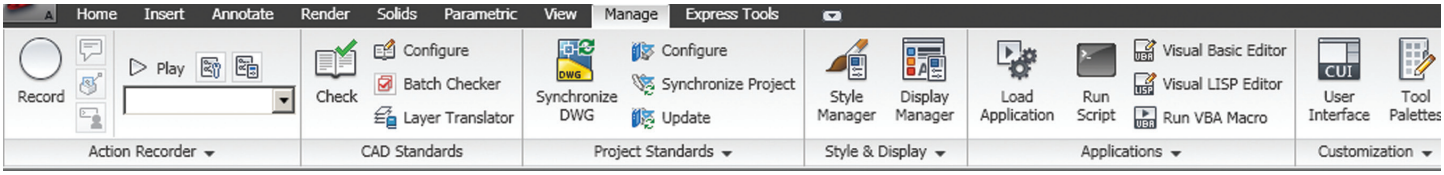

Figure 1: Ribbon

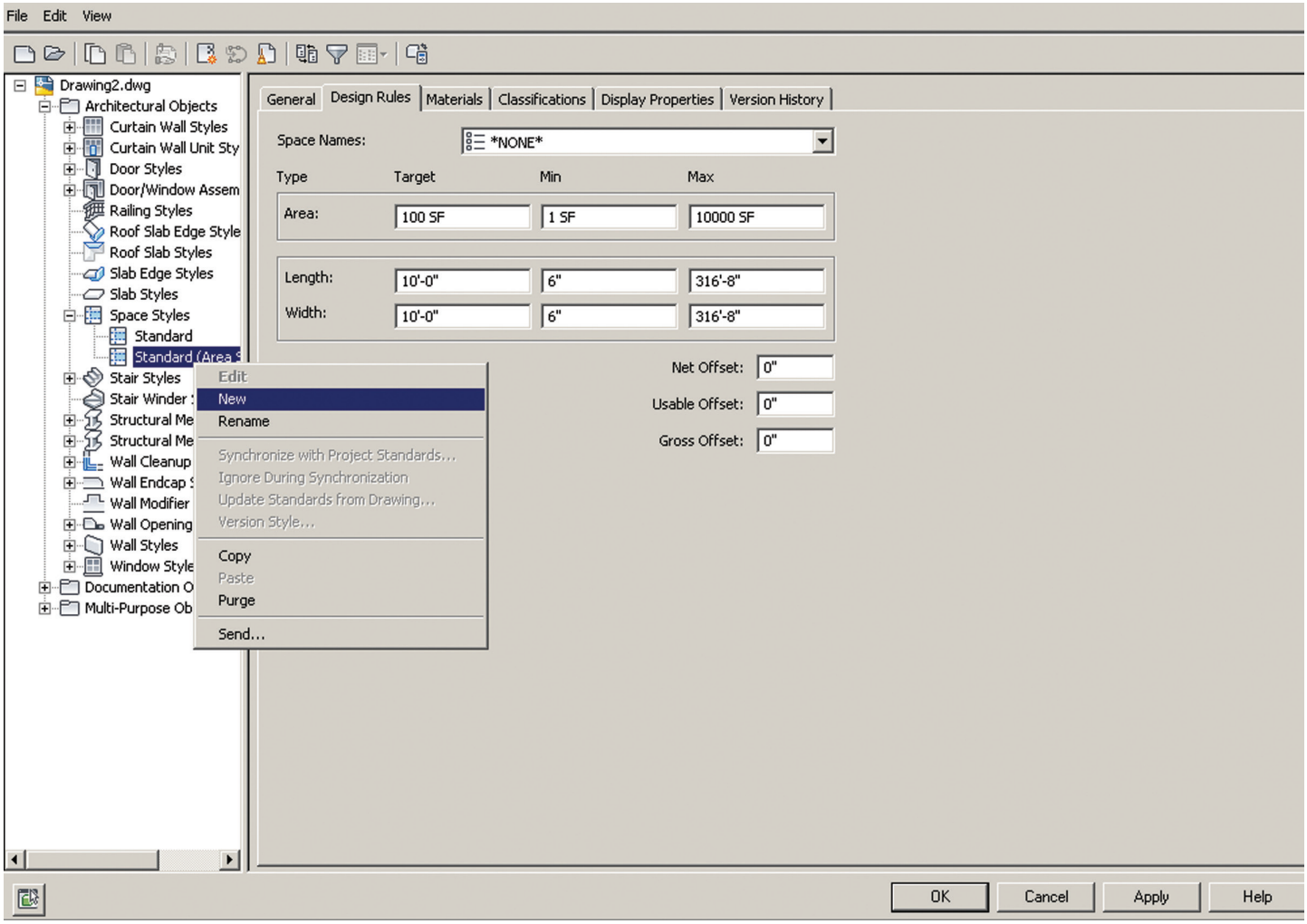

Figure 2: Style Manager

SPACE EVALUATION

The space evaluation is a documentation feature that calculates and evaluates the space information of your finished floor plan. This information is stored in a separate file you can export to a spreadsheet or word processing application. Evaluation templates ensure that the information is formatted and arranged in a consistent, structured way.

Architects need the space evaluation feature for submitting floor plans to the building plan approval authorities and to customers. Space evaluation can also be used for performing cost estimates, assigning jobs to contractors, and organizing facility management. Evaluations can be created for selected spaces in the current drawing, selected spaces from multiple open drawings, all spaces in a drawing, and all spaces from all open drawings. Spaces can also be evaluated from external references.

In previous versions of the software, areas and area groups could be evaluated with the area evaluation feature. Areas are now converted to spaces, area groups to zones, and the area evaluation has been converted to the space evaluation. If you attempt to use a legacy tool or run a legacy command to start the area evaluation, the following message will appear: "The command AreaEvaluation is no longer supported" (see Figure 3). If you click Run Space Evaluation, the space evaluation will be started instead. You should remove area evaluation tools from your palettes and exchange area evaluation commands for space evaluation commands in your scripts.

Figure 3: Space evaluation

SPACE BOUNDARIES

Spaces have four different boundaries: base, net, usable, and gross. You can use them to display, edit, and schedule different aspects of the space. You can choose that these boundaries are not offset from each other and lie on top of each other. If you do not need different boundaries, you can even turn off the display components for the additional boundaries. Here are some typical use cases for using individual boundaries:

- **Base boundary** – Normally representing the inner area of a room covered by a space. This is the area generated by boundary objects in an associative space. In most cases, the base boundary is identical to the net boundary, except in some area calculation standards such as the Swedish SIS standard.
- **Net boundary** – This boundary can be used for planning and detailed design. For example, if you need to determine the hiring of cleaning personnel for an office, you would use the net area as the calculation basis. The net boundary can also be used for special applications when the calculated area of a space is smaller than the base boundary.
- **Usable boundary** – This boundary is, in many area calculation standards, used for planning and detailed design, renting calculations, tax and other duty calculations, statistical calculations, maintenance, pricing, and more. The usable boundaries typically extend from the inside of the exterior walls to the middle of the interior walls (or a specified distance into the interior walls).
- **Gross boundary** – The gross boundary can be used in connection with cost calculation, price estimation, calculation of tax and other duties, key numbers for the building or a specific floor, and more. Normally, the gross boundary is measured from the outside of the exterior walls to the middle of the interior walls.

SPACES ARE AN INTEGRAL PART OF ENHANCING YOUR PRODUCTIVITY FOR FACILITY MANAGEMENT AS WELL AS THE WORKING DRAWING PHASE OF YOUR PROJECT.

There are different ways to determine how the boundaries should be offset from each other and calculated. These are Manual, By Style, and By Area Calculation Standard. It is important to note that in previous versions of the software, objects that were invisible due to a frozen or hidden layer were never included in the generation or update of associative spaces. Beginning with this version, frozen and hidden objects are included in the space generation and update if they are set as boundary objects.

CREATING SPACES IN YOUR DRAWING

AutoCAD Architecture provides tools that allow you to quickly place spaces by selecting a space tool with a specific space style as

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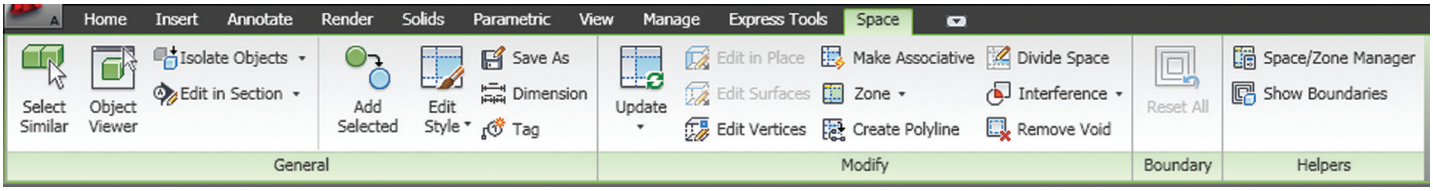


Figure 4: Space tab

well as other predefined properties. You can use the tool as is with its default settings or you can change any of the properties that are not controlled by the style. You can also use space tools to apply tool properties to existing objects to create new spaces. Space tools can be found on the space tab of the tool palette. To begin creating spaces in your drawing, drag and drop the desired space from the tool palette to your drawing and begin. You can also find space tools in the Stock Tool Catalog, the Sample Palette Catalog, and the Design Tool Catalog. Once you are in the Space command, the Space tab will appear in the ribbon (see Figure 4).

You can also create spaces in your drawing by converting polylines, object outlines, and profiles to spaces. Simply open the Space tool palette and right-click on the Space tool you wish to use. Next, select Apply Tool Properties To and then select Linework And AEC Objects (see Figure 5). Select the objects and/or polylines you wish to convert and hit Enter. Under Cut Plane Height on the Convert to Space worksheet, enter the height at which the object should be cut to generate the profile of the new space. Select OK.

Another way to generate an associative space in your drawing is to begin by verifying that all necessary boundary objects have their Bound Spaces property set to Yes. Open the tool palette that contains the space tool you want to use and select it. For offset boundaries, select how the four space boundaries (base, net, usable, and gross boundary) are calculated:

- **Manual** –The net, usable, and gross boundaries can be manually edited with grips.
- **By style** – The net, usable, and gross boundaries are offset from the base boundary by a value defined in the space style.
- **By standard <Standard Name>** – The net, usable, and gross boundaries are defined by the area calculation standard listed.

On the Properties palette, for Create type, select Generate. It is important to note that the Associative property is interlinked with the Create type. If the Create type is Generate, the Associative setting defaults to Yes. If the Create type is Insert, Rectangle, or Polygon, the Associative setting defaults to No and becomes read-only. Select Yes for Allow Overlapping Spaces if you want to be able to generate spaces from boundaries that already contain a space. This could be useful if you want to generate spaces from an xref drawing that already contains spaces, but you need to generate spaces with different settings. For Geometry type, select 2D, Extrusion, or Freeform. In the drawing, generate the spaces. If you want to generate a 3D freeform space, enter "G" (generate all). If you want to generate a 2D or extruded 3D space, you can either enter "G" (generate all) to generate spaces for all visible boundaries or you can pick inside closed boundaries in order to generate spaces for them.

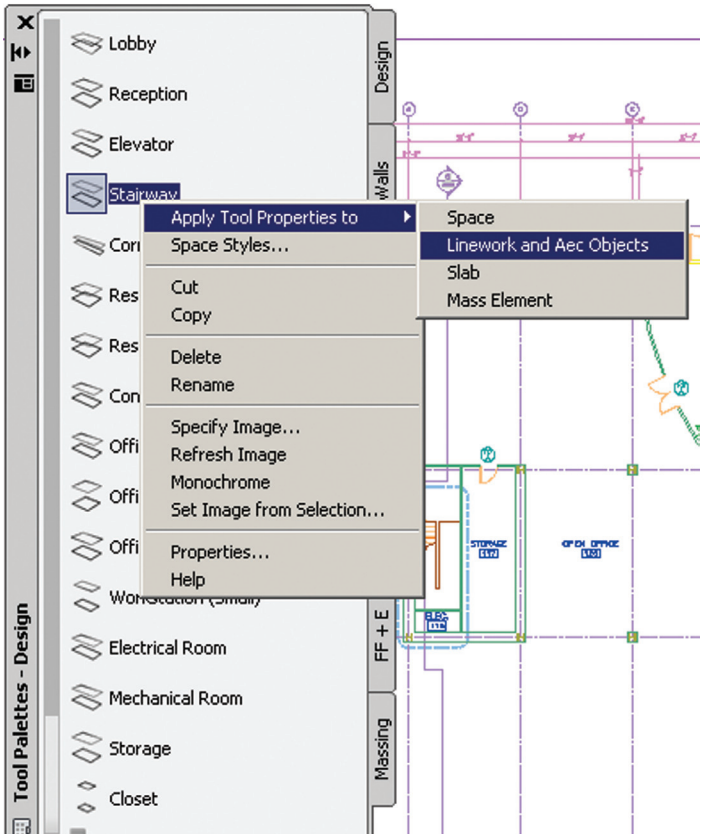


Figure 5: Apply tool properties

CONCLUSION

Spaces are an essential part of AutoCAD Architecture software. They help you extract data contained in the drawing for use in scheduling, tagging, and analysis. Spaces are an integral part of enhancing your productivity for facility management as well as the working drawing phase of your project. I encourage you to explore the possibilities with spaces and see how far you can go!

