AUGIWorld
The Official Publication of Autodesk User Group International
December 2011

Insider Insights

Also in this issue:

- Halfway to Paperless
- Material Matters
- Super Families: A Kit of Parts

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HP recommends Windows® 7.

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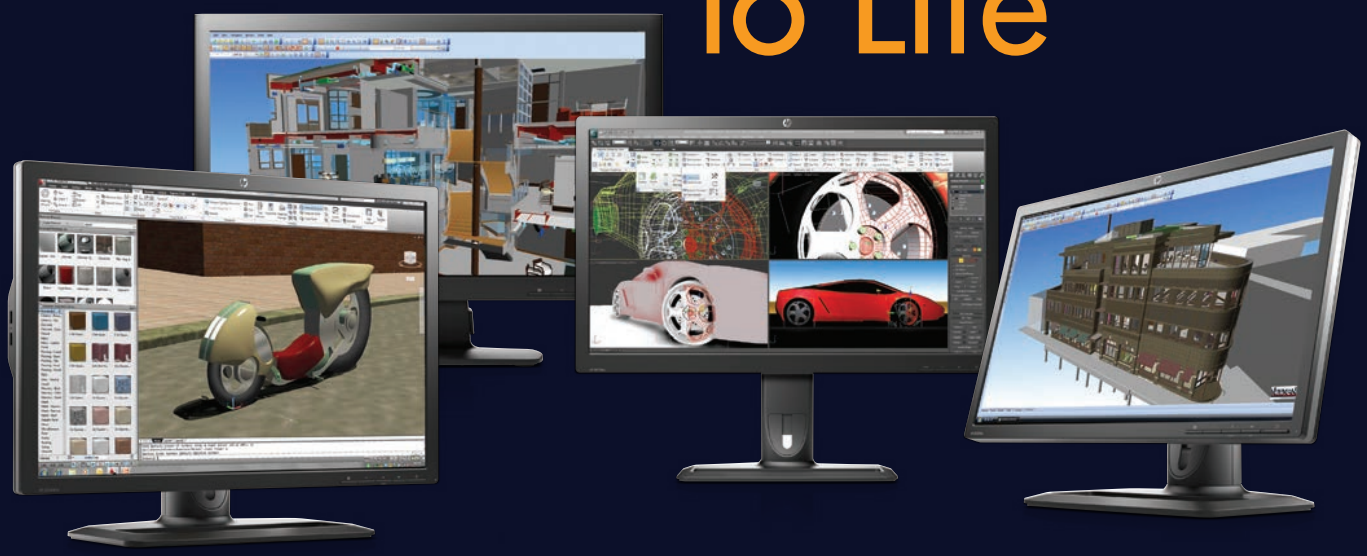

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1 As compared to mainstream monitors with TN (Twisted Nematic) panels when viewed at 60°.

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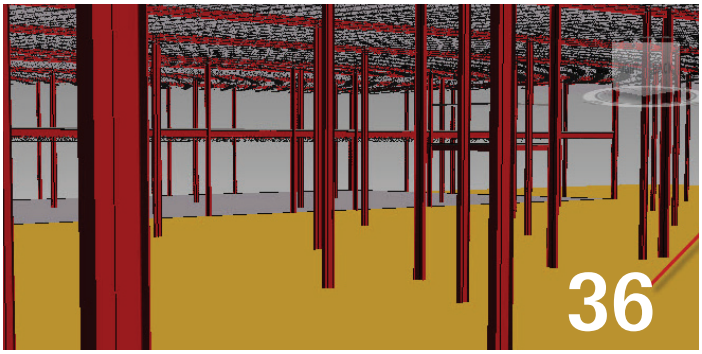
product focus



columns

Derek, 32 years old

Profession: Project Manager

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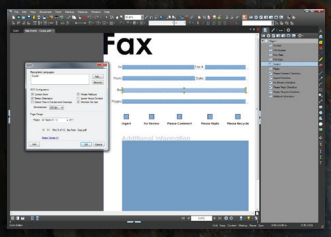

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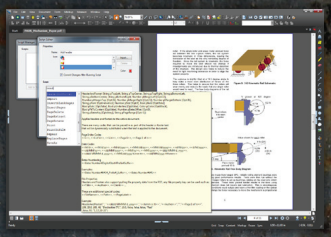

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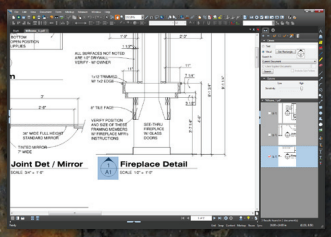

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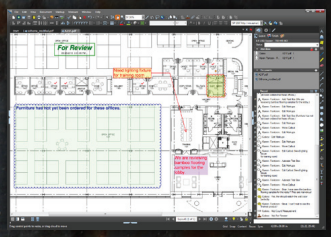

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AUGI

Welcome to another exciting edition of *AUGIWorld* magazine! More than 8,000 Autodesk users are probably still recovering from attending Autodesk University 2011. If you were there, you know what I mean. And if not, then perhaps next year you can join in all that AU has to offer. One of the major reasons to attend AU is the networking. Networking, by default, leads to insider information and increasing one's skill set and overarching career goals. Getting some insider insight is the theme of this AUGIWorld issue. Our cover image is of a glass staircase at an Apple store in Boston, MA. The relation to our theme may be a stretch for sure, but we are inside and Apple products are very hot and often can lead to some great networking. And with that, let's run down the article lineup.

We start off with an article by Bryan Thompson who takes on the topic of being paperless in an office with AutoCAD in the mix. Then Melinda Heavrin shows us that materials really do matter when using AutoCAD Architecture. And then we have our monthly Heads Up column, pointing out what is new and hot in the Autodesk update world.

This month our Autodesk Insider is Paul Sullivan, Senior PR Manager in the AEC division. We learn that PR isn't a bad word; instead, it is all about finding the good words! Then Chris Fugitt tries to move us on out of neutral when using AutoCAD Civil 3D. Sometimes pointing out flaws is the best way to get fixes made. And then Francesca Maier spins a different tale outlining how to create BIM content when using AutoCAD Civil 3D.

Then over into our Revit space, Todd Shackelford helps us get to the next level when using Revit MEP. Mark Kiker takes the helm of the Inside Track, highlighting the newest tech and software, just in time for the holidays! And Kyle Benedict proves that, yes, you can do advanced rendering using the Revit API—and have it look advanced! Then Nicholas Kramer builds us a breakdown of making super, and advanced, families in Revit Architecture.

We have Sean Woods breaking down the benefits of Revit Structure for construction estimators. And in our monthly BUILT column, James Salmon again gets wicked showing off the great tools for the build industry. And Tom Cipolla gets personal with Victor Erthal of Neoscape. I'm barely worthy to even look at his pixels! Then Scott Moyse discovers the true meaning of Computer-Aided Manufacturing when using Inventor.

And with that we round out 2011 in great fashion! We have published around 100 articles during the year and several hundred pages of magazine. What's in store for 2012? Much of the same great content for sure, but keep an eye on your mailbox. You may just start *physically* seeing *AUGIWorld* again. Until next time…

David Harrington

AUGIWorld

www.augiworld. com

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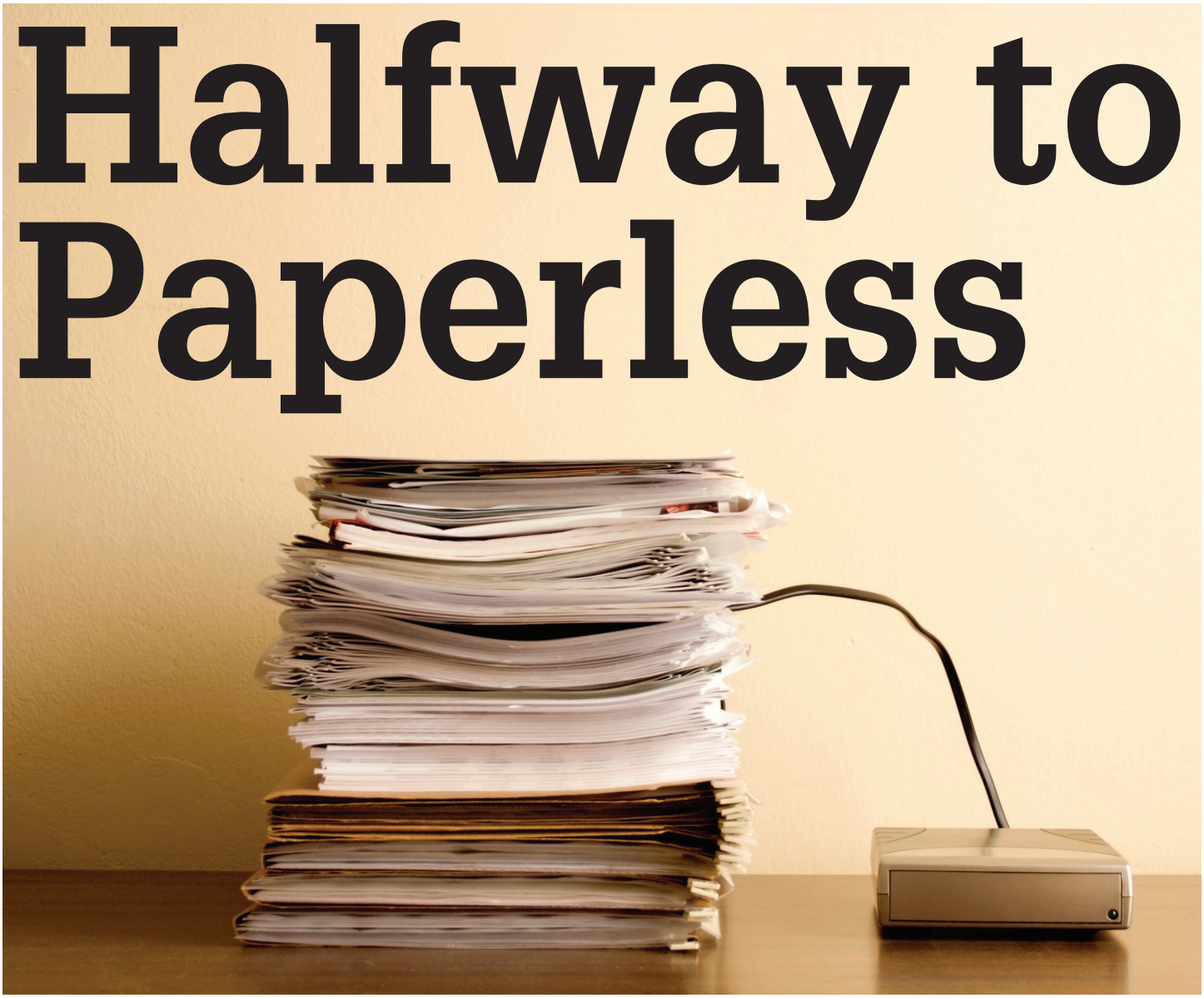
AUGI

Halfway to Paperless



The paperless office, envisioned decades ago, is not yet a reality. What will it take to get there?

More than 20 years ago, we were convinced that with the development of computer systems, offices in the future would be environments where paper was not only unwelcome, but also not required. Every office in the world would be emptied of the nuisance that paper was fast becoming. Taking its place? A grand environment where you could store millions of documents and a nearly unlimited amount of information. More importantly you could share, publish, and digest this information paperlessly.

Theories aside, we still use paper. At the same time, we have this grand digital environment for document creation, storage, and management. It seems we are stuck in the transitional period that should have lasted, at most, a few months.

Most places I have worked claim to be paperless and everything is electronic. What I usually find is that, yes, they are potentially paperless in that they have the appropriate systems in place. Still, everything that is stored electronically continues to be printed on paper and then stored in ring binders and file cabinets. Paper copies also have to be printed in triplicate so they can be stored by various third parties. While everyone did have access to everything electronically, paper copies were still produced.

How do we get out of this transitional state that we are in now? The only way forward is to stop printing; stop wanting to file and retain paper. Simply realize that you don't need the paper copy, that everything you need is on the computer taking up less physical space.

I think predictions of the paperless office were off the mark in terms of the time scale. They were right with the digital aspect, but they were wrong about paper fading away. I don't think the early prognosticators realized just how much people love paper. Perhaps as the older generation retires and today's students are in the workforce we will see a paperless office. Until then we will be stuck at the point we are today—halfway to paperless.

Most of my work is in highway design offices, where there is a high demand for very detailed drawings showing small sections of a large road. This, by default, means hundreds of drawings from the start and most of the time everyone, from the front desk to the project director, wants a printout of everything. In one of my most recent jobs, we had an online electronic document management system that was supposed to be the central hub for all documents. The process, as follows, was simple.

- Drawing created.
- Drawing uploaded to the electronic document management system for review.
- Drawing approved (or comments for amendments).
- Drawing issued for construction.

The fact that three A0 plotters were running 12 hours a day should be enough to prove this system did not work. I found that most of my billable time was used printing, marking up, folding, and filing drawings. Looking back now, I remember having to fill out paperwork in order to access this paperless system. I should have realized then what I was getting into.