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

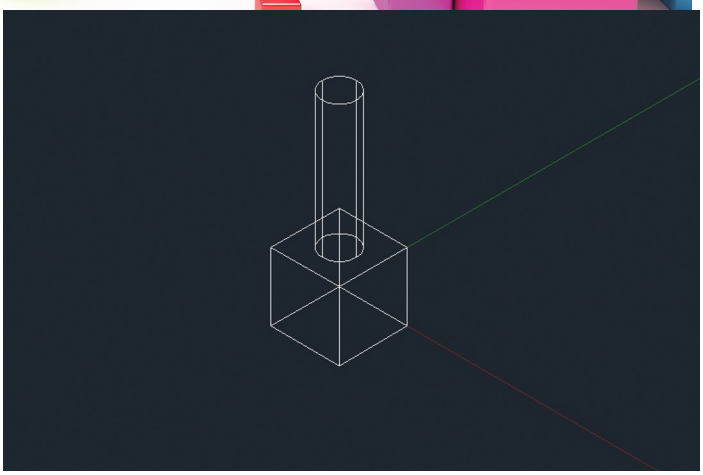
by: Chris Alexander

Basic 3D Object Tools for Every User

There is one thing for certain in the world of AutoCAD®. All users—seasoned veterans and brand new users—had a beginning. Getting back to our roots, there are many basic tools we can use to help us create some custom 3D objects. Let's go over a few solid editing techniques that will either launch your AutoCAD career or brush up those old skills. Let's see what the Union, Subtract, Intersect, Extrude Faces, Slice, and Shell commands have to offer us.

Let's start by going over some basic 3D modeling techniques. Union, Subtract, and Intersect are the three common commands used when creating custom 3D models. You can find these tools either by typing in their full name in the command line, by using their out-of-the-box shortcuts, or by creating your own custom commands. The out-of-the box shortcut commands are Union = UN, Subtract = SU, and Intersect = IN.

Start by drawing a 3D box with these properties: Length = 12", Width = 12", and Height = 12". Also, draw a cylinder with these properties: Diameter = 6" and Height = 24". Then take the base of the cylinder and place it on top of the box, directly in the center. Now perform the Union command and select both the box and the cylinder. As you will see, you now have a 3D solid object that is the combination of the cylinder and the box. If you press and hold



CTRL, you can use the "filter select" command to select the box or cylinder if you want to change the properties of that object while it is still in its combined form. Give it a try. Hold CTRL down and select the box. Change the length of it to 24" and then exit out. You still have your single 3D solid but the shape of the box has the 24" length property. This filter selecting technique comes in very handy when creating 3D objects when you want to change properties of basic shapes versus starting over again.

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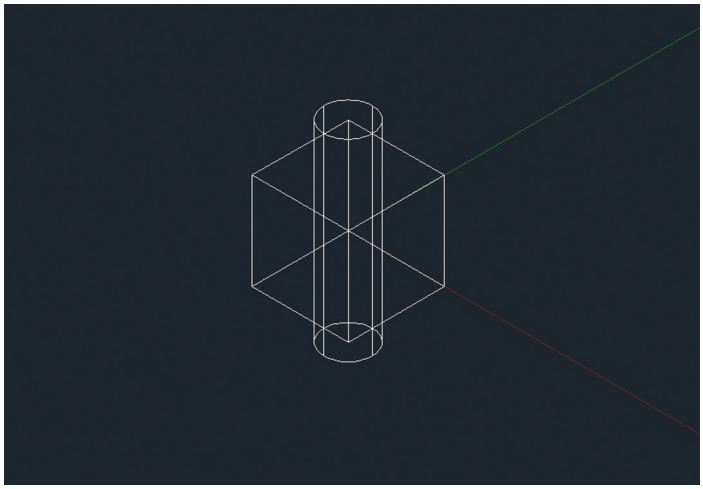
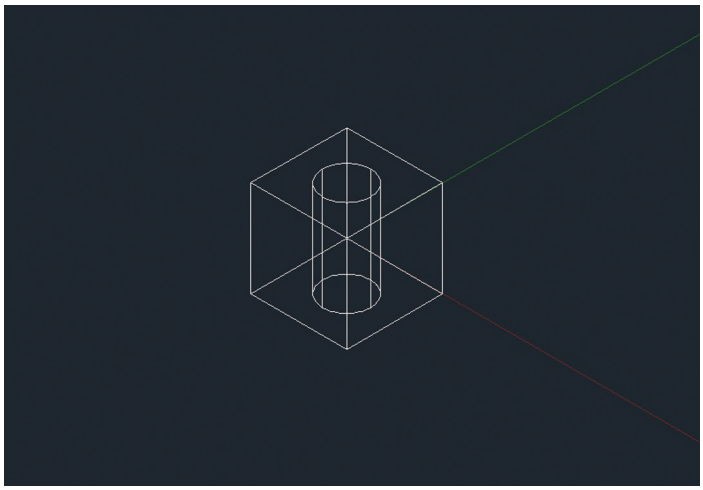
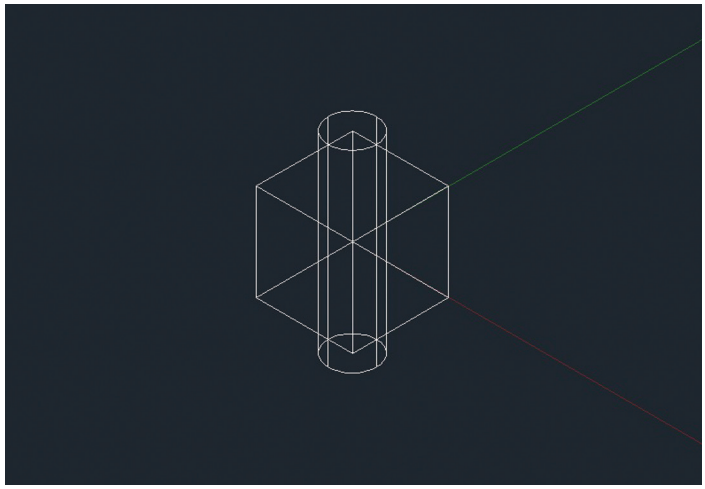
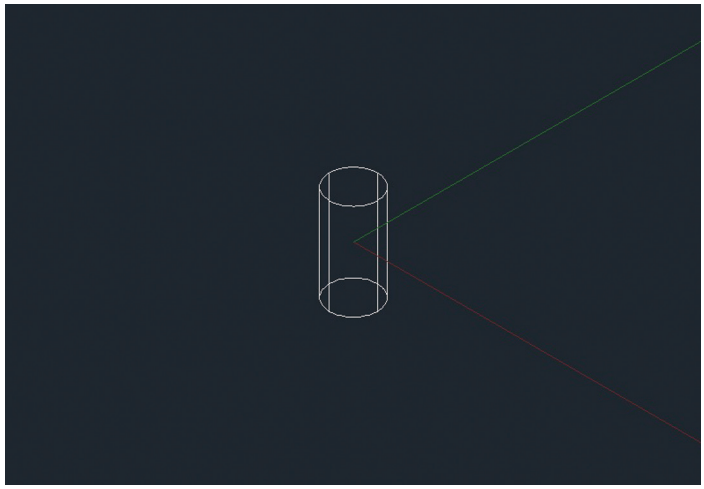
Let's work with the Subtract command now. Once again, create a box and cylinder with the same properties as the ones we created for the Union command. Now, place the center of the cylinder directly in the center of the box overall. Using the Subtract command, select the box first, hit enter, select the cylinder second, and then hit enter again. You have just taken the part of the cylinder that passes through the box and subtracted it from the box, leaving a void. Using the filter selection technique from before, you can still change the properties of each entity without having to start over with your 3D object.





Now on to the Intersect command. Create a box and cylinder with the same properties as you did in the Subtract section and place the cylinder in the same location. Now, perform the Intersect command and select both the box and cylinder. Finish by hitting enter and you will see that the new shape will be where the box and cylinder intersect, erasing anything else that does not. As before, you can use the filter selection technique to select each original entity and change its properties to update your new 3D object.

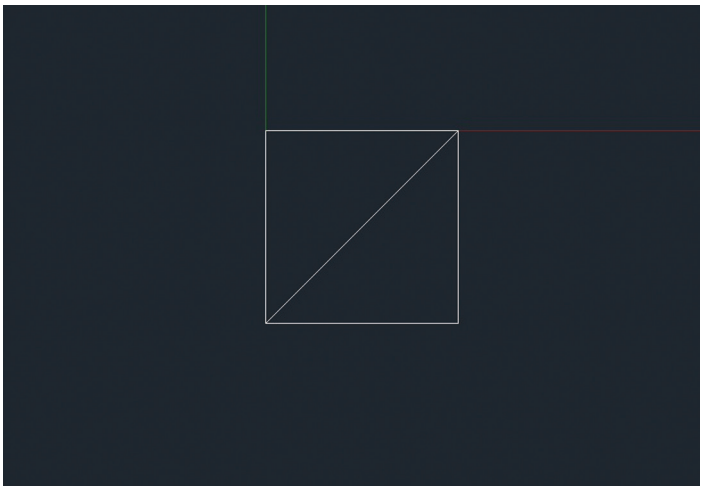




With enough practice, these three commands can help create any custom 3D object you want. Using the filter selection technique allows you to change the properties/position of the 3D entity you used to create the custom objects without having to redo/start over. Try using them and see what kinds of custom things you can come up with. Over time, these will become second nature and there will be no limit on what you can create.

Another really helpful 3D editing tool is the Slice tool. With Slice, you can take 3D objects and slice them in different ways and angles to create new 3D objects. To use the Slice command, you can either type it out in the command box, use the out of the box shortcut (slice = SL), or create your own.

Start by drawing a 3D box with these properties: Length = 12", Width = 12", and Height = 12". Now type Slice in the command box and select the 3D box you created. Select the lower left-hand



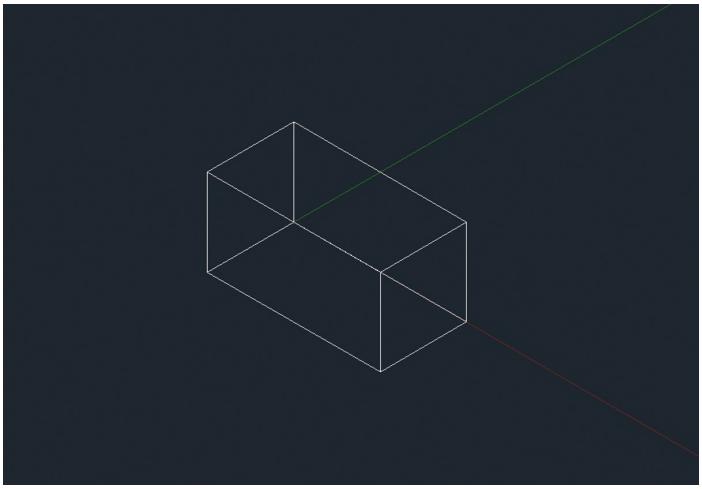
corner of the box and then select the upper right-hand corner of the box. Before you hit enter, look at the command line. It will give you the option to either keep both sides of the object or to select a point on the desired side of the object to keep. For now, keep it at both. Hit enter to complete the command and you will now have two separate 3D objects in the form of a 3D triangle.

There are a few different ways to use the Slice tool. The previous way described is the most common way to use it in 3D editing. If you perform Slice and select your object, you can look down at your command bar and see the various ways you could slice your 3D object. For example, slice in the XY axis, YZ axis, ZX axis. Let's do a few different examples of this. Start with your original box as before. Perform the Slice command and select your box. In the command box type in "ZX" and then hit enter. Select the center point on the left side of the box and then the center point on the right side of the box. Hit enter to keep both sides. As you can see, you have a slice right down the middle of the box from left to right. If you were to use the "ZX" Slice command and then select two points in the YZ axis, the slice command will not perform. Once again, create a box as before and this time slice it using the "YZ" command. As you can see, you will have to select points in the Y and Z axis in order for this to work.

With the Slice command, you can further edit your custom 3D object by slicing it in various different ways. This becomes useful when you want to slice the object into two different parts, but want to keep the same shape of the original object just beyond the slice point, or if you want to delete just one side of the object.

Extrude Faces is a useful tool when you want to take a face of a 3D object and extrude it to a specific value. You can even apply a taper to the face that you want. Let's try it.

Create a 3D box with these properties: Length = 24", Width = 24", and Height = 24"and then type "SOLIDEDIT" into the command box. Then type "F" into the command box and hit enter. This will



give you the option to select one of the faces of the box. Type in "E" to select the extrude faces command and then select the right face of the box (make sure you are in an isometric view). In the command box, type 18" to specify the distance in which the face will be extruded and hit enter. The command box will now prompt you to add a taper into the face, but for now just leave it at 0. Hit enter again to complete the command and you will see your face of the box will now grow by 18".

WITH PRACTICE YOU CAN USE THESE BASIC COMMANDS TO MAKE SOME VERY ADVANCED CUSTOM 3D OBJECTS.

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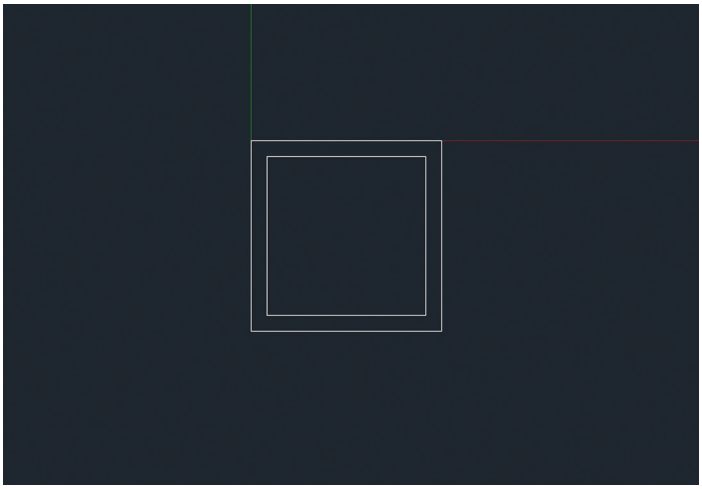
With the Extrude Faces tool, you can take one or more faces and extrude them with a specific distance that you specify. This comes in handy when dealing with more complex objects that have multiple faces when you just want to extrude one face without affecting any other face on the object.

The Shell command is a useful tool that will take a 3D object and hollow it out to a determined thickness specified by you. Let's try a few examples.

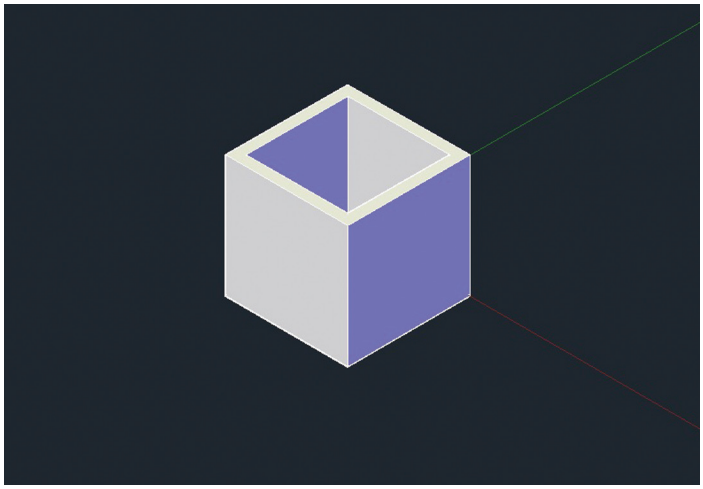
Create a 3D box with these properties: Length = 12", Width = 12", and Height = 12"and then type "SOLIDEDIT" into the command box. Then type "B" into the command box and hit enter. This will give you the option to select the body of the box. Type in "S" to select the Shell command and then select the box. Hit enter and then give your "shell offset distance" a distance of 1". Hit enter to complete the



command and you will see that your box now has been hollowed out with a thickness of 1". You could bypass typing "SOLIDEDIT" by selecting your Shell command off the Tool ribbon in the Solids Editing menu. If you wanted to remove one or more faces of the box while performing the shell command, all you have to do is select one or more faces when prompted and then the face selected will be deleted from the shell command. Let's try an example of this.

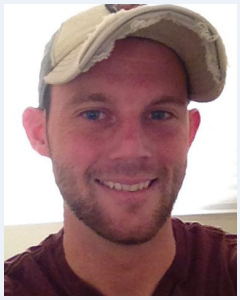
Perform the Shell command as described earlier all the way up to selecting the box, but do not hit enter after selecting the box. If you look down into your command box, you will see it prompt you to remove faces. Make sure your view is isometric and select the upper face of the box. If the command removed the faces successfully, the command box will display this message: "1 face found, 1 removed." Now hit enter to give your box a "shell offset distance" of 1" and to complete the command. You will see that your box now has been hollowed out with a thickness of 1" and the top of the box has been removed, creating an open box.

You can use this tool to create hollow 3D objects that are either closed completely or have one/more faces removed, creating an open 3D object.



CONCLUSION

These are some of the basic editing tools you will encounter when editing 3D objects in AutoCAD. By using the Union, Subtract, and Intersect commands, you can work with multiple 3D objects to either combine, subtract, or take a combination of the two objects, resulting in a newly created object. The Slice command allows you to edit your 3D object further by slicing it in different angles/ways. With the Extrude Faces tool, you can select one or more faces to extrude out without affecting other faces of the object. You can even add a taper to the face of the object. Once you have your 3D object or even just a part of it, you can use the Shell command to hollow it out with a pre-determined thickness. As I stated before, with practice you can use these basic commands to make some very advanced custom 3D objects.



Chris Alexander lives in Bay Area in California. He works for one of the top electrical contractors in the nation as a BIM Lead. He started out as an electrical worker and has been working with 3D for the last five years. He is fluent in AutoCAD, AutoCAD MEP, Navisworks Manage, and Maya. In his off time, he enjoys learning new techniques for 3D modeling and keeping up with new 3D modeling techniques/programs. When he is not involved with 3D, he can be found in many endurance races throughout the nation, pushing his body to ultimate extremes. Running beyond 50 miles is his specialty to show how far one can push beyond limits and that anything is possible when you put your mind to it.

by: R. Robert Bell

MEP Families for Ceiling Coordination

The family editor remains a mysterious feature for many users of Autodesk® Revit®. However, there are edits that you can easily make to families to make them more useful in projects. This article will show you how you can use the family editor to make families better for ceiling coordination.

Many Revit MEP families, especially in the electrical discipline, display an annotation symbol rather than an actual physical size. While this is perfectly acceptable for plans for construction documentation, it is not so useful for coordinating ceilings. Have you ever gotten the request from an architect to see the actual device outline rather than the symbol? For example, a CCTV camera is usually a small round object, but the plans show a symbol for the camera (see Figure 1). Have you wondered how you will accommodate the request?

It can be done with some simple editing of your families. The heart of the technique is to leverage Revit's detail levels. Many firms set plan views for construction documentation to a detail level of either Medium or Coarse. It is natural to reserve the Fine detail level for, well, fine tasks. Ceiling coordination fits the bill!

Figure 1: An annotation symbol

One technique I have seen is to turn off the annotation family at Fine level and to turn off the display of the 3D model at Medium and Coarse levels. There are several reasons why this approach is not good.

1. This effectively reduces the possible displays of the family to only two choices rather than three. You have the choice to display the 3D model at Fine and the symbol at either Medium or Coarse. Is that so bad? Yes, if you want elevations and sections to NOT show small elements at Coarse detail level.
2. Any elevations, sections, or 3D views would need to be set to Fine in order to see the 3D elements.
3. If there are multiple 3D elements that make up the model, they all need to be set to the same visibility settings in order for all the 3D elements to be visible at the same time.
4. Displaying 3D work in plan views is a known performance issue and should be avoided when possible.

The alternative approach is similar in that the annotation family is turned off at Fine detail level. The difference is that symbol lines are used to display the outline of the device at Fine detail level rather than the 3D elements. This approach addressed the shortcomings noted earlier.

1. You still have three detail levels to work with in case you want to hide features at the Coarse detail level.
2. You can use any detail level you want for elevations, sections, and 3D views.
3. You can create just an outline of the element rather than all the details.
4. The symbol lines are all that show in plan views at Fine detail level, keeping model performance at an acceptable level.

FINDING A FAMILY TO EDIT

Although you can use any family (with a nested annotation family) intended for ceilings with these instructions, you may want to download the sample Revit 2012 family posted in the AUGI forums to follow the steps. The family is located in the Revit

Revit MEP 2013

MEP – Families forum under the thread titled "Sample Family for *AUGIWorld* Feb. 2013." The name of the family is "CCTV Camera (Ceiling)."

If you choose to use your own family, the names of the views could be different. But as long as your family is using a nested annotation family for the plan symbol and not showing 3D objects in a plan view it should work for the purpose of this article.

I suggest placing the family file on your desktop while following the steps in this article to avoid accidental overwrites of your live families.

TESTING THE INITIAL FAMILY

Start a new instance of Revit. Open a new Revit project to test your family edits. For this discussion, all you need is an open ceiling view with a single ceiling placed. The easiest way to do that is to:

1. Open a ceiling view.
2. On the ribbon, select the Architect tab > Build panel > Ceiling tool.
3. On the ribbon, select the Modify | Place Ceiling tab (if it is not active) > Ceiling panel > Sketch Ceiling tool.

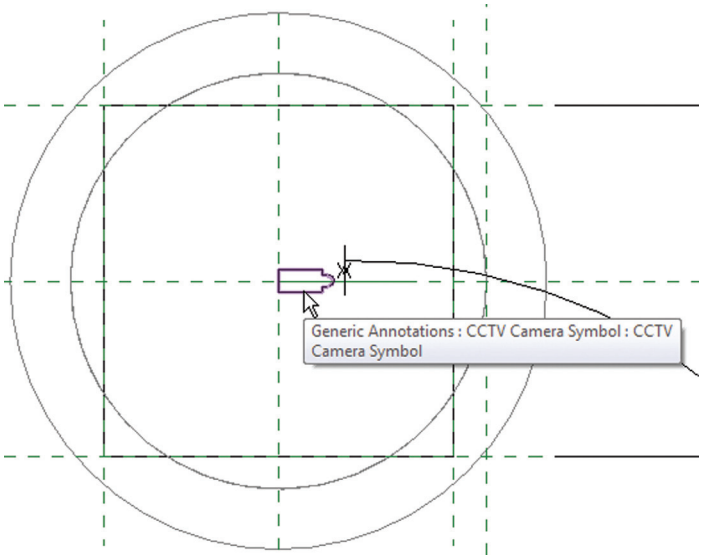


Figure 2: Select the Annotation Family

4. On the ribbon, select the Modify | Create Ceiling Boundary tab (if it is not active) > Draw panel > Rectangle tool.
5. Draw a rectangular boundary at least 10' 0" by 5' 0".
6. On the ribbon, select the Modify | Create Ceiling Boundary tab (if it is not active) > Mode panel > Finish Edit Mode tool.
7. Open the family in Revit.
8. On the ribbon, select the Family Editor panel > Load into Project tool.
9. Place an instance of the family on the ceiling (the sample family is a face-based family so be sure to select the Place on Face option on the ribbon).

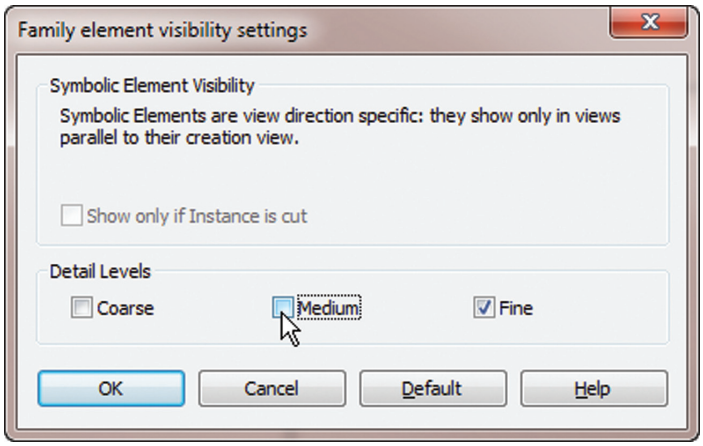


Figure 3: Turn off "Fine"

Now change the Detail Level to Coarse, then Medium, then Fine. The symbol is visible in all three levels of detail (at least for the sample family. If you are using your own family the results may vary).

Leave this test project open to continue testing as you work on the instructions.

STEP-BY-STEP INSTRUCTIONS

These instructions are written using Autodesk® Revit® MEP 2012, so the steps might vary slightly in other versions of Revit.

1. Switch to the family in Revit.
2. Open to the Floor Plans > Ref. Level view.
3. Select the nested annotation family placed in the view (see Figure 2).
4. In the Properties pane, select the Edit… button for Visibility/ Graphics Overrides.
5. Clear the Fine option for Detail Levels (see Figure 3).
6. Select OK.
7. On the ribbon, select the Load into Project tool.
8. In the Family Already Exists dialog box, select the Overwrite the existing version option.
9. Change the view's Detail Level to Fine. The symbol should disappear.
10. Change the Detail Level to Medium. The symbol should reappear.
11. Switch to the family in Revit.
12. On the ribbon, select the Annotate tab > Detail panel > Symbolic Line tool.
13. On the ribbon, select the Modify | Place Symbolic Lines tab (if it is not active) > Draw panel > Circle tool.
14. Place the cursor over the outer circle and type SC to snap to the center of the existing circle.
15. Select the outer circle to specify the center point.
16. Select the outer circle again to specify the radius.
17. On the ribbon, select the Select panel > Modify tool.
18. Select the symbolic circle you just created.
19. In the Properties pane, select the Edit… button for Visibility/ Graphics Overrides.

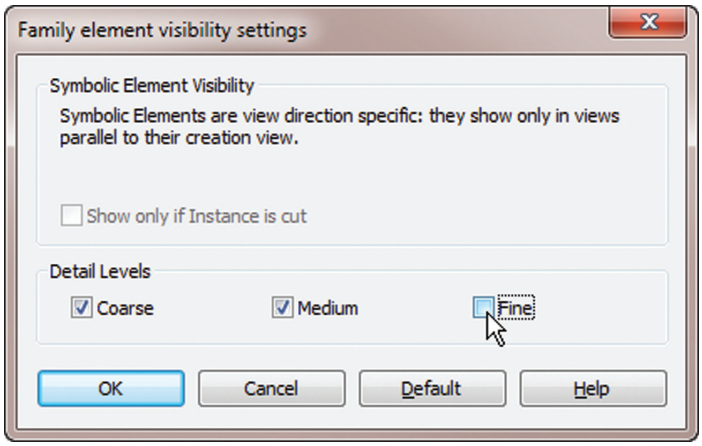


Figure 4: Turn off "Coarse" and "Medium"

20. Clear the Coarse and Medium options for Detail Levels (see Figure 4).
21. Select OK.
22. On the ribbon, select the Load into Project tool.
23. In the Family Already Exists dialog box, select the Overwrite the existing version option.
24. Change the view's Detail Level to Fine. The circle indicating the actual outline of the element should appear.
25. Change the Detail Level to Medium. The symbol should reappear and the circle should disappear.