I once quizzed an older colleague about why he did not like the paperless system. He responded honestly by saying he never had the chance to look at it. He fully understood the concept and was more than comfortable using a computer for email and word processing. I decided to get him to take a look at a drawing that I had produced on the screen using Autodesk® Design Review software. It was an interesting moment for both of us as he opened the drawing. He asked only one question: "How do I move?" After I showed him how to use the scroll wheel for zooming and panning, he was off and running.

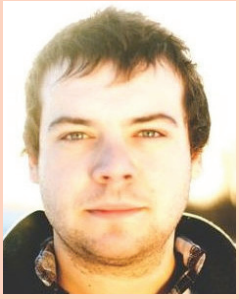
A few years later I received an email from him that contained a DWF loaded with comments and highlighted suggestions! This man had been the stereotypical older engineer with stacks, rolls, and piles of paper on and around his desk. I haven't seen him in a while, but I have this image of him sitting next to a computer with only a few pens and a notepad on his desk.

Autodesk has gone out of its way to make the paperless process as easy as possible for us. With most designers and engineers working on computers, you'll find Autodesk Design Review installed on most computers. However, I think that only a handful of staff members know it's there, fewer know what it is used for, and even fewer know how to use it.

Digital documents are slowly being accepted as original copies and there has been some recent progress with digital signatures in the UK. While digitally signed documents are now being used and accepted in the UK court system, some UK governing bodies will still only accept an original, printed, hand-signed document, usually required in triplicate.

With most designers and engineers working on computers, you'll find Autodesk Design Review installed on most computers. However, I think that only a handful of staff members know it's there, fewer know what it is used for, and even fewer know how to use it.

In my opinion, the digital "switchover" should have and could have happened years ago. It will be an easy and painless process as all the infrastructure is in place. But will it happen anytime soon? A project I recently worked on left behind a necessary 18km of new motorway and an unnecessary 145m³ of old signed documents that are required to be stored for 30 years in a heated, secure data vault, so let's hope so!



Bryan Thompson started out on AutoCAD around seven years ago working in a highway design section for a multidisciplinary worldwide company. Since then, he has worked for various parties mostly designing for highways and in particular traffic management for roadwork's schemes for which he is now renowned in Scotland. Bryan runs Bryan Thompson Design Services (www.bryan-thompson.co.uk) and currently lives in Motherwell, Scotland, with his lovely wife, cat and two ferrets. Reach by email at bryan@bryan-thompson.co.uk

Material Matters

AutoCAD® Architecture has everything you need for presentation-quality renderings. Before you are able to create these photorealistic renderings, however, much needs to be understood about working with materials, including creating, modifying, and applying materials to objects.

A material in AutoCAD Architecture corresponds to a specific finish material in a building model, such as concrete, glass, or brick. Materials are useful for illustrating plans, sections, elevations, and renderings in the design process. Materials also provide a way to manage the display properties of object styles.

You can take advantage of Visual Styles, Rendering Materials, Lights, and Cameras in AutoCAD Architecture. Materials provide the ability to assign surface hatches to objects. Surface hatches can be displayed in model, elevation, and section views. This is helpful to clearly illustrate sections and elevations. Let's take a closer look at materials.

Materials Browser

You can use the Materials Browser to navigate and manage your materials within an AutoCAD Architecture drawing. You can organize, sort, select, and search materials to use in your drawing. From the Materials Browser, you can access the Autodesk library as well as user-defined libraries. To access the Browser, select the Render tab of the ribbon, Materials panel, and then Materials Browser. The browser contains the following main components (see Figure 1):

- **Browser toolbar** – This contains the Create Material menu, which allows you to create generic materials or create from a list of templates.
- **Document Materials** – This includes a set of display options for the materials saved in the current drawing. You can sort the document materials by name, type, and color.
- **Material library** – This displays the Autodesk library, which contains the predefined Autodesk materials and other

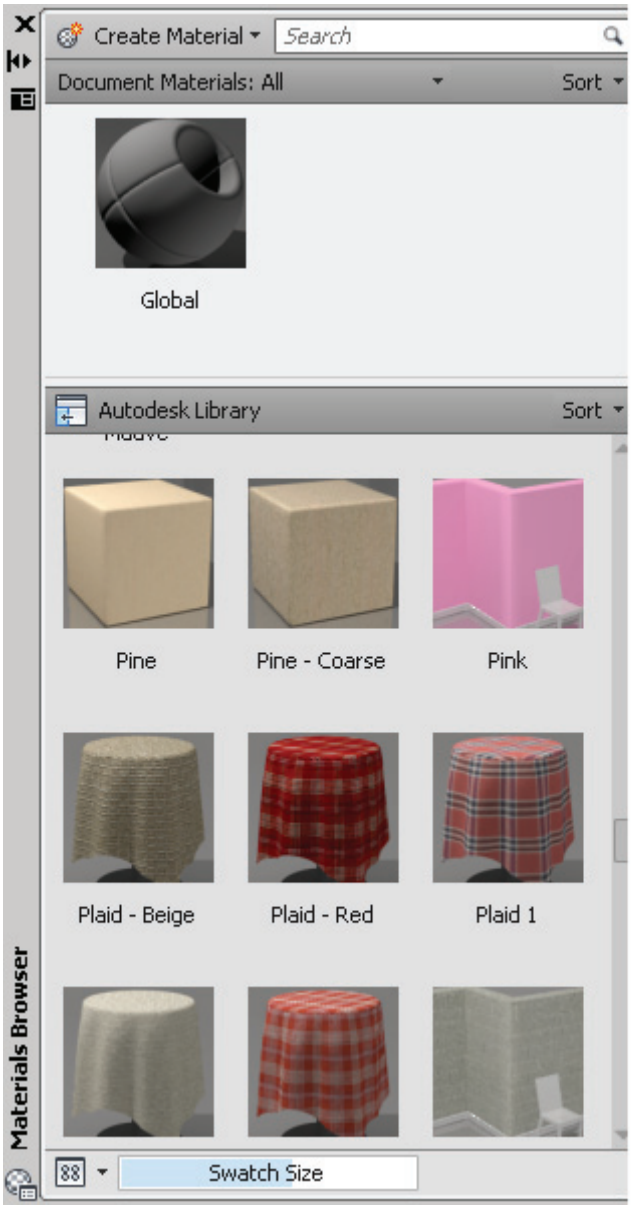


Figure 1: Materials Browser

libraries that contain user-defined materials. It also contains a button for controlling the display of libraries and library categories. You can sort the materials in the library by name, category, type, and color.

- **Library details** – This displays previews of the materials in the selected categories.
- **Browser bottom bar** – This contains the Manage menu, which provides options for adding, removing, and editing libraries and library categories. It also contains a button for controlling the display options for the library details.

Materials Libraries

The Autodesk library contains more than 700 materials and over 1,000 textures. The library is read-only, but you can copy Autodesk materials into the drawing, then edit and save them to your own library. There are three types of libraries.

1. **Autodesk Library** – This contains predefined materials provided by Autodesk for use by all applications that support materials. It contains material-related resources such as textures and thumbnails.
2. **User Library** – This contains all materials, except those in the Autodesk library, that are intended to be shared between drawings. You can copy, move, rename, or delete user libraries.
3. **Embedded Library** – This contains a cache of materials used or defined in a drawing and available only to that drawing. This library is created automatically when the first Autodesk application using Autodesk materials is installed. You cannot rename this type of library as it is stored within the drawing.

The materials in the Materials Library are typically assigned to 3D objects. AutoCAD Architecture objects to which you can assign materials are: curtain walls, walls, doors, windows, railings, roof, stairs, spaces, slabs, mass elements, mass groups, and structural members.

You can add materials to a library by opening the Materials Editor, right-click the material, and select Add To. Now select the library to which the material will be added. You can add the material to multiple libraries if desired.

Note that materials that you use more often can be placed on a custom tool palette for easier access. Click the Tool Palettes window title bar and click New Palette (see Figure 2) to create and name a new palette. The palette is customizable and you can add material tools by copying and pasting from other material palettes. The controls for doing so are on the Tool Palettes window shortcut menu.

Applying Materials

A material can be applied to individual objects and faces or to objects on a layer. Note that AutoCAD Architecture 2012 supports per-face color for all materials and textures. If an object has per-face color and a diffuse texture, the pre-face colors are shown when the texture is faded.

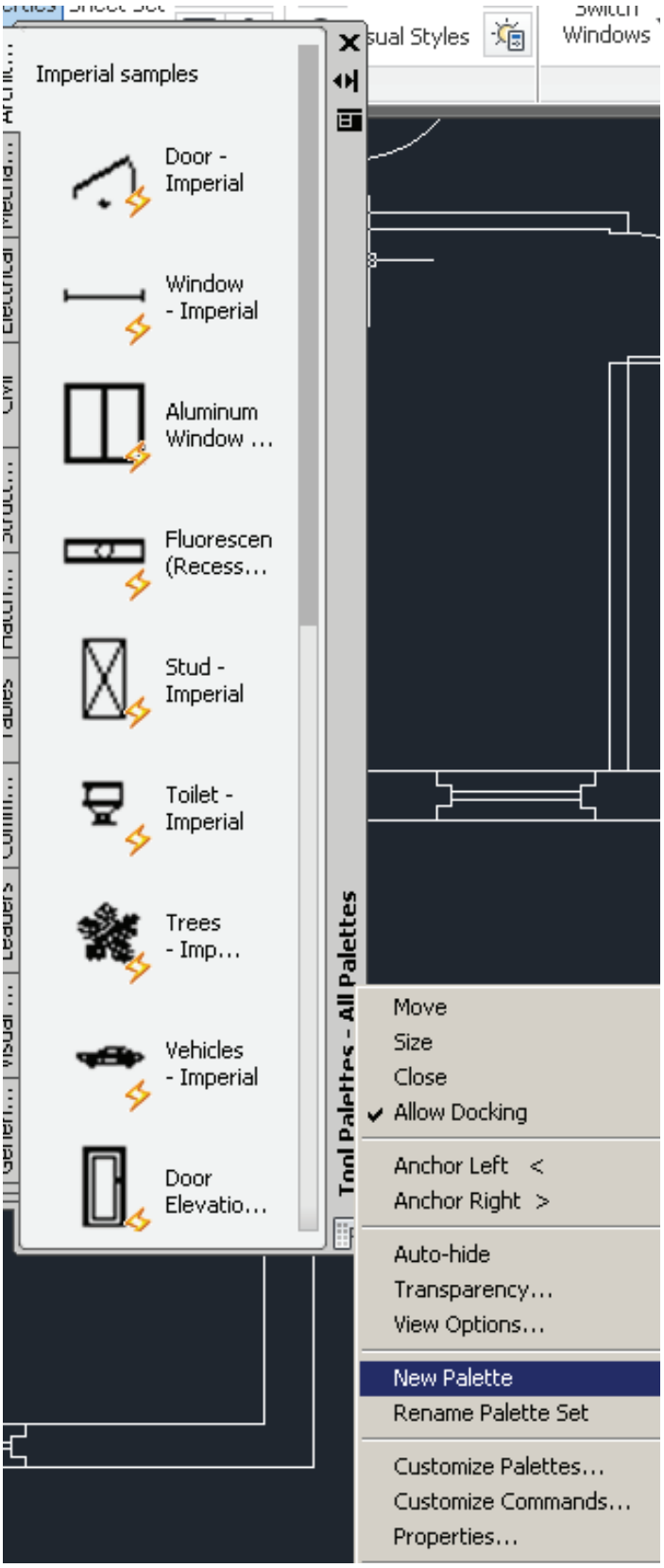


Figure 2: New tool palette

To apply a material to an object or a face, first select the object and then select the material from the Materials Browser. The material is added to the drawing and it is also displayed as a

swatch in the Materials Browser. When creating or modifying a material in the Materials Browser, you can click a material in the library and the material is applied to any selected objects in your drawing. Drag the material swatch directly onto objects in your drawing or assign a material to an object by clicking the Assign to Selection in the shortcut menu on the material swatch in the Materials Browser.

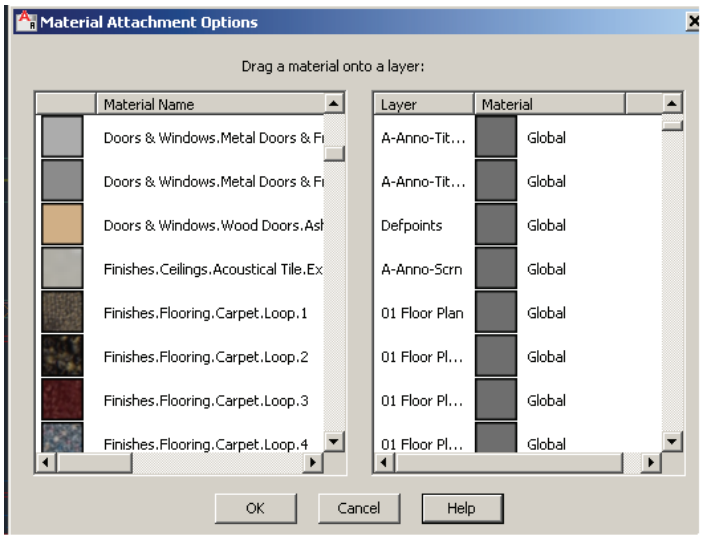


Figure 3: Material attachment options

You can assign a material to a layer by entering MATERIALATTACH at the command prompt. The Material Attachment Options dialog box will open and you can drag a material onto a layer (see Figure 3). When applying materials to objects by layer, the material is applied to all objects on the layer whose Material property is set to BYLAYER.