As you can see (Figure 5), you now have a family that has the capability to show the actual geometry of an element at Fine level of detail even when the element normally shows a symbol at other levels of detail.

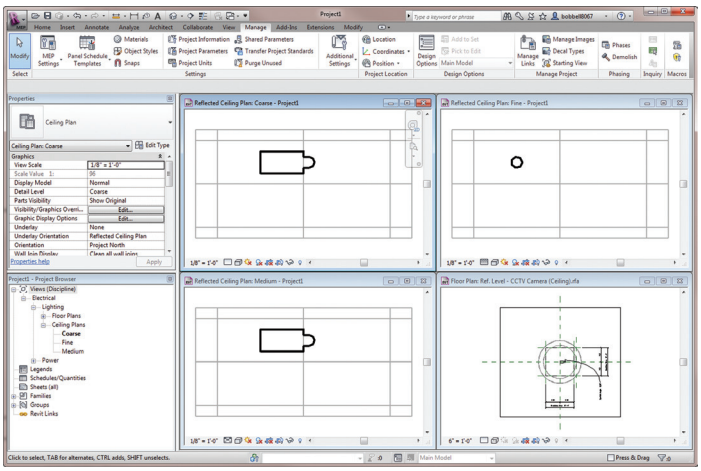


Figure 5: The results

I'M NOT QUITE DONE YET

The symbolic circle that we added hasn't really been tied to the geometry of the family. For example, if you change the Base Radius parameter in the family to 4" instead of 3 1/16" you will see the symbolic circle does not automatically adjust. This can be easily corrected.

1. Switch to the family in Revit.

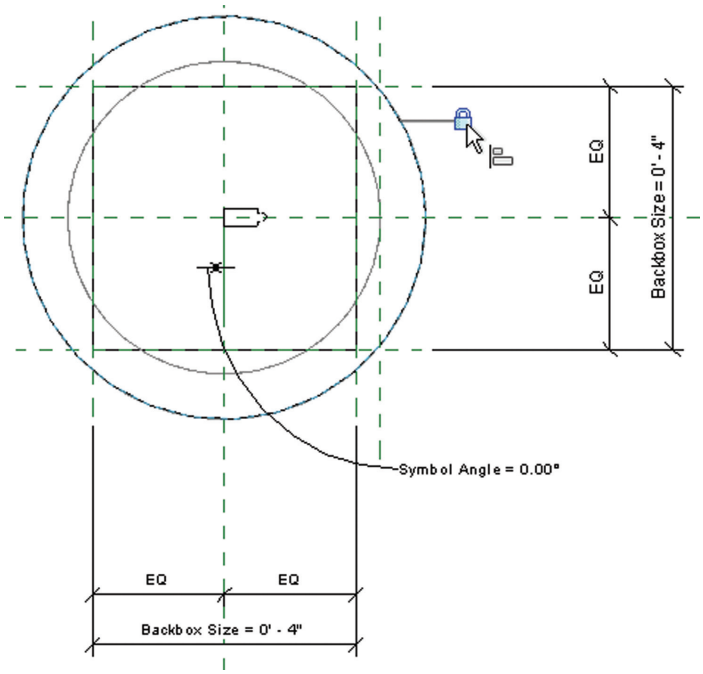


Figure 6: Add a constraint

2. Select the symbolic circle and change its radius to 5" or some other larger value.
3. On the ribbon, select the Modify tab > Modify panel > Align tool.
4. Select the extrusion circle.
5. Select the symbolic circle. The symbolic circle should adjust back to the size of the extrusion.
6. Select the blue padlock symbol to constrain the symbolic circle to the extrusion circle. The padlock symbol should change to "locked" to constrain the symbolic circle (see Figure 6).

Change the Base Radius parameter in the family to 4" instead of 3 1/16" and you will see the symbolic circle automatically adjusts to the new size.

You may have noticed that some of the elements in the family editor turned gray after you modified them. The grayscale is used to indicate elements that are not visible at the current detail level. The grayscale will only be evident in the family editor.

CONCLUSION

Modifying families so you can perform ceiling coordination is not difficult once you have done it a few times. The only issue you will run into is the tedium of changing a lot of families to enable this capability.

R. Robert Bell works for Sparling in Seattle, Washington, US. He is their Design Technology Manager. He has used AutoCAD since v2.18 (AutoLISP!). He has served on the AUGI Board of Directors.

by: Philip Russo

Understanding Line Weight Basics

One of the first concepts new Autodesk® Revit® users need to grasp is how to control visibility and appearance of objects. Most users start off as great modelers, but fall short with construction documentation because they are unable to get all the objects to look correct on paper. This article will look at all the major components that control the line weight appearance of objects.

Model Line Weights | Perspective Line Weights

Model line weights control line widths for objec

There are 16 model line weights. Each can be

	1" = 1'-0"	1/2" = 1'-0"
1	0.0030"	0.0030"
2	0.0070"	0.0070"
3	0.0120"	0.0120"
4	0.0180"	0.0180"
5	0.0250"	0.0250"
6	0.0350"	0.0350"
7	0.0500"	0.0500"
8	0.0750"	0.0750"
9	0.1000"	0.1000"
10	0.1350"	0.1350"
11	0.1750"	0.1750"
12	0.2250"	0.2250"
13	0.3000"	0.3000"
14	0.3000"	0.3000"
15	0.4000"	0.4000"
16	0.5000"	0.5000"

Figure 1: Object line weight table

LINE WEIGHTS

Revit uses a numbering system to assign line weights to objects. Numbers range from 1-16 and may vary depending on the scale of the view. This table can be found by selecting Line Weights from the Additional Settings pull-down located on the Settings panel of the Manage ribbon.

Object Styles

Model Objects | Annotation Objects | Analytical Model Objects | Imported Objects

Filter list: Structure

Category	Line Weight		Line Color	Line Pattern	Material
	Projection	Cut			
Columns	1	4	Black	Solid	
Detail Items	1		Black	Solid	
Floors	2	5	Black	Solid	Default Floor
Generic Models	1	3	Black	Solid	
Mass	1	2	Black	Solid	Default Form
Parts	1	2	Black		

Figure 2: Object styles

Once you get a grasp on how these line weights print you need to verify they are associated to your objects. This is done at a global level by accessing Object Styles found on the Settings panel of the Manage ribbon.

Figure 2 shows objects with their associated line weights assigned for a projected display and a cut display. Even though these values can be overridden, these settings are global for your project. As shown in Figure 2, a column would use a line weight of 1 if the view range does not cut through the column. However, if the column is cut by the view range, then the line weight of 4 would be used. You can also assign a line color, line pattern, and material to your objects.

By now, hopefully you understand the link between your view scale and the line weight assigned to your objects. The next component

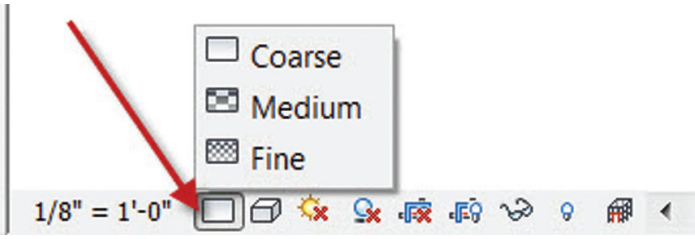


Figure 3: Detail level

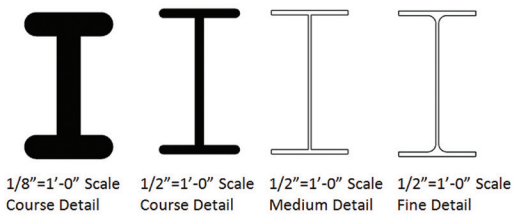


Figure 4: Detail level with scale comparison

that comes into play is the detail level of your view. Depending if your detail level is set to Coarse, Medium, or Fine, control of how your objects display will change. The lower left-hand corner of your view is where you assign the detail level. This is shown in Figure 3. The detail level can also be set in your Properties palette.

Figure 4 shows the differences in combining different scales with detail levels. You will notice that a coarse detail level will display columns with a single line representation. When the scale is changed from ⅛"=1'-0" to ½"=1'-0" the column shows crisper in the coarse level of detail. Once the detail level changes to medium, the column is represented with double lines showing the web thickness. And finally, when the detail level is changed to fine you get a true representation of the column showing the fillet at the web.

OVERRIDE LINE WEIGHT

Sometimes you may have a view created in your project where you want to use different line weights than previously set up in the global settings. This can be done using your visibility graphics. Every view in your Revit project can have different visibility graphic overrides applied.

When you select a category in your visibility graphics you have the option to apply an override to the line weight used on the object for the view you are editing. This is shown in Figure 5. This override will not change other views in your Revit project; it will affect only the visibility graphics of your current view.

There also may come a time where you need to control the line weight of just a few objects and not all the objects in a view. Maybe there is an existing column on a plan where you need to display it with a lighter line weight. This could be handled with phase filters; however, let's assume this is a small job and you did not have the time or possibly the knowledge to apply filters to your project. Revit allows you to apply overrides to individual elements without affecting the same objects in the view or other objects in the project.

Select the objects to which you want to apply the override, and then select Override Graphics in View from the shortcut menu. Using the By Element option will change only the selected elements. Selecting By Category is the same as editing the category in the

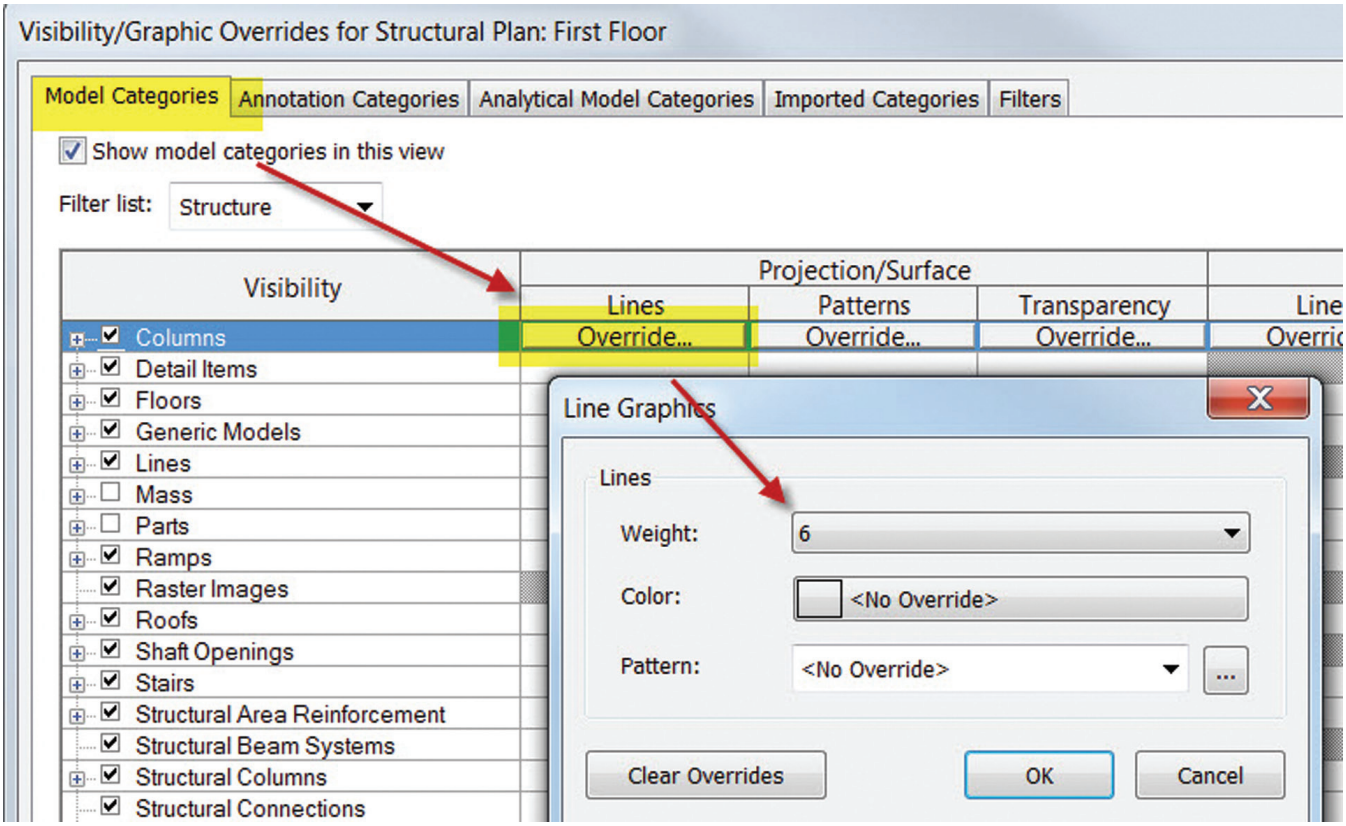


Figure 5: Visibility Graphics override

Revit Structure 2013

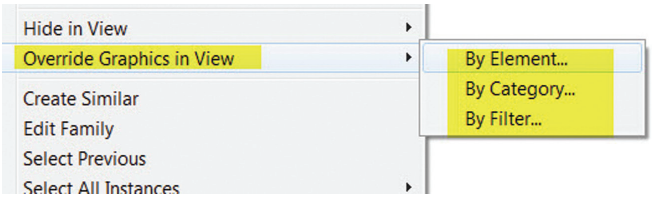


Figure 6: Visibility Graphics override by element

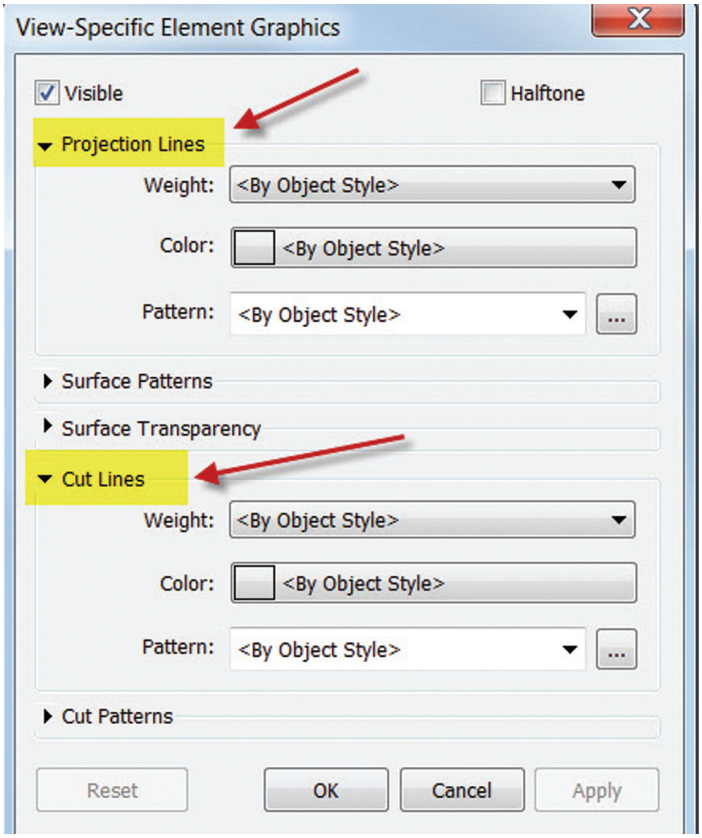


Figure 7: By Element line weight overrides

visibility graphics explained previously. The final selection is By Filter, which allows you to select elements to which to apply an override based on a defined filter.

OTHER VISIBILITY BASICS

When you are working at a small scale with the detail level set to Coarse, objects may appear very bold when you are zoomed in on them. You can toggle your line weights on and off using the thin line display tool.

Another major obstacle for Revit beginners is view range. Sometimes you will draw a beam in a plan view and you just do not see it, but when you switch to 3D view it is there.

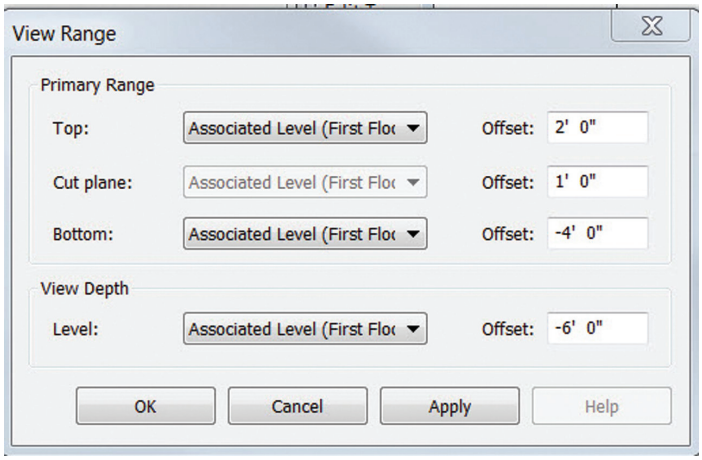
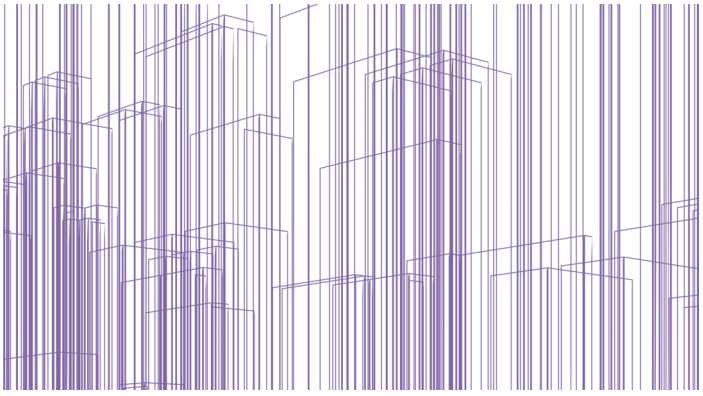


Figure 9: View range

Every plan view has a property called view range. The view range is a set of horizontal planes that control object visibility in the view. The horizontal planes are top, cut plane, and bottom. The top and bottom clip planes represent the top-most and bottom-most portion of the view range being displayed. The cut plane is a plane that determines at what height certain elements in the view are shown cut. As mentioned previously, the cut display has its own line weight assignment versus projected. These three planes define the primary range of the view.

View depth is an additional plane outside of the primary range. You can set the level of view depth to show elements below the bottom clip plane.



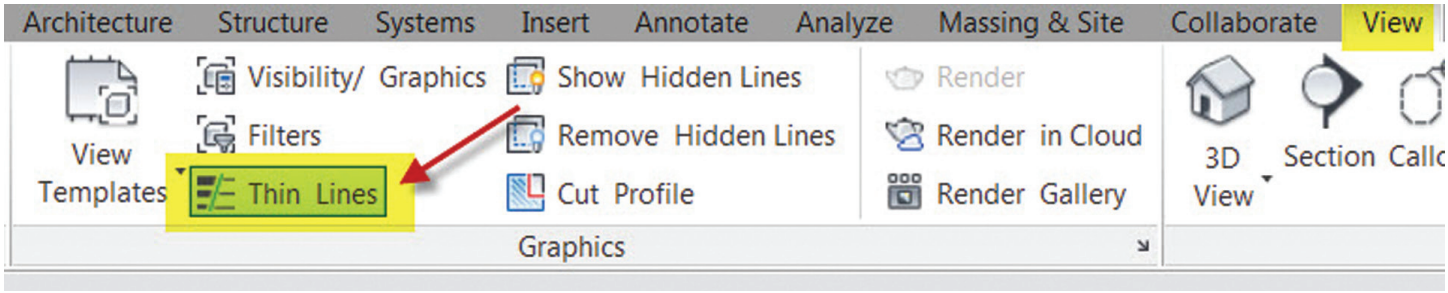


Figure 8: Thin line display tool

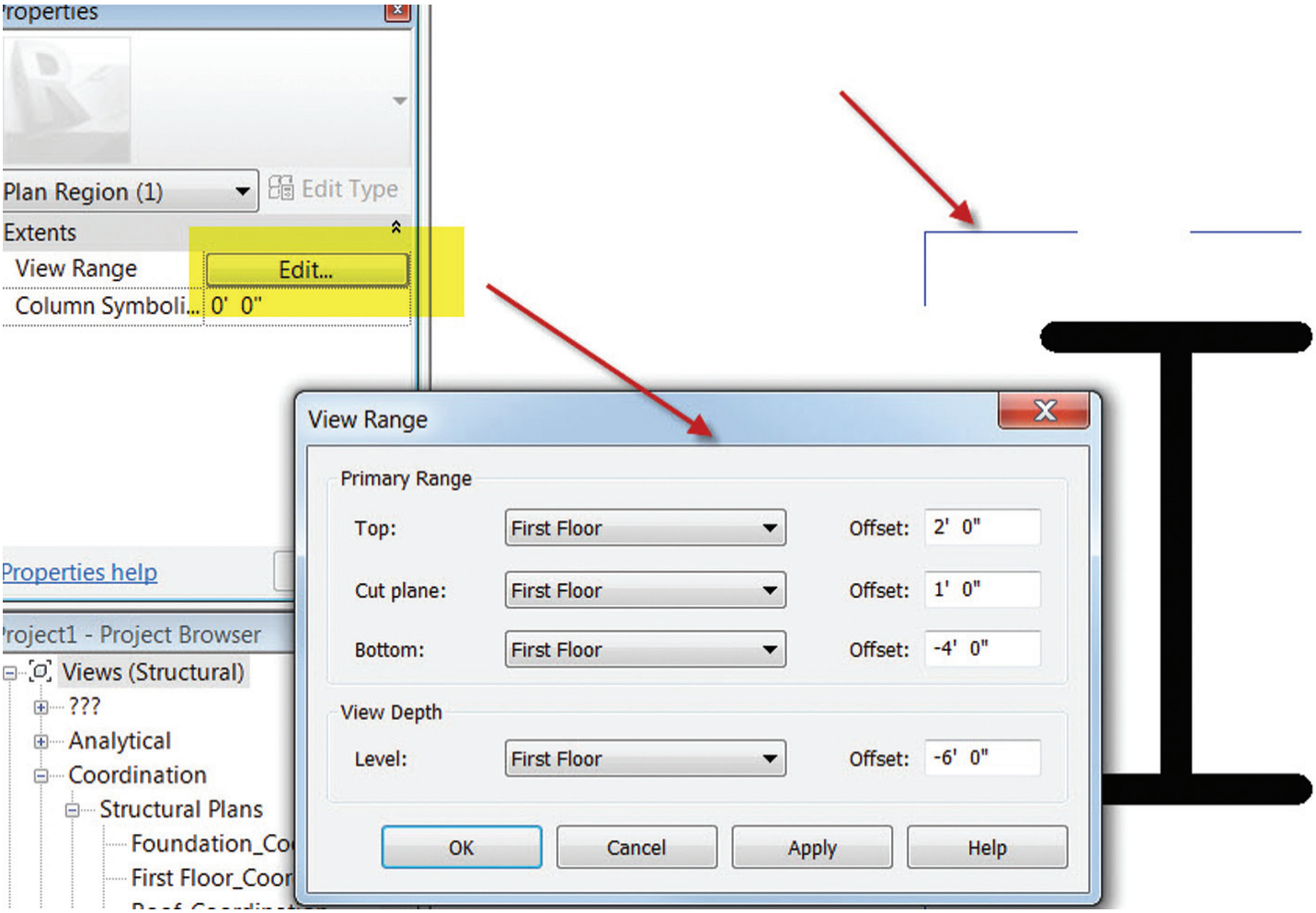


Figure 10: Plan Region

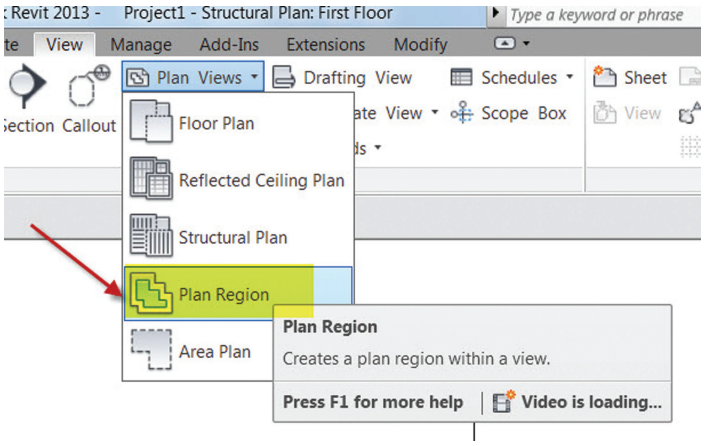


Figure 11: Plan Region view range override

You may need to show some structural framing such as a mezzanine level in your view. When you adjust your view range to display a mezzanine level, the framing in the main plan disappears. Revit's Plan Region tool allows you to define an area of your plan that will have its own view range different than the properties of the view. Think of it as a view range override.

SUMMARY

Hopefully, some of these basics will help you ramp up your skill set inside Autodesk® Revit® Structure.