Creating Materials

A material is defined by a number of properties. The available properties depend on the selected material type. To begin, open the Materials Browser. Next, on the browser toolbar select Create Material (see Figure 4). Now, select a material template. This opens the Materials Editor. Enter a name for the material and specify the material color options. Finally, use the sliders to set the properties for shininess, opacity, refraction, and translucency. You can also copy and modify an existing material. Note that the material GLOBAL is always available in a new drawing. This material is applied to all objects by default until another material is applied.

Modifying Materials

After a material is created and applied, the properties can be modified in the Materials Editor. The material swatches that are available in the drawing are displayed in the "Materials In This Document" section of the Materials Browser. When a material swatch is double-clicked, the properties for the material become active in the Material Editor sections (see Figure 5).

As you modify the settings, they are saved with the material. The changes are displayed in the material swatch preview. By holding down the button below the swatch preview window, a set of fly-out buttons display different geometry options for the material preview.

To modify the name of a material, open the Materials Browser and select the material. Right-click and select rename. Now you can change the name and description of the material in place.
If you wish to change the material preview shape and render quality, open the Materials Editor and then select Options. Now you can select a different swatch shape and render quality for the material.

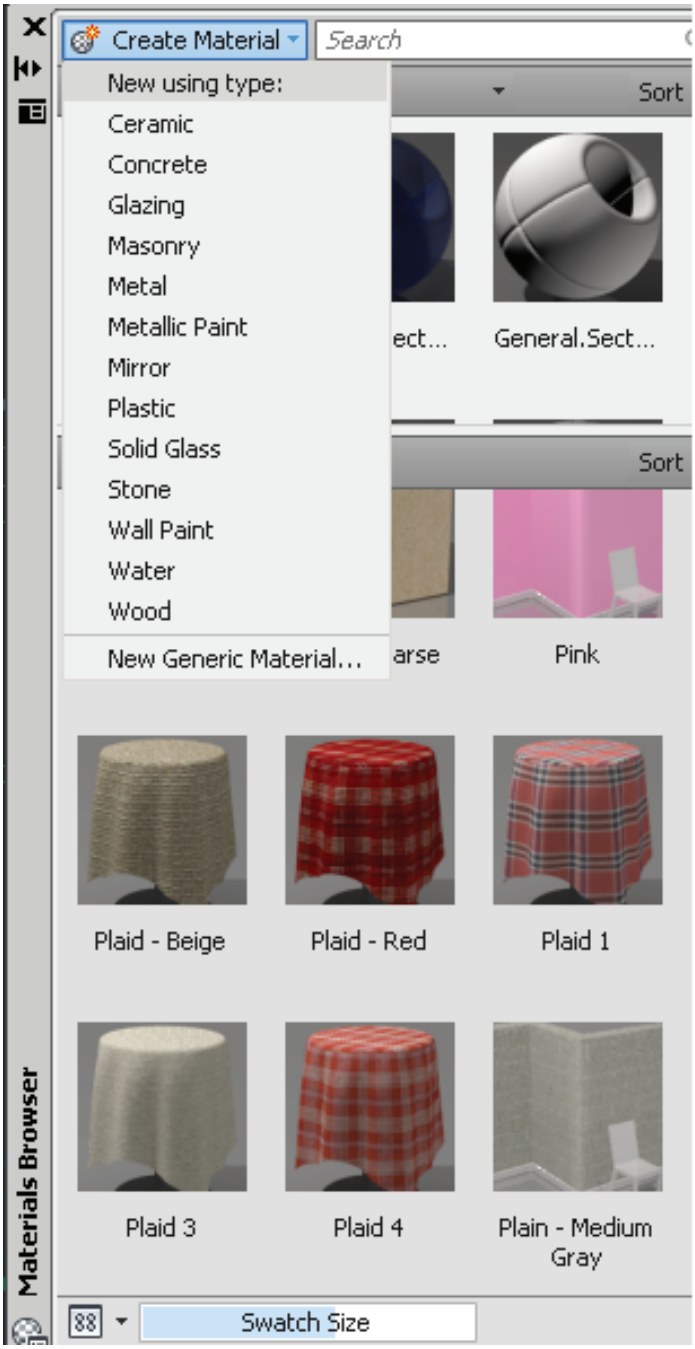


Figure 4: Creating new materials

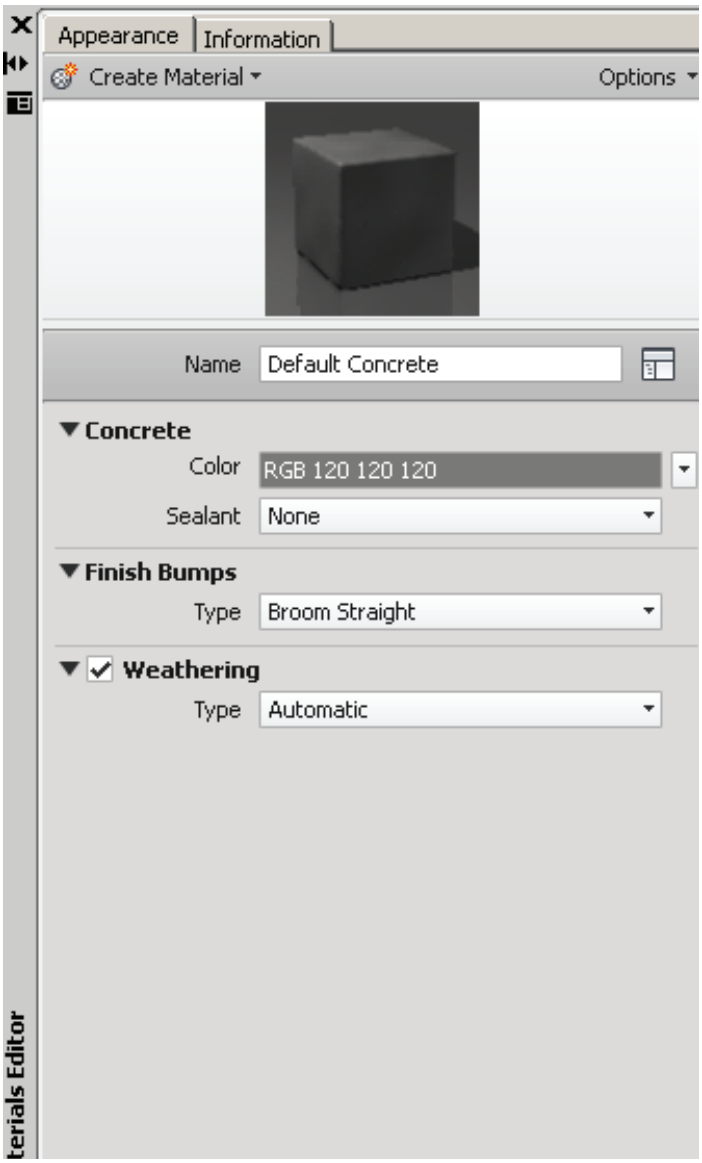


Figure 5: Materials editor

Manage and Organize Materials

Managing and organizing materials will ensure less confusion in finding what you are looking for. When a material is moved, a copy is created and it is added to the new category. If the material is copied into the root node, its original category is maintained and it is recreated in the new library. There are two ways in which to move materials.

- **Drag and drop** – You can drag swatches or materials from a library to the Materials in This Document section in the Materials Browser. You can also drag materials from a library to another library. A new copy of the material is created and saved with the drawing.
- **Shortcut menu** – You can use the shortcut menu to copy a material to a new library. Use the Add To option and then select material in the library copied to the document or a library material copied to another library.

You can search the materials in all open libraries based on the material's name, description, and keyword information entered in the Materials Editor. All the materials are filtered to show only those matching the search string. Only the materials that have a match for the search string are displayed. Click the X button in the search box to clear the search and return to viewing the unfiltered library.

The search results depend on the library you have selected in the tree view. For example, if you select the Library root node, it displays the search results for all matching materials in the selected library. However, if you select a category, it searches only within that category.

You can delete a selected and unlocked material by using the shortcut menu or with the Delete key. It is important to note that locked materials cannot be deleted from the Materials Browser or from the shortcut menu.

Converting Materials

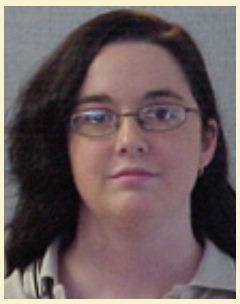
When a legacy material (any material created in AutoCAD 2010 or earlier releases) is shown in the Materials Editor, you have the option to convert the material into an editable format. After the conversion, the Materials Editor controls are enabled and editable.

Legacy materials are rendered but not editable in the application. It is recommended that you convert these materials to their generic equivalent. The new materials provide better results and can be shared across Autodesk applications.

Conclusion

AutoCAD Architecture has many available materials that can be used to render photorealistic images for presentation purposes. As the architectural industry is moving toward these types of presentations, it is best to learn all you can about materials and then rendering. It is best to begin slowly and progress forward as you learn.

In my next article, I will explore how to use these materials in the actual rendering process. Stay tuned!



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: David Harrington

HEADS UP!

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

AUTOCAD® 2012

2011-Dec-13	AutoCAD and AutoCAD LT 2012 SP1 Ribbon Hotfix
2011-Sep-27	AutoCAD 2012 Service Pack 1
2011-Jul-13	AutoCAD 2012 Block Editor Save Corruption Hot Fix
2011-Apr-01	Autodesk 2012 Content Explorer Service Hot Fix
2011-Mar-23	Autodesk Material Library Medium Resolution Image Library 2012

AUTOCAD LT® 2012

2011-Sep-27	AutoCAD LT 2012 Service Pack 1

AUTODESK® REVIT® ARCHITECTURE 2012

2011-Dec-13	Hotfix - Autodesk Revit Server 2012 - Improve stability when uploading to Revit Server
2011-Oct-11	Hotfix – Autodesk Revit 2012 – Apply material family parameters using the Paint tool

2011-Jul-13	Revit Architecture 2012 Deployment Utility
2011-Jul-13	Hotfix - Incorrect Ribbon Icons

AUTODESK® INVENTOR® PROFESSIONAL 2012

2011-Dec-12	Hotfix - Multiple Issues Addressed (see Summary and readme file)
2011-Nov-23	Hotfix - Task Scheduler Check-In corrupts BOM/Error 1200 on Item Assign & Cannot use the iLogic Add Rule
2011-Nov-18	Hotfix - Projected edge will not select as a closed loop for offset
2011-Nov-29	Hotfix - Multiple Issues (see Summary and readme file)

AUTOCAD® ARCHITECTURE 2012

2011-Dec-13	AutoCAD and AutoCAD LT 2012 SP1 Ribbon Hotfix
2011-Nov-14	AutoCAD 2012 Performance Slowdown Hotfix (32/64 bit)
2011-Sep-29	AutoCAD Architecture 2012 Service Pack 1
2011-Aug-30	AutoCAD Architecture 2012 & AutoCAD MEP 2012 - Localization Hotfix: Corner Windows

AUTOCAD® CIVIL 3D® 2012

2011-Dec-13	AutoCAD and AutoCAD LT 2012 SP1 Ribbon Hotfix
2011-Dec-08	AutoCAD Civil 3D 2012 Update 1
2011-Nov-14	AutoCAD 2012 Performance Slowdown Hotfix (32/64 bit)
2011-Sep-07	Hotfix - Prospector Lock-up
2011-Jul-13	AutoCAD 2012 Block Editor Save Corruption Hot Fix
2011-Jun-23	Autodesk Infrastructure Design Suite Network License Hotfix

AUTOCAD® MAP 3D 2012

2011-Dec-13	AutoCAD and AutoCAD LT 2012 SP1 Ribbon Hotfix
2011-Nov-09	AutoCAD Map 3D 2012 Service Pack 1
2011-Sep-14	Localized UI Hotfix
2011-Aug-10	Autodesk® Infrastructure Administrator 2012 Feature Rule "Check Perimeter" Hotfix (for AutoCAD Map 3D 2012)

AUTOCAD® MECHANICAL 2012

2011-Oct-27	AutoCAD Mechanical 2012 Service Pack 1
2011-May-11	Localization Hotfix for AutoCAD Mechanical 2012 Chinese Simplified, Chinese Traditional and Korean 32bit - Side-by-Side with AutoCAD Mechanical 2011

AUTODESK® 3DS MAX® 2012

2011-Oct-25	Autodesk 3ds Max 2012 Service Pack 2
2011-Sep-29	Backburner 2012.1
2011-Sep-23	Hotfix 1 – Autodesk® 3ds Max® 2012
2011-Sep-23	Hotfix 2 – Autodesk® 3ds Max® 2012

AUTODESK® ALIAS® 2012

2011-Aug-09	Alias 2012 SP1
2011-Aug-03	Hotfix - Unable to open CATIA V5 R20 files with DirectConnect 2012
2011-Jul-08	Hotfix - Import shrink option not functioning properly with DirectConnect 2012
2011-Jun-17	Hotfix - Imported B-Spline surfaces from CATIA V5 are over extended with DirectConnect 2012

AUTODESK® MAYA® 2012

2011-Oct-11	Autodesk Maya 2012 Service Pack 1
2011-Aug-12	Composite 2012 Hotfix
2011-Aug-03	Hotfix - Unable to open CATIA V5 R20 files with DirectConnect 2012
2011-Aug-01	Autodesk Maya 2012 Hotfix 4

AUTODESK® NAVISWORKS® MANAGE 2012

2011-Sep-12	Autodesk® Navisworks® 2012 Service Pack 1
2011-Mar-22	Autodesk IPv6 Network License Manager for Windows

AUTODESK® VAULT 2012

2011-Nov-30	Suites Update
2011-Nov-17	Update 1
2011-Sep-30	Autoloader Update
2011-Sep-30	DWG UDP Update

by: David Mills

AUGI Talks with Paul Sullivan

Senior PR Manager

Architecture, Engineering, and Construction

What is your role at Autodesk,® Paul?