Philip Russo began with AutoCAD version 2.5 in 1986. Through the years he has held positions in the CAD industry as CAD Draftsmen, CAD Manager, Sr, Applications Engineer, and is a Certified Autodesk Instructor. Lately Phil's focus has been on the implementation of standard practices for the Revit platform. He currently holds the position of Sr. Technical Application analyst at O'Brien & Gere Limited and has his professional product certifications for Revit Architecture 2013, 3DS Max 2103 and AutoCAD 2013. O'Brien & Gere is an engineering firm located in Syracuse, New York. Phil can be reached at phil.russo@obg.com

by: Kevin Miller

Navisworks in A University Curriculum

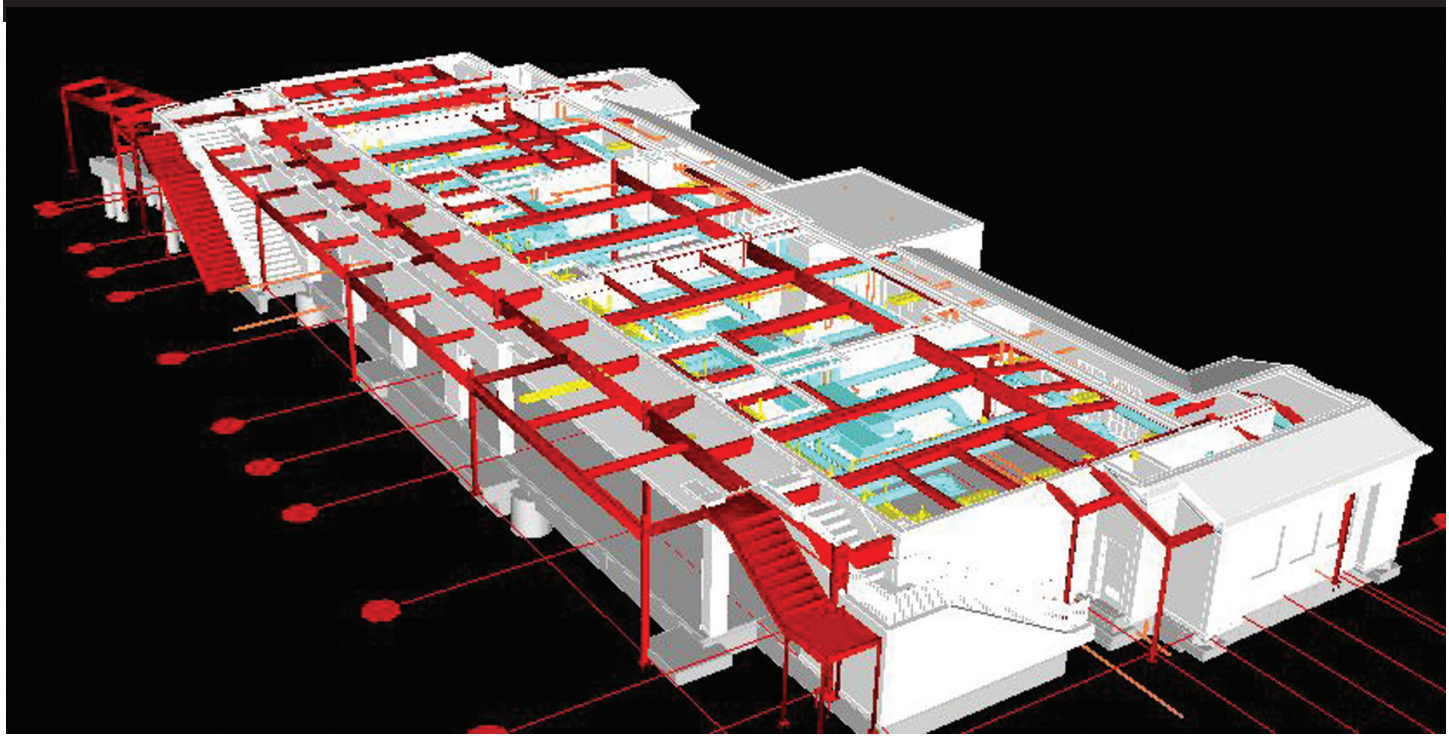


Figure 1: Model sectioned by floor

As BIM is integrating into the curriculum at BYU, one of the BIM applications being taught is Autodesk® Navisworks. Navisworks is being used to perform clash detection, create fly-through, and facilitate visualization.

The skills learned in Navisworks are helping students understand construction issues in the classroom as well as preparing them for entry level positions in preconstruction services or operations.

CLASH DETECTION

While clash detection is often referred to as the low hanging fruit of BIM, many companies are still struggling with finding methods or processes to perform clash detection efficiently. With the sheer number of clashes that arise if complete models are clashed against each other, clash detection can be an overwhelming activity if a streamlined process is not followed. Working with multiple contracting firms, educators are able to discover the best practices of clash detection that can be incorporated into the curriculum.

Best practices such as breaking the models into floor-by-floor sections instead of complete structures, using search sets, using rules to eliminate false positive results, and adjusting the visual properties of the model for clash detection have been observed from industry and incorporated into the students' coursework.

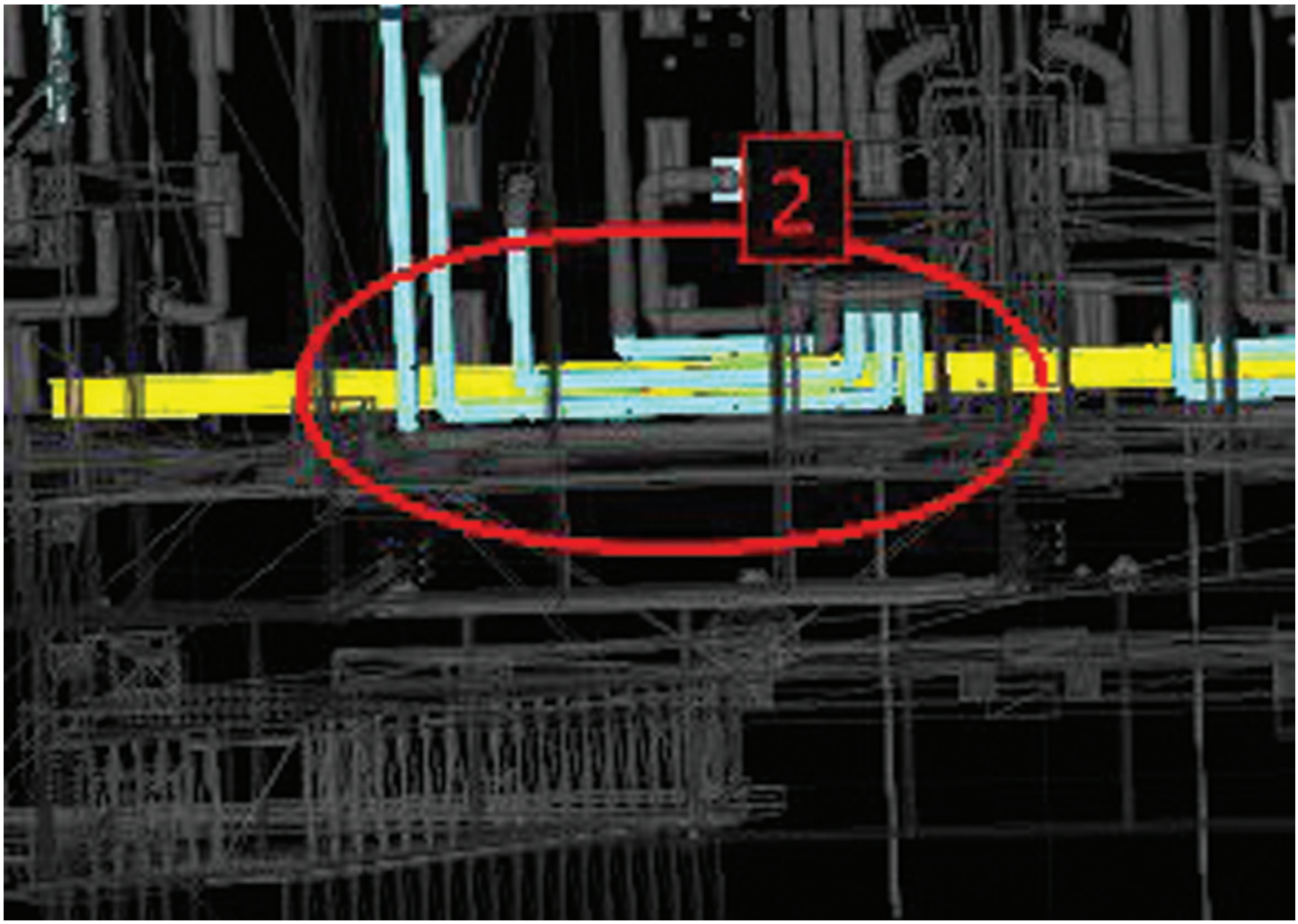


Figure 2: Grouping clashes in coursework

I created a tutorial for clash detection that can be found on my course website. The URL is:
http://cmfac.groups.et.byu.net/miller/cm411/help/Navis/Navis11.php

FLY-THROUGHS AND SEQUENCING

Using Timeliner and animated saved viewpoints, students are able to create sequences of class projects they are working on. With the Navisworks tools, students are able to see how project management decisions affect the project and the ramifications of their decisions. The tools also allow students to study various what-if scenerios to address the constructability of class projects. I created a basic Timeliner tutorial that can be found on my course website. The URL is:
http://cmfac.groups.et.byu.net/miller/cm411/help/Navis/Navis11.php

VISUALIZATION

Navisworks can be used for several different forms of visualization. The first is to demonstrate a site logistics plan in order to show how the project will interact with the surrounding area and how it will impact the traffic flow.

The second is to view the 3D model on a 2D monitor and then walk around the model to see what "gotchas" might exist. The gotchas that may be found are things such as a column in the center of a corridor instead of being embedded in a wall.

Figure 3: Viewing the model on a 3D monitor

Navisworks Manage 2013

The third method is using a 3D monitor to view the 3D model. This is a lesser known feature in Navisworks; however, with the right hardware, some patience, and research on the settings, viewing the model on a 3D monitor allows you to feel the space rather than just see it. While this could be used as a sales tool, the real advantage is helping project owners feel what the space will be rather than waiting until after the space is constructed and then understanding the spatial relationships.

While the 3D monitor helps you feel the space, adding furniture, cars, plants etc. will help to further enhance the spatial understanding.

HAVING A PLAN

I'm guessing that most people reading this article didn't grow up watching the "A Team" TV series, but one of my favorite lines from the show is "I love it when a plan comes together." When people have an unfavorable experience with BIM, it is typically because they were told to use BIM, but no one has a plan on how BIM will be used on the project. A BIM execution plan will make the BIM experience better for everyone involved. The catch is that the BIM execution plan must also be followed.

If you are looking for ideas on what could be included in a BIM execution plan, I have a sample one available. Make sure you also look at the spreadsheet link for the BIM execution plan as well. The spreadsheet helps to define how much detail should be included in the model:
http://cmfac.groups.et.byu.net/miller/BIM/EP/index.php

The BIM execution plan helps define who should model an element and who should not. For example, everyone wants to model the floors and slabs so the elements can be used for reference; however, a problem arises when a wall moves or a floor opening shifts—you don't know which model is correct. If you follow the BIM execution plan, then each element should only be modeled once and the confusion surrounding which model is correct disappears.

CAREER PATHS

While students are learning how to use all these great tools, they need to understand that the career path for a BIM manager is rather short. If a student is hired as a BIM manager, he or she is at the top of the career path. It would be better for students to be hired as BIM project engineers or BIM estimators instead because then there is a defined career path. Their additional BIM skill sets will aid in the traditional roles.

PROVIDE TRAINING MATERIALS TO INDUSTRY

I have visited construction companies around the US seeing how BIM is being used by companies of various sizes. Some companies have essentially wanted me to sign Non-Disclosure Agreements (NDA) prior to the visit. This really built up the level of anticipation prior to the visit to see what was so advanced that no one else was doing it, thus requiring an NDA. What I found was the companies that took this approach were often behind their local competitors in their use of BIM and that in being so closed about their approach to BIM they were actually hurting themselves.

THE COMPANIES THAT ARE MORE OPEN AND WILLING TO SHARE THEIR PROCESS SEEM TO BE THE LEADERS IN BIM.

The companies that are more open and willing to share their process seem to be the leaders in BIM because they associate with others that are willing to share and as a result they help each other discover new methods and processes that make them more efficient with BIM. These companies have learned that it is the people that provide the competitive edge, rather than technological tricks and tips.

Another thing I found was that many of the companies are organizing their own "University" to train employees on various topics such as BIM. I feel it would be more efficient if there were more interaction between academia and industry where academia could create and make publicly available the training materials to benefit the entire industry.

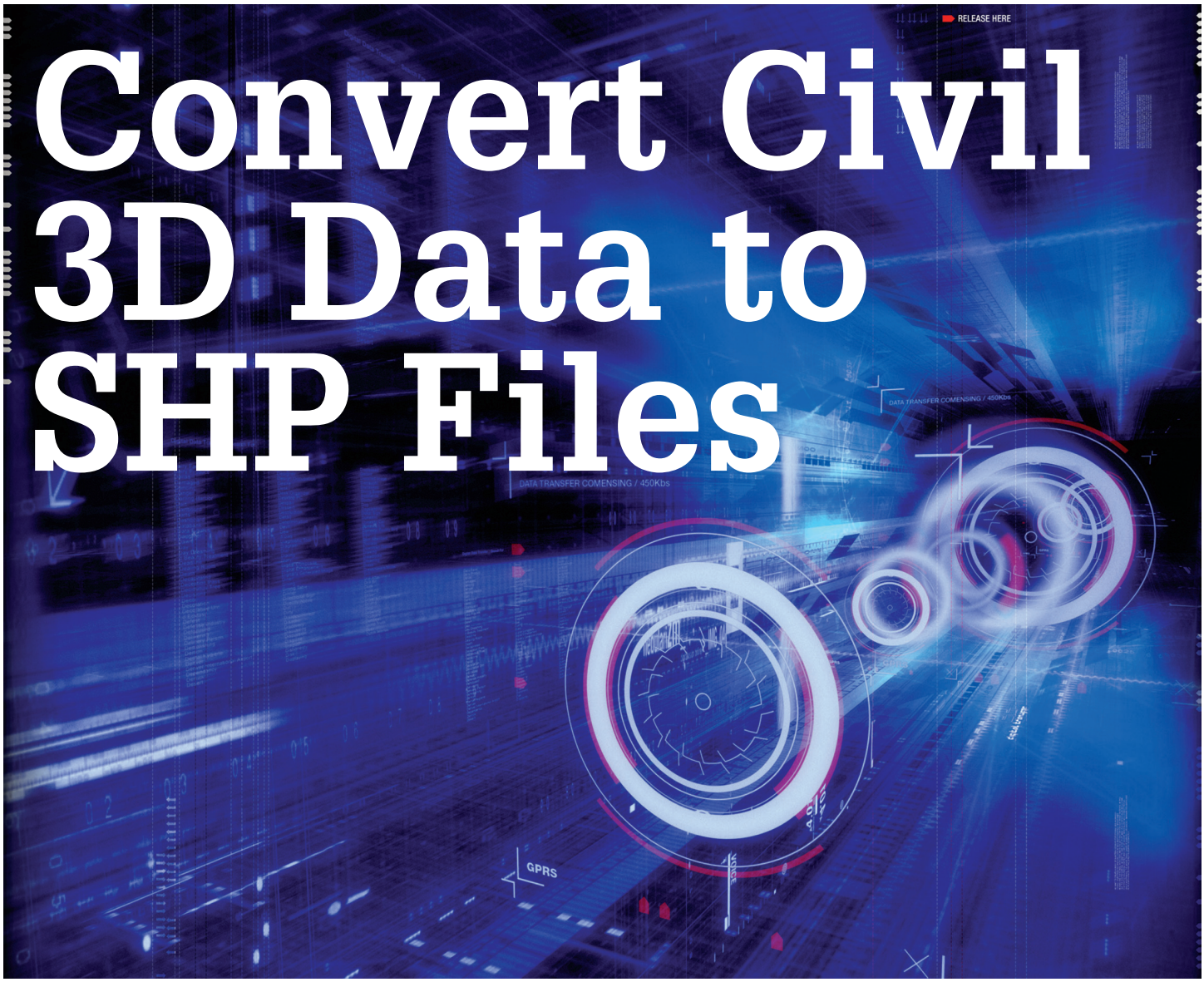
In this article I have shared a couple of the Navisworks tutorials that I use in my classes. Tutorials for using Revit to create basic schedules are also available as well as tutorials for sectioning the Revit model floor by floor for clash detection. If you are interested in these, please send me an email and I will share those as well.

FEEDBACK

This article has focused on how Navisworks is integrating into the curriculum at the university level in a construction management program. If you have additional ideas on how BIM tools could be integrated into the university curriculum, or would like additional training materials created for industry, please email kmiller@byu.edu with your ideas.

Kevin R. Miller is the program chair for the Construction Management program at Brigham Young University and earned his Ph.D. from Arizona State University. Prior to his academic career, he worked as an estimator for a large commercial construction firm.

Convert Civil 3D Data to SHP Files



As a certified Autodesk® instructor and a manager within the civil engineering industry, I have been asked many times about using AutoCAD® Civil 3D®-created data within ESRI ArcGIS. This article describes the required steps to bring Civil 3D data into ArcGIS for Desktop. The process will extract the line work and data from the Civil 3D drawing (DWG file) and create a Shape file (SHP file) that is compatible with ArcGIS. The created ArcGIS file can then be imported into ArcGIS for Desktop. The goal is to create data that can be visualized and analyzed in ArcGIS while maintaining the design information in Civil 3D and maintaining a simple and efficient workflow.

One of many solutions I have read about was to explode the Civil 3D objects and then import the line work into the GIS software. The problem with this is that all the data created by Civil 3D software's designers is then lost. All of this would then have to be recreated by the people using the GIS software. This doesn't fall within my idea of keeping everything as simple as possible.

The following conversion technique has been tried on different versions of AutoCAD, from 2008 through 2012, but my suggestion is to export and import using the same version as you will ultimately be using. The first portion of the import will create 2D line work, which can then be used for import into a CAD or GIS program. The line work created in the steps below will also maintain the data associated with it. It is at this point you will create SHP files with this data for export and then import into the GIS database.

Following the steps below will allow all data created by the designer to be incorporated into the GIS program. This will also mean that you will not have to explode the Civil 3D design. This will be very important to the design team and maintain the database as designed. Please note that this should be performed at a late stage in the design process. This will then give the client a very useful tool for existing and future design and maintenance of their facilities.

AutoCAD Civil 3D 2013

Article collaborator Justin Comeau and I created the steps listed below for export from Civil 3D and import into ArcGIS for Desktop.

1. Export Civil 3D data to SDF format (I will use 2012).
   a) "AeccExportToSDF" (Civil 3D only) is the command or "Output" from the Civil 3D toolbar, then "Export Civil Objects to SDF" in the "Export" box (this may vary per Civil 3D version). Or "MapExport" is the command or "Map" then "Tools" then "Export" in Map 2008 menu.
   b) Make sure you have the correct coordinate system setup in your drawing or you will be prompted to select one.
   c) A file will be created with a count of items at the command prompt and with the same name as the drawing and the extension "XXXXXX.SDF" and placed in the same directory as the drawing.

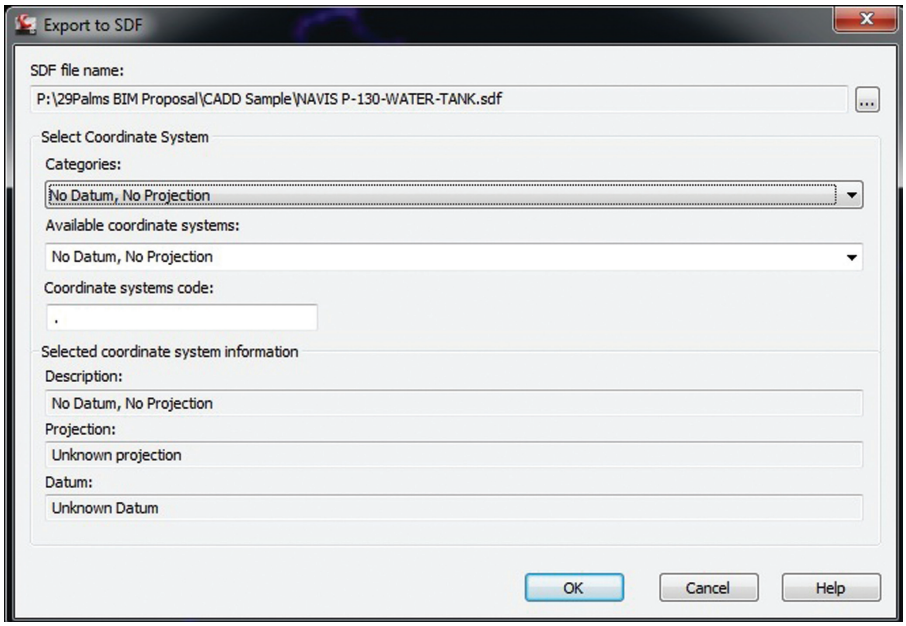


Figure 1

2. Now open a new drawing (I will use 2012).
3. Now import a SDF format file:
   a) Change workspace to "Planning and Analysis" (this may vary per Civil 3D versions or setup).
   b) Select to "Insert" on the toolbar.
   c) Select "Map Import" in the Import Box (this may take a few minutes).
   d) Select the file you created in step 1.
   e) This will open the box shown at the right.
   f) Select the "Coordinate System."
   g) Select the items you would like to import (i.e., Pipes, Structures).
   h) Then select inside the "Data" box and a radio button will display.
   i) Select the radio button to get "Attribute Data." You will get an Attribute Data window.
   j) Select "Create object data." This is a very important step as this will import the data information that will be required for the "SHP" files later.
   k) Select OK.
   l) Select OK. This will import the data as lines and points with Civil 3D data included (you may have to do a zoom extents, and also set "PDMODE" to "2" to see the point data).
   m) Save your drawing to a new name (and maybe version).

Now open the drawing you just saved; I will use 2012. For this step, use 2008, 2011, 2012, or 2013, but do not use 2010 as this will not give you all the options you will need.

4. Export a "SHP" file. Now you will need to create a shape file for each type of data you have, i.e., "Pipes" (line data), "Structures" (point data), and so on.
   a) Change your workspace to "Planning and Analysis" (this may vary per Civil 3D versions or setup).