I manage Public Relations for Autodesk's AEC Industry Division. In its most basic definition, PR is responsible for communicating with our customers and wider community through the media. One of the many ways that my team and I are involved is to work with our executives and our subject matter experts to provide pertinent information to the media. I am fortunate to have an incredible team working alongside me. In essence, the PR team sometimes feel like BIM evangelists since so much of our work involves building information modeling.

It fascinates me that we have such creative customers who create data-rich intelligent 3D models of their projects, and then leverage that information to gain greater insight, make more informed decisions, and create better engineered, more attractive and believable products. I have so much admiration for these designers and creators who are delivering unique solutions for a range of problems spanning robotics, automotive, sustainably designed buildings, custom fit prosthetics, and myriad consumer industries.

How long have you been with Autodesk and doing this? Any other roles?

I joined Autodesk four years ago to support the AEC business. I was attracted by the unique opportunity to be a part of something special. I remember thinking, "here's a 3D design software company that walks the walk, talks the talk, has very noble core values, and delivers products that are, literally, making the world a better place". I am very privileged and quite honored to play a small role in what the firm is doing.

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

Communications has been part of my DNA from the start. When I first graduated college, I spent a couple of fun years teaching history in high school. I left this profession after two years, unfortunately, because I earned barely enough money to eat. Two years of ea ting frozen dinners. My dinner table was a cardboard box with a placemat on top. No chairs. Things got a lot better when I moved into business and specifically the world of technology. Prior to coming to Autodesk, I had never actually been in public relations, having spent 23 years at Intel in various sales, marketing, and industry analyst relations positions. While in those roles, I was also given an exciting opportunity to be one of the company's field spokespersons and "technology evangelist" on TV.

What does a typical day look like at your desk?

There really is no such thing as a typical day. Except maybe that they are all long. And they are always different.

What kind of challenges do you and those you work with deal with?

We on the PR team have similar challenges as most people in other positions. We have deadlines that seem to pop up faster and faster all the time. News, especially with social media, is traveling more quickly than before, and news cycles are becoming increasingly short. Patience, "grace under fire," and flexibility are required.

How many coworkers are on your team and how do you share the work?

Autodesk has a superb, very tight-knit PR team; and this includes our wonderful agency partners. I love these coworkers. Everyone is so incredibly supportive of one another; we have fun together and have really come to rely on each other. As a team they are responsible for Corporate and Industry PR, including Media & Entertainment, Platform (AutoCAD), Consumer, and the Manufacturing industries.

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

Yes, we work closely with product teams and industry marketing to prepare product news releases and outreach to media.It's also fun for people outside of Autodesk to check out what is going on and what may become a product on Autodesk Labs (http://labs.autodesk.com/). So you too can get a glimpse of new technologies that could eventually be productized.

Do you get to do any planning for Autodesk University or other events?

Autodesk University is a huge event for the PR team. Many of your readers will agree, we took a bold step in delivering a very unique experience this year. In addition to the standard "university classes," we in the PR team hosted special events for our media. Last month we had almost 100 reporters, editors, bloggers, and analysts from around the world participate. It is special and so enjoyable to meet the media from different geographies. We also participate in numerous conferences in each of our industries.

Do you check out the activity of other forums like ours at AUGI? How much time to get to do external research apart from responding to users directly?

Absolutely while we read the forums, we don't generally talk directly to the users, except through the publications. The PR team makes it a point to spend time researching what readers are interested in, and what readers are talking about. Trend watching is important so we can stay current and provide a better service to our editors. As for how much time is spent doing the research, it is probably more accurate to say the research never stops.

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

My favorite activities outside of work include downhill skiing, hiking in NH's White Mountains, travel, and reading.

What was the last book you read?

I read a lot, and I read multiple books simultaneously. There are more than 1,000 books in my home library and these books range from technology and business, to biographies, philosophy, history, and architecture. In addition to topics such as cities, architecture, and civil engineering, I am fascinated by people and therefore biographies are my favorites. The most recent biographies I finished included *Steve Jobs* by Walter Isaacson, Keith Richards' *Life*, and Eric Metaxas' *Bonhoeffer*.

If money were no issue, where would you go on vacation?

If I want to go somewhere, I go. Finding the time is more of the restricting variable. Next year my travel plans include Park City, Grand Cayman, and cruising the Mediterranean.

What would we be most surprised to know about you?

That's an interesting question. Let me see. If the readers don't know me they probably couldn't care less, and if they do know me they wouldn't be surprised. Does that make sense?

Stuck in Neutral

As other segments of the AEC segment move toward real-world, object-oriented design, the civil segment is stuck in neutral. A rich, object-oriented design for site civil design remains elusive.

Henry Ford is thought to have said, "If I had asked people what they wanted, they would have said faster horses." The current incarnation of AutoCAD® Civil 3D definitely has the feel of being a faster horse. While architectural design products have moved toward utilizing terms such as walls, windows, and ducts, Civil 3D uses design terms such as feature lines, alignments, and profiles.

I asked my daughters, ages 4 and 6, what those terms meant. They easily described the architectural design terms, but the civil design terms were met with blank stares. They thought I was teasing them with made-up words.

Being a Civil Engineer, I do talk to my children about the infrastructure around them. As I drive them around I point out the curb and gutters, asphalt pavement, Portland concrete pavement, handicap ramps, and retaining walls. They understand the basic language of a Civil Engineer. Unfortunately none of those terms are utilized to describe the objects in Civil 3D.

Scanning

At the release of Civil 3D 2012 I was fortunate to be invited to Media Day at Autodesk's AEC Headquarters. One of the big new features Autodesk is excited about today and for the future is laser scanning to collect existing information. What I didn't see expressed was including real-world objects in Civil 3D.

I found this a bit surprising, because this squarely puts the product in neutral for the future. At Autodesk University 2010, Jeff Kowalski, chief technologist at Autodesk, was illustrating the future of computing through infinite computing. The civil space was illustrated by taking a laser scan of a site and using the infinite computing to strip out the rich data of the scan into a surface. No talk of converting the rich data into curb, gutters, trees, signs, stripping, or any other real-world objects the survey was intended to capture. Instead of a rich model we get a bare bones surface with only an intelligence of X, Y, Z, and color. What benefit does this infinite computing provide the civil industry? I consider it a waste of computing power if the goal is to get to the same aerial survey product of the past.

I recently put together a proposal for a project that consists of the demolition of an existing big box store including underground piping, parking lot, and building. My workflow at this point is nearly exactly the same for a traditional aerial survey and a laser scan survey. Both surveys collect points which are then converted into lines, arcs, and points representing the real-world objects. Wouldn't a better result be real-world objects? I could then delineate the area of demolition and get a quantity take off of items to be removed. Instead I'll have to manage with four lines representing the existing curb. I have to make sure I count those four lines only once.

The future of scanning appears to be stuck in neutral representing methods of the past that are just a bit faster.

Surfaces

With the advent of NPDES II requirements, the need in the civil industry for a data rich model is paramount. Many NPDES permit requirements demand that the design take into account hydro modification and prevent the post development water runoff from exceeding the predevelopment runoff. With the current incarnation of Civil 3D this becomes a harder process then it needs to be.

If Civil 3D was driving full speed ahead, a designer would be able to model using real-world objects for pavement, buildings, and landscaping. If the surface were made up of real-world objects, it would then be possible to model the flow of a water drop across the site. The water drop could then collect information as it flowed to the low point. It could determine that it goes slow in the landscaping area and speeds up once it hits an impervious surface.

The necessary hydrology coefficients could be derived from the different types of objects that make up the surface as the water drops flow through the model. It would no longer require the manual quantity takeoffs the process now requires. In a civil industry in "drive," the change would be made and the calculation inputs would be updated.

Pipe Networks

For the past several releases of Civil 3D, Pipe Networks appears to be one of the most neglected portions of the product. Pressure pipe capability does not appear to provide the ability to model water supply systems. The industry is stuck in neutral—having to use un-intelligent objects to perform the design. Sewer laterals from the main line to the property lines remain elusive, requiring a heavily manual process of labeling (if required by the sanitary sewer utility).

Nearly all utilities require separation between sewer and water lines. The industry is still tasked with performing this check in a manual fashion—either by manually checking the distances between utilities or running a conflict report. The industry is stuck in neutral with not having the water and sewer lines dynamically react to each other.

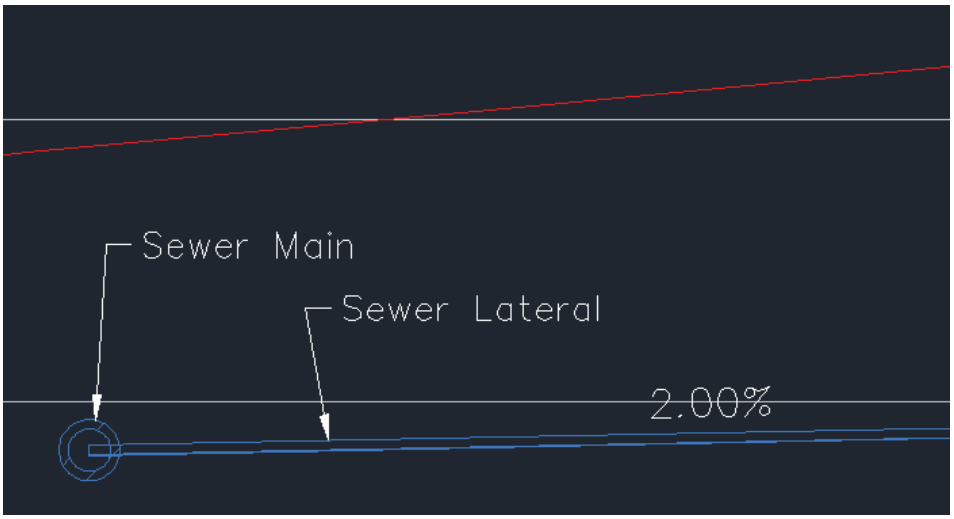


Figure 1: Sewer network

Many public works departments have specific locations for where utilities belong in the right of way. For instance, in Riverside County, water lines are to be located seven feet from the curb and storm drain lines seven feet from the center line. Have a design change in

the roadway? Unfortunately, the location of the utilities don't update with changes to the alignment.

Buildings

It may not come as a surprise to you, but buildings sit on sites designed by civil engineers. If you are a civil designer you may be excused for not knowing this, as your civil design software doesn't seem to know it, either. The main driving force in designing sites is mainly for the construction of buildings on the designed sites. I recently created a preliminary grading plan for a small subdivision project. Unfortunately, I messed up by putting a finished floor (FF) elevation on the plans, but was grading from that FF elevation instead of the pad elevation.

With a building object integrated into the product, my mistake could have been eliminated. I could have established the thickness of the pad in relation to the FF using the building pad object. Better yet, it would be great to import a Revit model of the buildings and pull the elevations from the model.

Handicap Ramps and Driveways

In the US, nearly every project requiring sidewalks requires handicap ramps to comply with the Americans with Disabilities Act (ADA). The ADA requires strict limits on the slopes that the ramps require. Driveways are also common occurrences for roadways. Both driveways and handicap ramps are absent in the Civil 3D product.

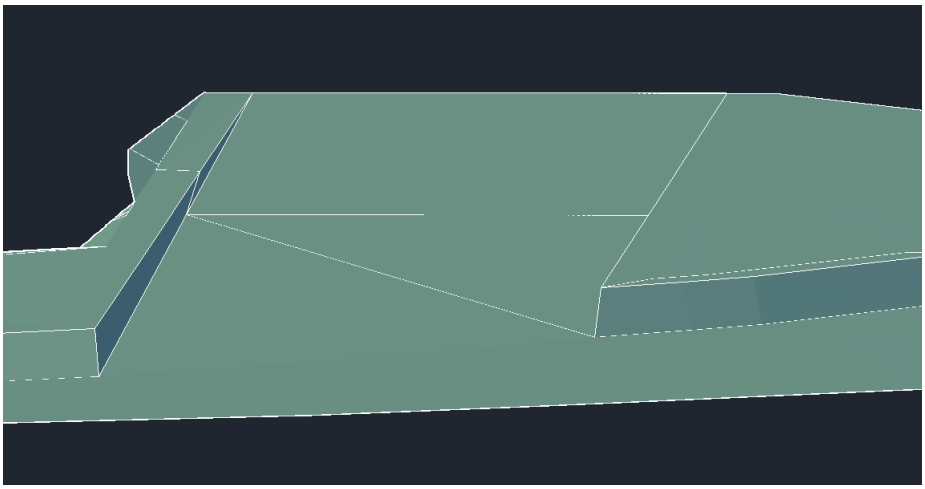


Figure 2: Modeled handicap ramp

A lack of a dedicated object makes illustrating a design troublesome. Figure 2 shows a handicap ramp I modeled using feature lines and a surface. The results are less than spectacular from a standpoint of illustrating how the finished product will look. Can you tell what surfacing is between the handicap ramp and the curb and gutter? Without a dedicated surface, showing the design takes a lot of work, creating boundaries and individual surface types.

Corridors

Corridors appear to have received an outside share of development within Civil 3D. This is most likely due to Autodesk's push to get Civil 3D accepted into the Department of Transportation in several US states. The user interface improvements have made the product easier to use. With the inclusion of Civil View in Autodesk's civil software portfolio, showing a corridor design in Navisworks is easier.

Corridors are one of the few parts of Civil 3D that meet the promise of Building Information Modeling. Even so, one glaring omission exists. The profile is tied to the stations along an alignment rather than a geographic location. Any changes in the alignment results in the profile not reflecting the design intent. It's rather frustrating seeing the demonstrations of the product and not being told that the changes are reflected in the profile. This is especially frustrating on long lengths of road on hilly terrain where the changes can cause the roadway to no longer balance.

Stormwater Design

Stormwater design has been greatly improved with the addition of Autodesk Storm and Sanitary Analysis (SSA) to the Civil 3D package. Built with the EPA-SWMM, it provides the ability to perform pollution removal analysis. As mentioned previously, this article the integration could be better integrated with the Civil 3D model. With EPA-SWMM it's possible to model how pollutants will be conveyed through a project site.

SSA also provides a way to model both the hydrology and hydraulics of a site. A closer integration between Civil 3D and SSA is needed, but I don't see that as being possible until Civil 3D enables modeling of required information such as surface type, coefficients, and flow direction to an inlet.

Conclusion

While Civil 3D is an exceptional improvement over Land Desktop, it falls far short of consideration as a BIM product. Many of the benefits of utilizing Civil 3D as a design tool are the improvements over the tools found in Land Desktop. 3D polyline tools have been replaced with feature lines, surfaces have been improved to be dynamic, and pipes are easier to use. Unfortunately if we view Civil 3D as a BIM product, then we also have to call Land Desktop a BIM product because of the same tool sets available. I'm not quite sure if you can find many who would call Land Desktop a BIM product. If all that has been done is an incremental improvement over Land Desktop, I'd have to consider the civil software industry firmly in neutral.

Christopher Fugitt is a Civil Engineer and has spent the last eight years designing government projects as well as residential subdivisions. He now provides Civil Engineering and Civil 3D services at Civil Reminders. Christopher maintains and authors the Civil 3D Reminders blog at http://blog.Civil3DReminders.com/

Create BIM Content with Corridor Models

Civil design deals primarily with linear infrastructure that is constructed by laying out an alignment and profile and offsetting features in the field to the left and right. The corridor model is AutoCAD® Civil 3D® software's answer to managing the design data for this linear infrastructure, with cross-sections, proposed surfaces, and earthworks and material quantities a byproduct of the corridor model. A corridor model is built with at least one defined baseline (alignment and profile pair) and an assembly (typical section) defined for each region along the baseline.

Unfortunately, corridor models are "2½D." That is, a corridor model is represented by a series of feature lines in 3D space that connect the points on the 2D assemblies placed perpendicular to the feature lines at each station specified in the frequency dialog. This hasn't impeded the plans production process, but has been a sticking point for civil designers on BIM projects. The options for creating 3D objects to coordinate with other disciplines and do clash detection or schedule visualization have included manual AutoCAD lofting along the feature lines or using the Dynamite VSP connection to Autodesk® 3ds Max®. While both methods were functional, neither was efficient.

Subassembly Composer

Subassemblies are the building blocks of assemblies. A road cross-section assembly might be built from left and right lane subassemblies with left and right curb, gutter, and sidewalk subassemblies attached.

The stock subassembly library that ships with Civil 3D is relatively comprehensive for simple road design, but is sparse for other applications. Skilled VBA and .NET developers have been able to develop custom subassemblies for years, but that skill set is not common among civil engineers and CADD professionals. Civil 3D has a standard tool to create a subassembly from a polyline, but those subassemblies are not dynamic and cannot vary the cross-section based on target conditions.

The Subassembly Composer, released to the Autodesk Subscription Center in July 2011, is a new development environment for authoring complex custom subassemblies. It is available for Civil 3D 2011 and 2012, both 32-bit and 64-bit versions. The Subassembly Composer is a visual and flowchart-based development platform that is intuitive and easy to learn. There is a support pack for users of the custom subassemblies who won't be developing their own.

The Subassembly Composer is usable without any prior programming knowledge. A seasoned Civil 3D user can apply the Subassembly Composer to create custom, dynamic subassemblies with relative ease and a much faster development time compared to the .NET development workflow. The ability to preview the geometry and test how it responds to target conditions is a significant improvement. The Subassembly Composer can create subassemblies with points and links that relate to each other with the full capability of the .NET Math Class.

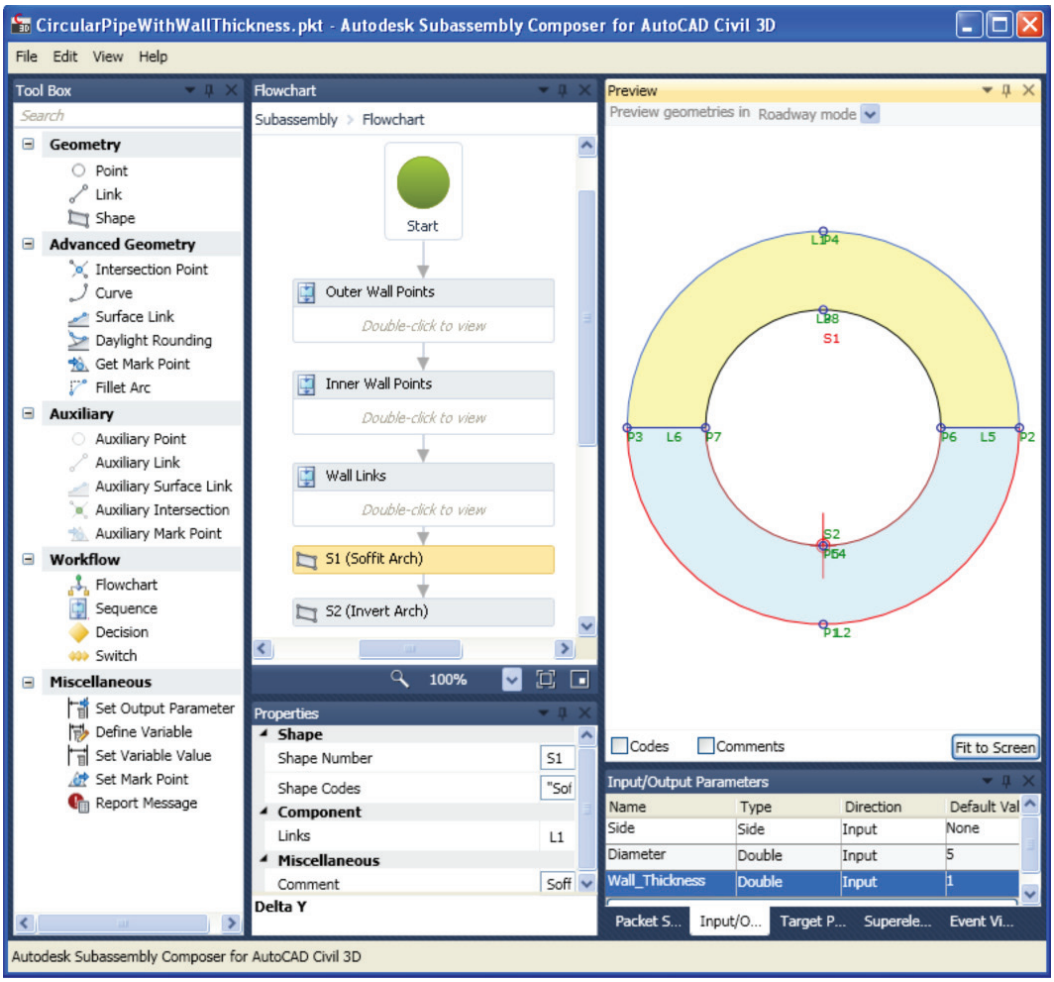


Figure 1: The Subassembly Composer for AutoCAD Civil 3D.

Applications of the Subassembly Composer include retaining walls, rail track, tunnels, guard rail, concrete barriers, rock benching, bridge beams, and duct banks. The CalTrans standard Type 1 retaining wall is a great example of the power of the Subassembly Composer. It is relatively straightforward to create a retaining wall subassembly that varies the footing dimensions and key location with the wall height, while the wall height varies based on a surface or elevation (top of wall profile) target. Subassemblies can be developed that also target horizontal offsets (alignment, feature line, or polyline) and react to superelevation. The only relational link that is unsupported by the Subassembly Composer is the link to pipe networks as used in the stock TrenchPipe2 subassembly.

The Subassembly Composer supports circular and parabolic arcs, daylight roundings, and fillet arcs. All curves will be tessellated, but the user specifies the level of tessellation (i.e., number of chord segments). The level of tessellation can be hard-coded in the subassembly or included as a variable to be specified within Civil 3D. The ability to create dynamic curved links and a very high level of tessellation has numerous applications from pressure pipes to tunnels.

Workflow with the Subassembly Composer

Plan your Subassembly. Decide on your origin point before you start building your subassembly. This is where your subassembly will attach to the assembly or other subassemblies. Select a side (left, right or none) in the Input/Output Parameters tab. Determine what Point, Link, and Shape codes and Targets, Variables, Inputs, and Outputs will be needed. Figure out if you'll need Decisions or Switches. It may be helpful to sketch your flowchart on a piece of paper.

Build a neat and logical flow chart. Start building your flowchart from the origin point. I like to label my points on a print-out—it helps me build my points in a logical order. Use Sequences to collect a series of Points, Links, and Shapes into a logical group. Copy and paste sequences that represent alternate cases (Switch or Decision outputs) reusing point, link, and shape names. Test your subassembly in the preview window by dragging the targets. Test left and right side functionality and other inputs.

Choose Point, Link, and Shape codes carefully. Use standard Civil 3D point, link, and shape codes where applicable to support surface, feature line, and quantity takeoff applications. "Top" and "Datum" link codes have special meaning in surface creation, but you will get yourself into trouble if you assign these codes to vertical links. Shape code names are especially important if you will be using the Corridor Solids tool. It is possible to use an input field for your code names for the designer to specify them when using the subassembly in Civil 3D.

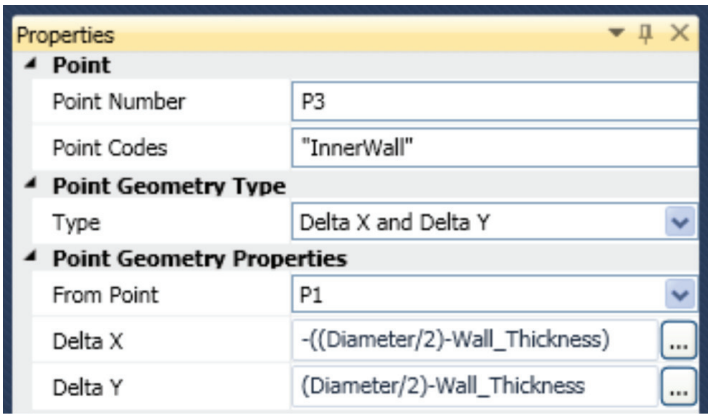


Figure 2: P3 location defined mathematically using input parameters for pipe diameter and wall thickness.