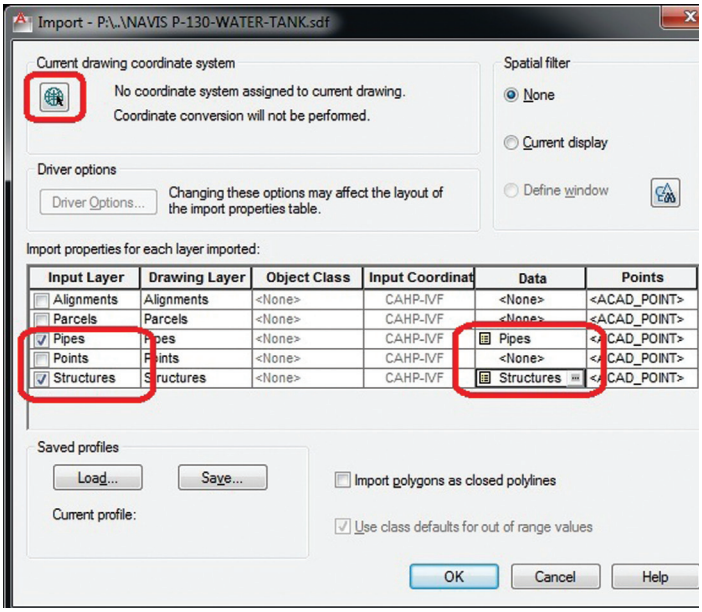


Figure 2

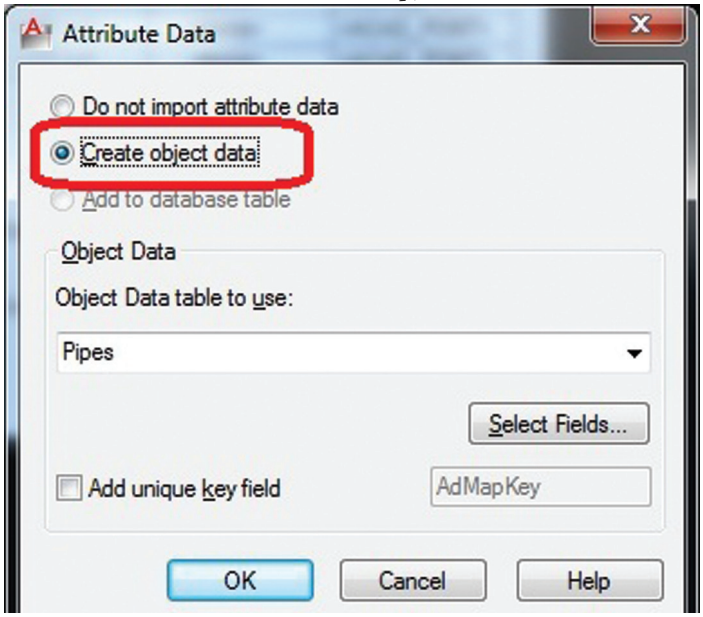


Figure 3

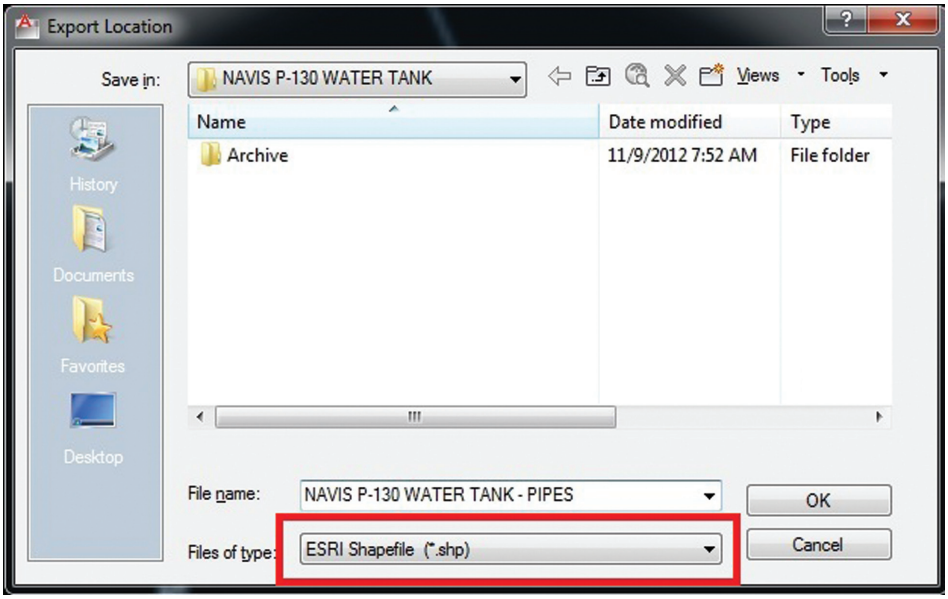


Figure 4

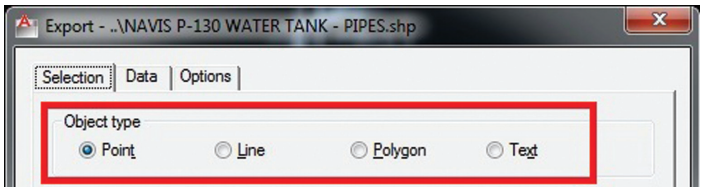


Figure 5

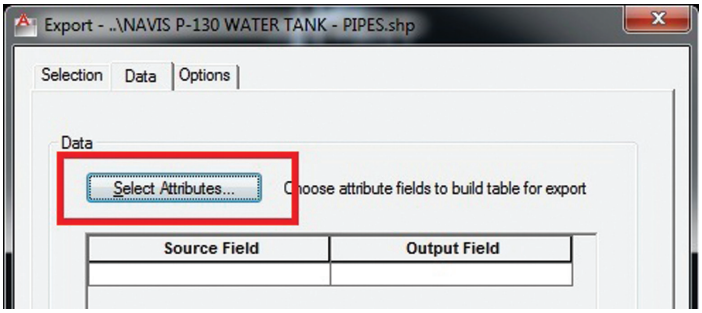


Figure 6

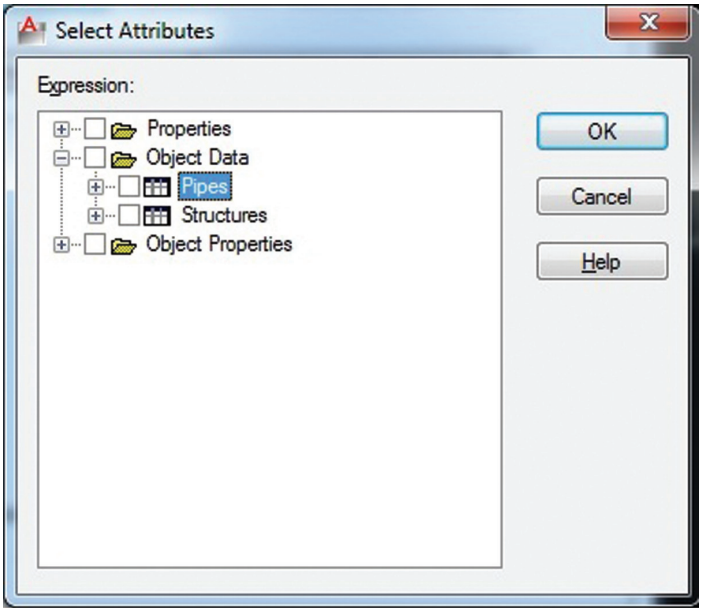


Figure 7

b) Select "Output" from the ribbon.
c) Select "Map 3D Export" from the "Map Data Transfer" box (this may take a few minutes to open). See Figure 4.
d) Make sure the file type is set to "ESRI Shapefile (*.shp)."
e) Select OK (this may take a few minutes to open the next window).
f) When the export window opens, you will need to select the type of data you will need for the shape file (i.e., "Point", "Line", "Polygon", or "Text"). Note: this is the option you do not get in Civil 3D 2010.
g) Select "line" object type.
h) Select the "Data" tab at the top. This will bring you to the attributes window.
i) Select the "Select Attributes," which will bring up the attribute dialog box and you will need to expand the "Object Data" so you can select the type of shape file you are creating.
j) Select "Pipes" (which matches "Lines" selected in step 4g) for our example.
k) Select OK. This will now populate the fields "Source Field" and "Output Field."
l) Select OK. This will now create the required SHP file with the required data for input into ESRI software (note this will provide a count of the objects produced on the command line).

5. Repeat steps 4a through 4l to create additional SHP files as required.

The reason for the exercise is to get the following information into ArcGIS for Desktop without exploding or damaging the Civil 3D drawing. As you can see in Figure 8, all the design data is maintained in the SHP files for use in ArcGIS. This way, as the project moves forward we can still use the Civil 3D files. We will have to recreate the SHP as items change in Civil 3D. See Figure 8 for the final result in ArcGIS.

You may need to export and import in the same version of Civil 3D or Map.

AutoCAD Civil 3D 2013

Follow the steps above to import data into ArcGIS for Desktop (SHP file) and maintain the AutoCAD Civil 3D line work and data (DWG file). This makes a simple workflow from design to data visualization and analysis within ArcGIS for Desktop. With this we can produce required exhibits/maps for the client with ArcGIS for Desktop.

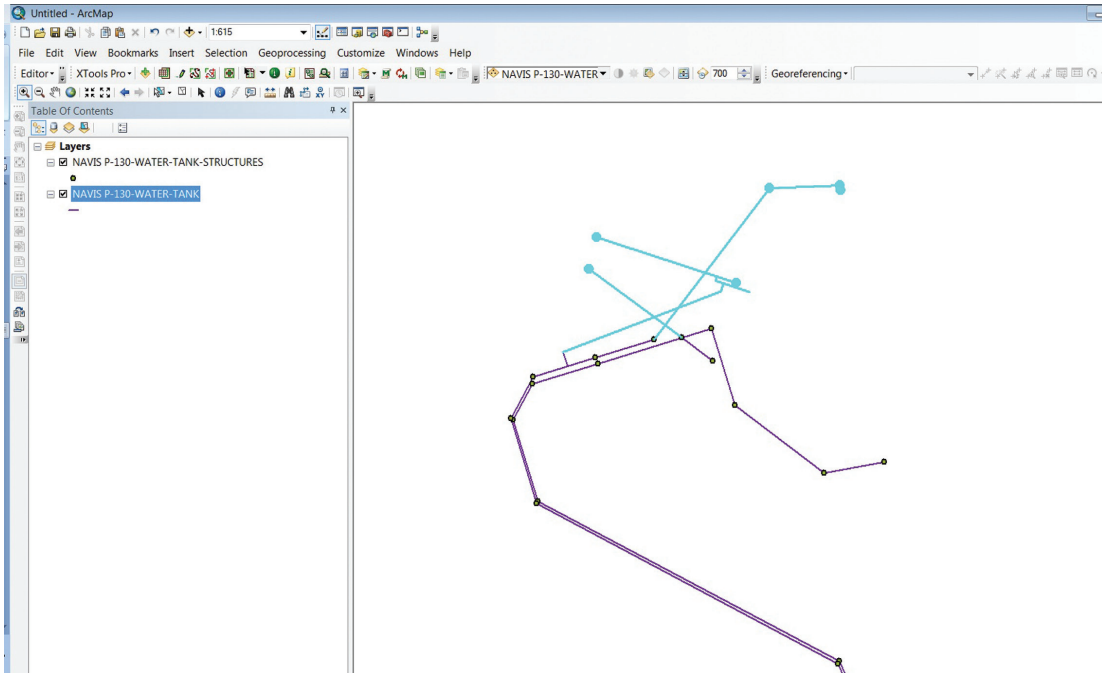


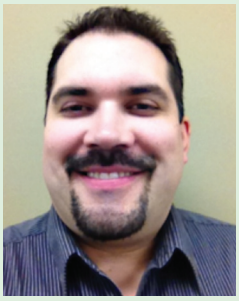
Figure 8

NAVIS P-130-WATER-TANK

Name	OutsideDia	Length	Slope	StartInver	EndInvert	PartSizeNa
Pipe - (53)	0.713333	12.954314	-0.252632	2160.967249	2160.999975	8.0 inch PVC Pipe
Pipe - (52)	0.713333	58.285945	-0.252632	2160.82	2160.967249	8.0 inch PVC Pipe
Pipe - (34)	0.713333	2.999684	14.772533	2162.983129	2162.54	8.0 inch PVC Pipe
Pipe - (33)	0.713333	21.915649	5.392816	2164.165	2162.983129	8.0 inch PVC Pipe
Pipe - (31)	0.713333	76.665579	0.653545	2163.063717	2162.562673	8.0 inch PVC Pipe
Pipe - (30)	0.713333	28.143245	0.610857	2163.235631	2163.063717	8.0 inch PVC Pipe
Pipe - (29)	0.713333	5.023395	0.610857	2163.266317	2163.235631	8.0 inch PVC Pipe
Pipe - (16)	1.566667	90.877559	0.25	2162.568467	2162.341273	18.0 inch PVC Pipe
Pipe - (68)	1.303333	11.012209	1.7285	2164.479881	2164.289535	15.0 inch PVC Pipe
Pipe - (67)	1.303333	13.702781	1.750327	2164.719725	2164.479881	15.0 inch PVC Pipe
Pipe - (66)	1.303333	27.263859	1.737128	2165.193333	2164.719725	15.0 inch PVC Pipe

Figure 9

Christopher Pitzer is currently a CAD/BIM Manager for Parsons Brinckerhoff, a global consulting firm. He has more than 24 years of experience in civil engineering as Project Engineer/Designer. He has extensive experience in design for residential, commercial, industrial subdivisions, and public improvement projects. This includes all aspects of streets, water, sewer, and storm drain design and analysis. He is also an Autodesk Approved Instructor (AAI) with experience in applying Autodesk® technology on transportation, building, and other infrastructure projects. He provides instruction on AutoCAD Civil 3D software in support of the Autodesk Authorized Training Center (ATC) at Parsons Brinckerhoff.



Justin Comeau is currently a Sr. CADD Designer for Parsons Brinckerhoff, a global consulting firm. In 2000 he earned his Associates Degree in CADD Technology. Justin has more than 13 years experience in the Civil Engineering field. His design experience includes numerous street improvement projects, bridge widening and replacements, residential subdivisions, apartments, churches, hotels, and retail centers. He starting using AutoCAD with Release 12 in the mid 1990s and has developed into an AutoCAD Civil 3D Professional.

IMAGE-O-MATIC

http://boostyourbim.wordpress.com/products/

Boost Your BIM

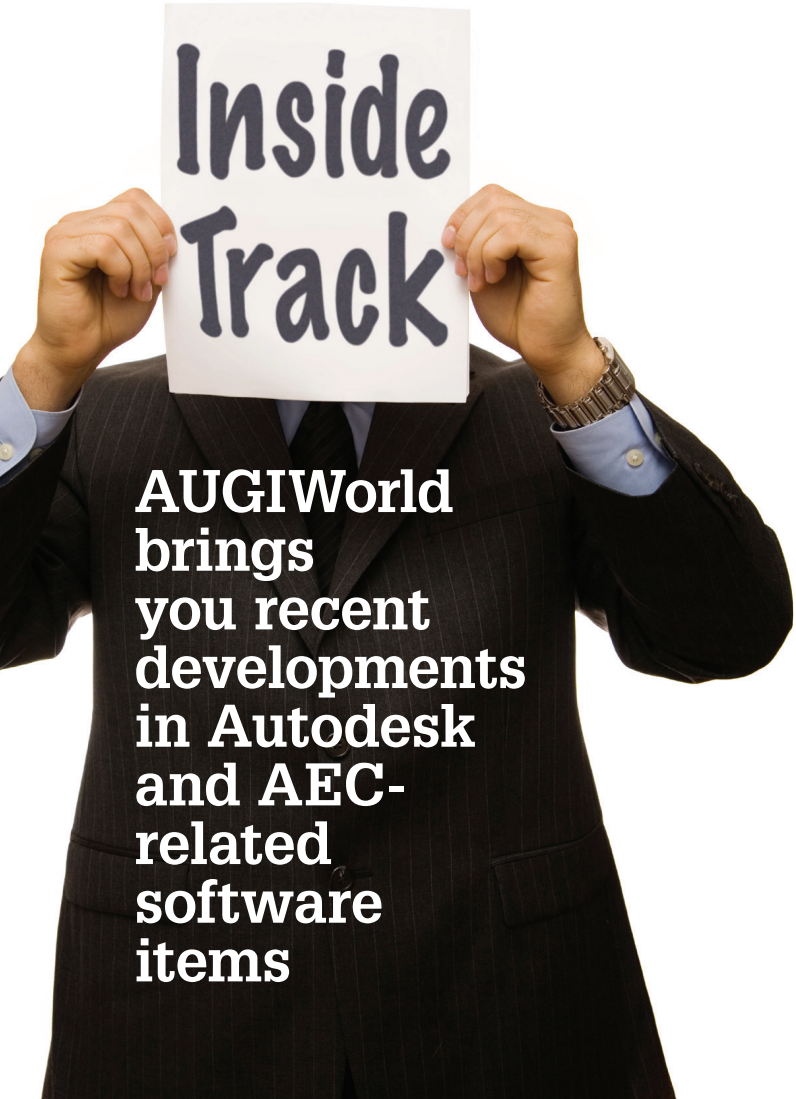
Image-O-Matic is a batch image exporter that can be used in two ways:

1) Select a family instance and one of its instance parameters. Then specify minimum, maximum, and increment values. Image-O-Matic will increment the parameter through this range and create an image file for each value

2) Select some or all of the phases in a project, and an image of the active view will be created showing each of these phases. To use this option, press the ESC key after running the command instead of selecting a family instance.

Watch this video to learn more. http://youtu.be/8QtFwulXmLk

Available for Free on the Apple App Store.



AUGIWorld brings you recent developments in Autodesk and AEC-related software items

CASE APPS ON SUBSCRIPTION!

http://apps.case-inc.com/content/faq

CASE Apps

Our BETA Subscription tools have launched! We also took this opportunity to reorganize how we are loading these items into the Revit ribbon. All of the CASE tools still get installed from the CASE Add-In Manager and install onto a custom ribbon tab named "Case Design, inc."

This new ribbon design also provides automatic updates to the latest version when it gets posted to our servers (only for tools that you already have installed)!

There are only 4 subscription tools in the system at the moment, but several others are on the way within the next few weeks. We have also added a FAQ page that answers some of the most frequent support questions that we get about these tools.

DAYLIGHT VISUALISER

http://www.velux.co.uk/professionals/architects/tools/daylight_visualiser

The VELUX Daylight Visualiser is a simple tool for daylight design and analysis. It is intended to promote the use of daylight in buildings and to aid professionals by predicting and documenting daylight levels and appearance of a space prior to realisation of the building design.

The VELUX Daylight Visualiser is free to download and can be used to calculate daylight levels and aid in design using different combinations of windows.

Free

Until next issue!

If you'd 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.