Review the Packet Settings tab. You need to give your subassembly a unique name. The name will ultimately appear on your tool palette

and as a folder name on your hard drive that stores the system files associated with your subassembly. Good practice is to provide a brief description of the subassembly and to create an image. (I use Print Screen.) If you will be deploying the subassembly for wide use it's a good idea to create a Help file.

Test your subassembly. Open tool palettes and, if necessary, create a new palette. Use the Import Subassembly command to add the subassembly to your tool palette. Create a test drawing with an alignment, profile, and all the required targets and test your subassembly. Test left and right functionality and as many target conditions as you can think of. If nothing breaks you are finally ready to deploy your custom subassembly. Make sure all the computers on which you will deploy the subassembly have the Subassembly Composer support pack installed.

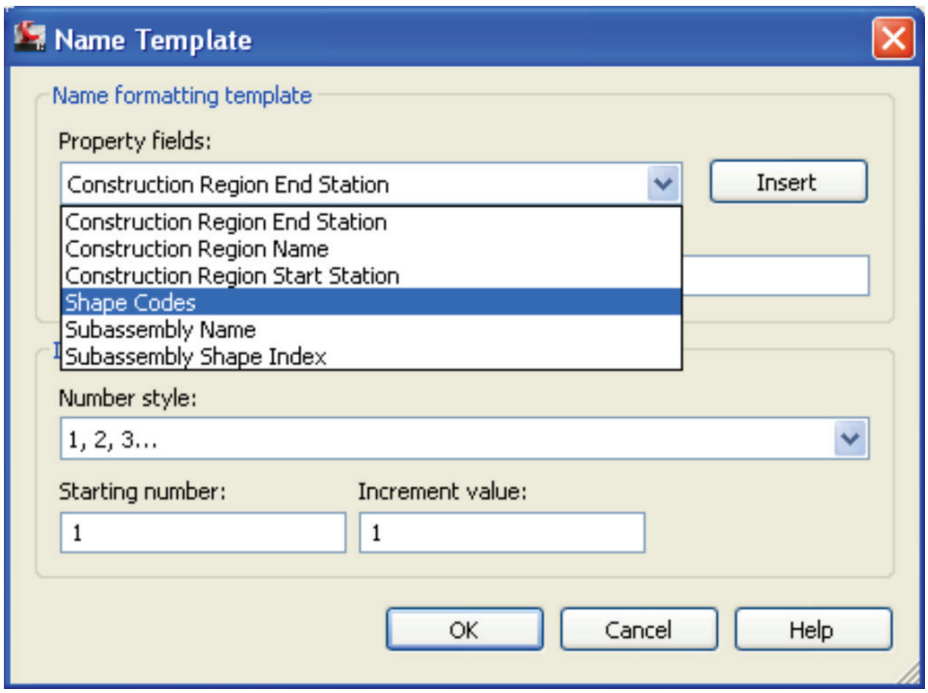


Figure 3: Layer Name Template property field options.

Creating Subassembly Geometry

Points are the foundation of a subassembly. All links are defined by points and all shapes are defined by links. When used in a corridor, the points connect feature lines, links create TIN surface triangles, and shapes are used for materials calculations or to create corridor solids using the new tool.

Points are located by a mathematical relationship to the origin. This relationship is described in the flowchart. The Subassembly Composer's geometry tools will do all the math for you. There are three groups of geometry tools for building your subassembly: Geometry, Advanced Geometry, and Auxilliary.

The Geometry tools are the basic point, link, and shape objects that make up a subassembly. Advanced Geometry tools let the Subassembly Composer calculate the placement of points and links by interacting with other geometry or targets you have created. Auxilliary geometry resides only within the Subassembly Composer. Auxiliary points and auxiliary links are used to calculate the placement of standard geometry points only.

The simplest way to start a subassembly is with a point located at the origin. Drag a Sequence from the toolbar into the flowchart and double click to open it. Next drag a point from the Geometry toolbar into the Sequence and define the mathematical relationship to the Origin in the Properties panel. To define a P1 location at the origin, you specify a Point Geometry Type of "Delta X and Delta Y" and set the Delta X and Delta Y offsets to zero.

Instead of defining the mathematical relationship to the origin for each point, points are chained together in the flowchart and related to one another. For the flowchart in Figure 2, Inner Wall Points may be defined relative to points in the Outer Wall Points sequence, but not vice versa because a flowchart operates in only one direction. This becomes very important as Switches and Decisions are added. You can add, modify, or delete the arrows that define the process order of the flowchart.

You can relate points using an angle or slope, an offset distance, or an elevation on a target surface. Use one of the Slope point geometry types to create a subassembly that reacts to Superelevation on the baseline alignment. Offsets can be hard-coded or mathematical expressions using input parameters (see Figure 3).

The Targets tab allows you to incorporate Elevation, Offset, and Surface targets. These are defined in the Corridor Parameters Target Mapping dialog within Civil 3D. The syntax for using an Elevation target is [Target Name].elevation. If the target name is "PG" to represent a proposed ground profile target, then the syntax for using an elevation target is PG.elevation.

Be careful when using an elevation target for a Delta Y definition, though. If your PG elevation is 650 ft, your Delta Y will be 650 ft, which is a substantial increment. Probably you want the relative elevation from the previous point, say point P2. Your Delta Y expression would then be (PG.elevation – P2.elevation). Offset targets are more straightforward. To target to an alignment, your syntax would simply be [Target Name].offset.

Links are defined in relation to points. The simplest straight line link is defined with a From point and a To point. A circular arc may be defined by passing through three points or with a center point and two pass-through points. Shapes are defined by a sequence of links that create a fully-enclosed area. Occasionally you will need to add short links that serve no purpose other than to create a shape.

Auxiliary points and links are defined only within the Subassembly Composer. They are used to create temporary geometry to define the location of permanent points. You might create an Auxiliary Point

to define the center of an arc or two Auxiliary Links to create an Intersection Point where they meet. Auxiliary Points and Links are especially useful for keeping your subassembly clean when using a Fillet Arc.

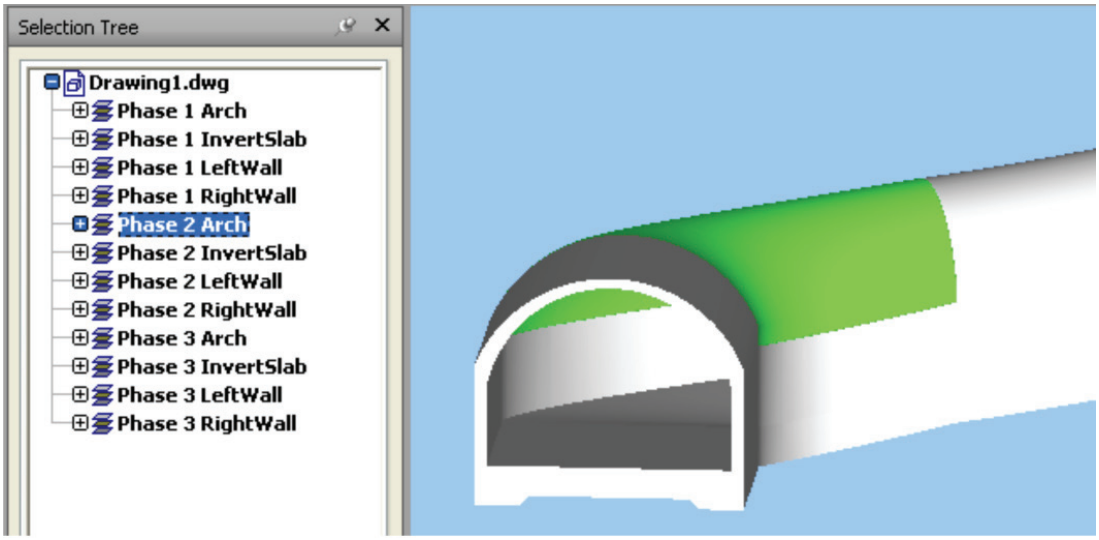


Figure 4: Solid model of a tunnel with circular arc roof.

Corridor Solids

Once you have built a parametric "2½D" corridor model, it's time to fill in the gaps between corridor frequency stations to add the last half-dimension and reap the rewards of your hard work in a BIM model. The Corridor Solids tool debuted on the Autodesk Labs site in August 2011 for Civil 3D 2012 64-bit only. The technology preview will operate until August 1, 2012. Once installed, the Corridor Solids tool is added to your Toolbox in Toolspace. The tool exports body objects for corridor regions, essentially automating the manual AutoCAD lofting workflow.

The Corridor Solids tool itself is a simple two-step wizard. The first tab is where you do all the work: select your corridor, specify your regions, and create your Layer Name Template (see Figure 4). You choose whether to place the 3D body objects within the current drawing or into a new drawing on the second tab.

Running the tool takes seconds, but you must set up your assembly and regions well to use it effectively. If your model will be used for schedule visualization, it's important to ensure that the output will tie seamlessly to the schedule. Your corridor regions will need to match construction phasing and your layer names need to be logical.

The designer probably did not have construction regions in mind when modeling the corridor, so you may have to redefine regions to coincide with construction station limits. The Add Region option allows you to aggregate or subdivide regions along a baseline independent of the corridor-defined regions. Ensure that the construction regions have logical names if you plan to incorporate the region name in your Layer Name template.

The Corridor Solids tool will place the 3D body objects on layers as defined in the Layer Name template. The tool includes six Property fields that can be used to generate the layer names, as show in Figure 4 above. I like to use "<[Construction Region Name]> <[Shape Codes]>." Well-chosen subassembly shape definitions that match the level of disaggregation required in Navisworks will save a lot of time downstream.

My preferred workflow is to output to a new drawing. The tool will place the 3D bodies into a clean AutoCAD 2010 drawing with only the default layers and the layers created by your layer name definition. This avoids a lot of interoperability concerns and provides a clean file to share for coordination. If your corridor has a high frequency or high tessellation, the 3D bodies add significant bulk to the file size and I like to keep my Civil 3D files lean. It's simpler to overwrite an external file if the corridor changes than to manually delete the 3D bodies in the design file.

The Corridor Solids tool is still in development. There has been some debate over whether or not body objects, which interact well with Autodesk® Revit®, are the best format for the 3D objects. ACIS solids, which work natively with AutoCAD's 3D solids editing tools, may work better for some workflows. The output is light on BIM data, too, taking just a smart layer name and the 3D geometry from the Civil 3D model. Maybe you would like the 3D objects exported within a block with attribute data from the corridor appended? What data would you like attached to your solids? How about an item number that could be tied to an Activity ID or a QTO item number? Join the discussion on the Autodesk Labs forums and contribute to the development of this important tool in the Civil BIM workflow.

Francesca Maier is a licensed professional engineer in Parsons Brinckerhoff's VDC Group. The group works with design teams to provide comprehensive VDC/BIM services for highway, rail, tunnel, and bridge projects throughout the US and internationally. Francesca also leads Parsons Brinckerhoff's Civil 3D user group and is an instructor in the company's Autodesk Training Center. She can be reached at maier@pbworld.com.

Getting to the Next Level

In the last several years, MEP firms have faced increasing pressure to adopt Building Information Modeling (BIM)-capable tools such as Autodesk® Revit® MEP. Some firms have put off change, some have tentatively dipped in a toe, while some have jumped in head first. No matter where your firm is now with regard to Revit MEP implementation, it seems clear that we all have to keep raising the bar to stay viable in a changing world.

So how does a firm go to the next level? It's more than a technical problem. It involves process and cultural changes as much as software and hardware upgrades. For all the expense of the upgrades, many firms have a much easier time writing checks than dealing with people and personality issues. Just as adopting a healthy life style is not a switch you turn on—one needs to eat right and exercise every day—adopting Revit MEP and a BIM process is similar. Firms need to spend money, spend time, and build a culture of embracing change.

A Brief History of Revit (and Revit MEP's Place)

Since Revit's first release in November 1999, by my count there have been:

- 21 Architectural releases
- 9 Structural releases
- 7 Mechanical and Electrical releases
- 4 Plumbing releases

Revit Architecture's 14 release "lead" has contributed to the perception that Revit MEP is not yet ready. While that perception is no longer true (demonstrated by the use of Revit MEP on thousands of projects), it is true that consulting MEP firms cannot simply decide to go 100 percent Revit like their architectural counterparts. Consulting MEP firms need to follow their client's choice of software. While many architectural firms have gone to Revit, some have not. Thus, projects are delivered in Revit MEP, AutoCAD MEP, and AutoCAD—depending on the wishes of the client.

For example, at my firm we are currently working on projects created in 2009, 2010, 2011, and 2012 versions of Revit. Having to stay sharp in multiple software packages and multiple versions of those products is not a bad thing. It prepares us for where the building industry seems to be going. It has been suggested that the average person uses 12 to 15 different programs today. In 10 years, look for that number to be around 50 and don't be surprised if the 12 to 15 different programs used today are not on the list of 50 in the future. What does it mean? Not only is Revit MEP ready for primetime, it is linking into more and more software packages. To access what comes after, firms must first be confident users of Revit MEP.

A Staged Approach

If we need to master so many software packages, how will we do it? Well, not all at once. Like a building, you must build a foundation first.

Stage 1 - Model in 3D
To get the most out of Revit MEP, the ability to model in 3D is required. It provides the ability to create basic construction documents and run interference checks. This is the low-hanging fruit for any implementation.

Stage 2 - Scheduling
The next logical step is to add information to the model. That information will also need to be extracted from the model in different ways that help the design and documentation of the project. The easiest way to achieve this is through the use of Revit schedules. To build and use schedules users must be able to modify and create Revit families. This will also include a solid knowledge of parameters and connectors.

Stage 3 - Calculations
MEP engineers will need to perform calculations. Many calculations can be performed in schedules with knowledge of shared parameters. Revit MEP has a built-in calculating function that must be mastered. Information in the model can be extracted from Revit in multiple ways and imported into the trusted software engineers have been using for calculations for years. This will force an assessment of the "end game" and what is the best route there. Inevitably, it will lead to a change of process.

Stage 4 - Diversify
No one can say for certain what the future holds, but we know that things will not stay the same. We have to prepare ourselves for the addition of new specialized software. These will be coming at us like IPod apps. The AutoCAD App store went live in June 2011—accessible from the Autodesk Exchange tab in AutoCAD. It would be foolish to think it will stop there. Autodesk's introduction of the Building Design Suite, Product Design Suite, and Infrastructure Design Suite is another indication of that strategy. Even now we have Ecotect, Green Building Studio, connectivity to Trane Trace and carrier HAP through gbxml. Even project management software such as Newforma is creating links to the Revit model, and the list is growing daily.

With the introduction of all these specialized software applications, drafters must become more like designers and engineers must become more like drafters. Roles will change, processes will change, fees will change, and buildings will change—we hope for the better.

The Art of Change

Change is not only continuous, it is accelerating. Dennis Neeley, AIA senior vice president, owner solutions at Smart BIM, suggested that CAD drafting took 12 years to overtake hand drafting and BIM will be adopted in only six years. If the trend of twice as fast continues, firms will have a smaller and smaller window in which to take advantage of an opportunity from the time it becomes possible or profitable to the time it is expected.

This is where building a culture that embraces change feeds progress. Look at the success of Google and Facebook. Their openness to change is a cornerstone to their young success. It should be noted that they are not only young companies; they are companies that employ the young. Compare the average age of Google or Facebook employees (late 20s and 26, respectively) to the average age at your firm. How the older generation handles change is different from younger generations who have lived with accelerated change their whole, albeit shorter, life. Chances are that established firms are not going to let all of their experienced people go so they can build a younger firm that will embrace change. Here are some common-sense tips to help any firm deal with change.

Embrace It
It is important to recognize that different approaches are necessary with different people. In the end, one way to take the most advantage of breakthroughs is to employ people who aggressively accept new opportunities. So embrace change and encourage it in others.

Adapt and Overcome
Recognize that new things come with new challenges, which require early adopters to adapt and overcome as a way of life.

Become a Life Long Learner
The cycle of change will continue and overlap with other cycles. It is best to just enjoy it.

Last Thoughts on the Future

With a widening base of opportunities, we can look for the days of the "general practitioner" to end. We will see more specialists bringing greater depth to engineering services. We will have to dive deeper to deal with tightening margins and to serve a much more sophisticated client base. Building modelers and BIM managers did not exist eight short years ago. There is a sub-industry growing right now around more complex modeling, analysis, and virtualization.

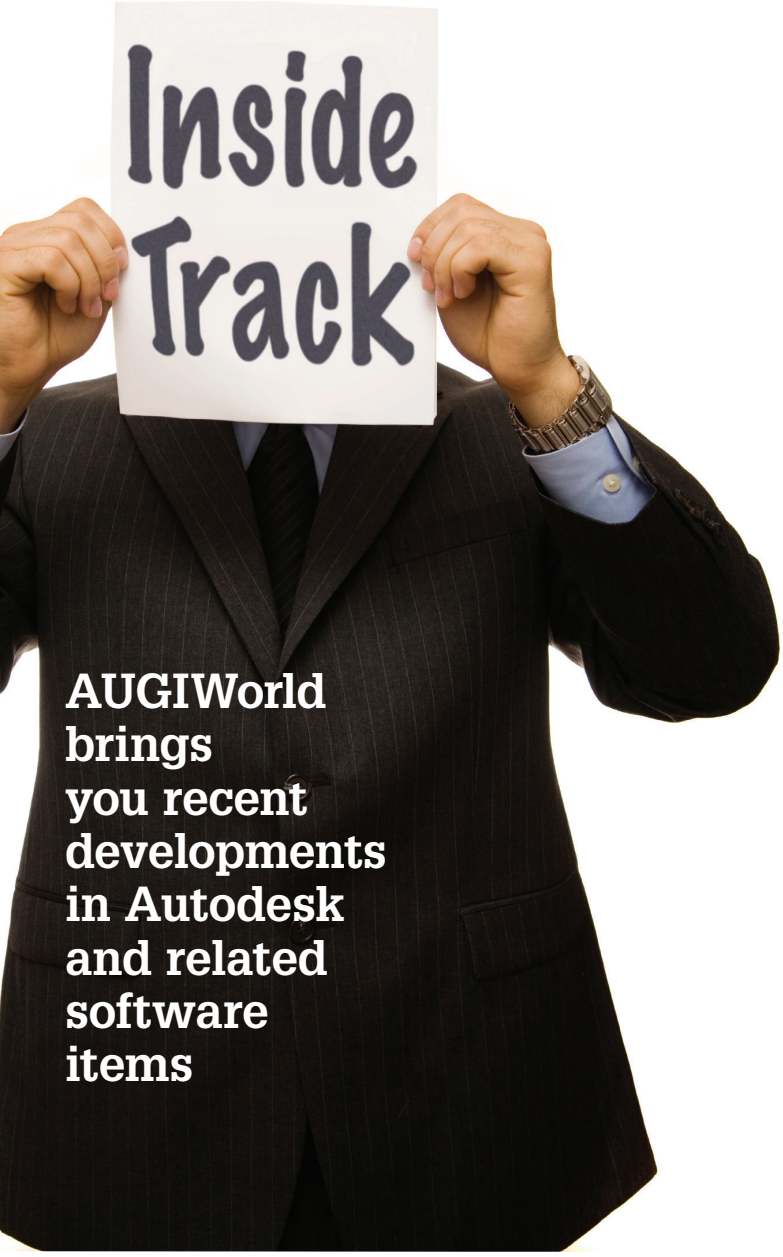
At different points in the history of AutoCAD®, users moved the software ahead; at other points the software moved the users ahead; and even third-party developers have pushed things forward. Revit is experiencing a third-party movement right now, and it is subject to have the users move it ahead in the short term. That is, if we are ready and willing to take the next step, and possibly a leap of faith.

Todd Shackelford is the BIM Manager for Alvine and Associates, the president of the BIM Board of Omaha, and an instructor for the University of Nebraska. He authors three Blogs; CAD Shack , The Lazy Drafter *and* Revit Basics. *Todd has been a featured speaker at Autodesk University, AUGI CAD Camps, CSI, IEEE and AIA events. Contact Todd at tshackelford@alvine.com*

aPriori Announces Latest Version of its Product Cost Management Platform

aPriori, a provider of product cost management software solutions, announced the general availability of the latest release of its software platform. aPriori 2011r2 offers new functionality and enhancements that expand the platform's cost optimization capabilities for companies with high-tolerance machining requirements in the automotive, oil & gas, semi-conductor equipment manufacturing, and aerospace/defense segments. Also, in response to the growing market need for better methods to estimate the cost of hard tooling (e.g., capital investments to support part production) that can be used by tooling experts and non-experts, aPriori has upgraded its capabilities to generate highly detailed tooling cost estimates for components.

http://www.apriori.com/64cfda5a-4751-41f1-b4b5-e3a6d505a937/news-press-release-detail.htm



AUGIWorld brings you recent developments in Autodesk and related software items

ANSYS helps to speed product development

ANSYS has launched a new version of its engineering simulation technology suite. ANSYS 14.0 is designed to optimize product development processes by reducing the time and cost needed to foster product innovations.

The new release includes hundreds of features that make it easier, faster and less costly for organizations to bring new products to market.

http://investors.ansys.com/releaseDetail.fm?ReleaseID=631569

Autodesk DWF Toolkit 7.7 Now Available

The DWF Toolkit includes C++ source code for reading and writing DWF files. More specifically, it provides APIs for:

- DWFx format support.
- Reading and writing 3D DWF from any application.
- Simplified 2D interfaces.
- Reading and writing composite DWF files (3D and 2D combined).
- Cross-platform support (Windows, Mac, and Linux).

The latest version of the DWF Toolkit, 7.7, ready for download here: http://www.autodesk.com/dwftoolkit.

3Dconnexion Announces SpaceMouse Pro

SpaceMouse Pro delivers professional navigation, application control, and an advanced ergonomic design.

3Dconnexion announced the SpaceMouse™ Pro, its newest 3D mouse for professional 3D software users working in a range of industries from mechanical engineering to media and entertainment, product design, architecture, and healthcare. SpaceMouse Pro combines 3Dconnexion's patented six-degrees-of-freedom (6DoF) sensor for intuitive and precise 3D navigation with an advanced ergonomic design and innovative on-screen display, to deliver superior comfort and a simpler, more productive workflow.

http://www.3dconnexion.com/products/spacemousepro.html

e-SPECS Version 7.0 Offers Advanced Functionality

InterSpec Inc., provider of BIM integrated construction specification software and services, announced today a major upgrade to its popular e-SPECS® specification management systems. e-SPECS v7.0 includes enhanced Autodesk® Revit® integration, Office Master Updater application integrated into the popular Microsoft® Word® application and specification manual publishing enhancements.

http://www.e-specs.com/especs-revit.html

Advanced Rendering in Revit

By now the advantages of Building Information Modeling (BIM)—specifically the Autodesk® Revit® platform—over simple CAD programs has been extensively analyzed, examined, and proven. More efficient workflow, quicker results, higher profit margin, yada yada yada. I know this; you (should) know this; so let's delve into a topic less often discussed: Presentations.

By presentations I don't mean construction documents, which are yet another benefit Revit provides over CAD. I mean presentations like most of us did in college and few of us get to do anymore. Today, presentation is a task usually reserved for someone with a focus in graphic or interior design. I'm referring to presentations that contain images usually generated by a program few designers have mastered (such as Autodesk® 3ds Max®) and are often outsourced by firms that don't have the personnel experienced with those programs.

Personally, as the project budget and time allows, I send my projects to Alex at Arccentric, based out of Chicago, Illinois, (http://www.arccentric.com/) for renderings or animations. I am sure your firm has a visualization expert on speed dial as well. But when I'm working with a tight budget and the client needs "something that looks nice," then I take advantage of the under-used presentation features in Revit—shading, shadows, materials, rendering—to create the images best suited to represent my client's project.

This article will show you how to create a multitude of presentation-quality images to satisfy the needs of the majority of your clients (regardless of how diverse they are), as well as add to your firm's portfolio, all the while bypassing the costs associated with professional visualization experts.

Setting up the View

If you have two eyes and are not a politician then the world you see most likely contains perspective. Therefore, you should be using the camera tool to create your presentation views. Using this tool is a simple two-step process. After selecting the camera (Camera) in a plan view,

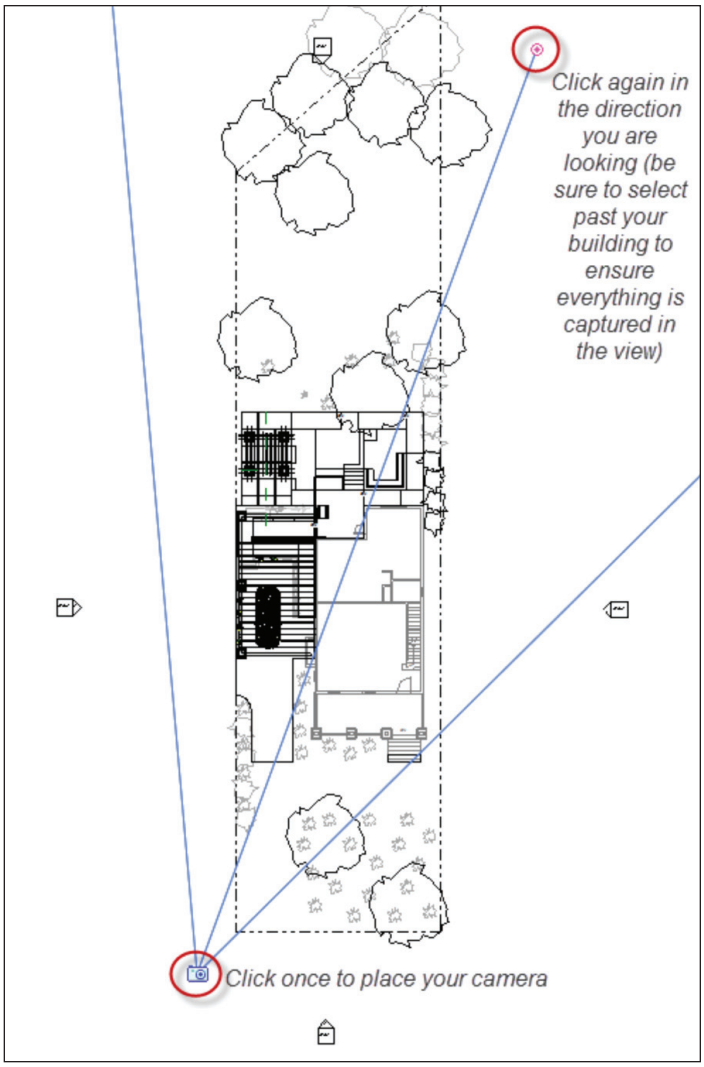


Figure 1: Creating a Perspective View using the Camera tool.

click the mouse once to represent where you are standing relative to your building (your default eye height is 5'-6" from the level you are placing the camera), then click it again, somewhere in the direction of where you want to look.

Figure 2: Perspective View in Hidden Line style.

That's it! Revit will automatically create the perspective view following the second click of your mouse.

Like most things in Revit, this newly created view is easily adjusted and manipulated. A great way to do this is by using the full navigation wheel, which is located within the view. I'll admit I was not a fan of this for many versions of Revit, but I have grown to love it—especially the "Walk" and "Look" tools within it. Once you get the hang of the wheel, you'll find it does a nice job of simulating your presence in the view and looking at exactly what you want to see.

One adjustment you should make now that becomes important later is the size of the view you just created. Since Revit is a vector-based program, the resolution will never deteriorate and will always look the same on your computer screen. But when the time comes to print or export this image, the image dimensions should be set to the size you want it to be on paper.

Remember, shrinking a large image affects its quality exponentially less than enlarging a small image. The lesson here: bigger is better. Adjust your image size by selecting the grips of the crop box to get the exact proportions you want. Then, to get the proper dimensions of that view, select the Size Crop button in the toolbar ribbon and input the specific dimensions you want. Be sure the "Scale" option is selected to maintain the proportions you just created.

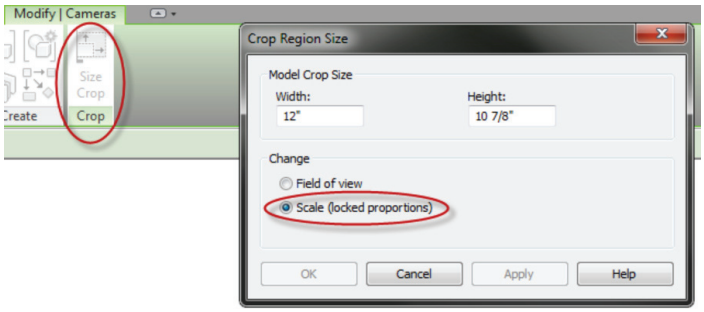


Figure 3: Resizing the new Perspective View.

Shadows

Once the perspective view is created, its default visual style is most likely Hidden Line. While this may look nice (especially to AutoCAD users or…gasp…Neanderthal hand drafters) we can do so much better.

Generate shadows using the Shadows On/Off button ( ) near the bottom left of your screen OR by opening the Graphic Display Options located in the properties dialog box of your view (Figure 4).

Shadows are easily controlled by adjusting the "Lighting" and "Sun and Shadow Intensity" settings in the Graphic Display Options. This allows you to create accurate shadows based on your building's specific worldly location or to simply add shadows to express dimension, depth, and contrast to your building.

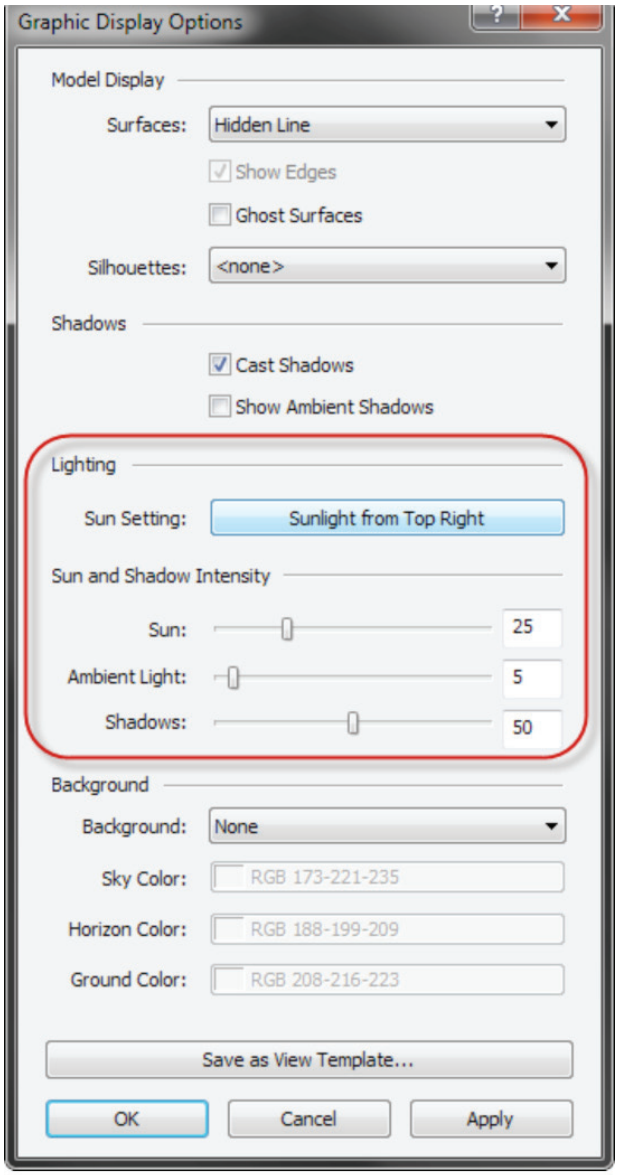


Figure 4: Controlling shadows with Graphic Display Options.

Figure 5: Perspective View in Hidden Line style with Shadows.

Color + Background + Ambient Shadows

For the next example I will focus on a Revit family within a project to demonstrate the power of color (named Shaded Views in Revit) and to show off my favorite, little-known Revit tool, Ambient Shadows.

Color complements the shadows we added earlier and creates even more "pop" to your images. All Revit objects can be assigned materials, so we can specify what they look like in Shaded View independent of their realistic material. The advantage to this is we can create a view which provides a good representation of objects (for example: wood is brown, brick is red, grass is green, and so on) without spending the extra time to set the true materials necessary for realistic or rendered views.

Adding a Gradient Background and Ambient Shadows are possible once again through the Graphic Display Options. Selecting the box to show Ambient Shadows gives your object or project even more of a realistic touch, while still saving you the time required to do a full rendering. While regular shadows are created from a singular light source in Revit, the Ambient Shadows tool creates shadows more realistic to the world we live in, which often has multiple indirect light sources.

Figure 6: Shaded View.

Figure 7: Shaded View + Shadows.

Figure 8: Shaded View + Ambient Shadows + Gradient Background.

Gradient backgrounds provide a simulated surface or sky using three colors of your choosing. This is just one more option to create a more complete scene for your objects and projects.

Realistic Views

One of the attributes of other modeling programs, such as Google Sketchup, that many people like is the ability to see real materials in their model without going through the rendering process. Recent releases of Revit Architecture have since added that ability.

Before getting an accurate Realistic Visual Style, we must first make sure the correct realistic materials have been set to the corresponding object materials. One disadvantage to this is that it can take a fair amount time to find and properly represent the correct material. Another disadvantage is that certain materials look better than others in the realistic view, so using those may dictate how you set up your camera as well as which materials you select. The big advantage, of course, is that you have a realistic looking view of the space you designed in less time than it takes to fully render.

A Realistic Visual Style view combined with shadows and ambient shadows generates a presentation-quality image sure to satisfy even the most discerning client.

Figure 9: Realistic View + Shadows+ Ambient Shadows.

Rendering

The final presentation option offered in Revit is the ability to do a photorealistic rendering. This option is certainly the most time consuming, but also the most visually rewarding when done properly.

The quality of your image post-render is determined by the output and quality settings you choose. Personally, I choose to use "Printer Resolution" which renders an image to the exact size of the crop box we specified previously. This will create a higher quality image than choosing "Screen Resolution" and consequently a larger file size. In addition, you can choose six possible quality settings and you can also specify various DPI, which affects the quality and detail level even further.

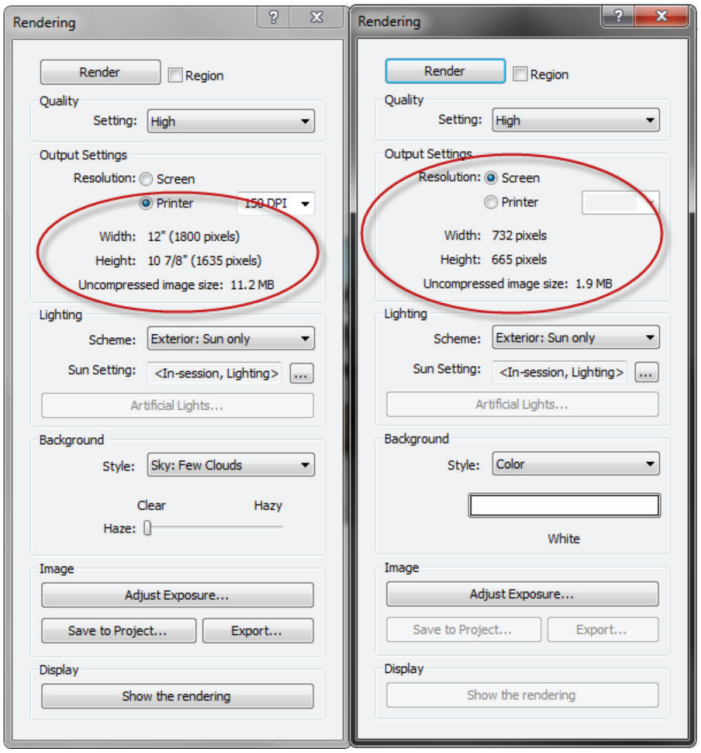


Figure 10: Rendering resolution settings.

Many of the preparations for rendering, such as the proper set up of materials and lighting, have already been covered in this article. For exterior daytime renderings, use the Sun Setting options within the Rendering dialog. This allows you to create a precise sun angle and position relative to your building. Or, if you specified a real-world location, then just state the time and date and Revit will accurately portray the sunlight for that time, date, and location.

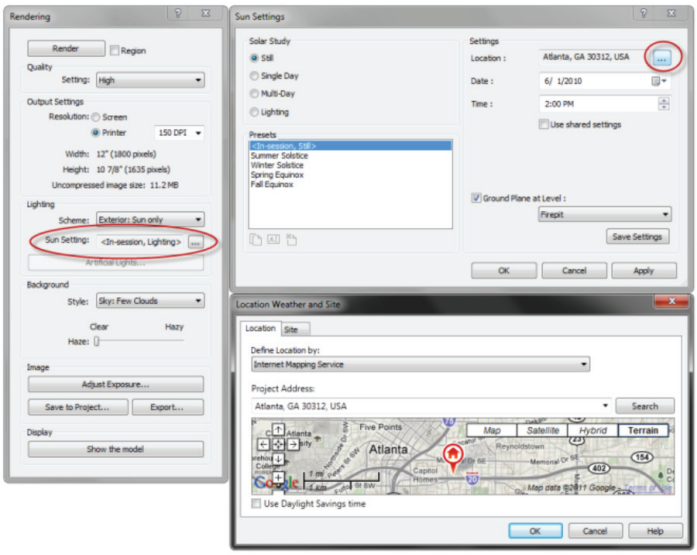


Figure 11: Specifying sun settings in the Rendering dialog.

I recommend using a draft quality and/or a rendering region on your first few renderings. This will ensure you are getting the image you desire based on the materials and shadows being generated without using a lot of time. Also think about the end use for your image. Is it the featured image on a large printed presentation board? If so, then you will want much better quality. Is it a tiny image, in which the level of detail will not be recognized (like the images in this article)? Then perhaps lower quality or a smaller image will suffice.

Figure 12: Final rendering at best quality.

Once your settings are determined, the actual render time will vary based on your computer hardware and whether you are using a single computer or technology such as rendering farms or cloud computing. In this case, my desktop rendered the house in 62 minutes at best quality, while the same image took only 90 seconds using draft quality. As always, the bigger the image and higher quality the output, the longer it will take to render.

Image Editing and Exporting

Post-render image adjustment is often done in feature-packed image editing software, such as Adobe Photoshop. But were you aware you can make an assortment of minor changes to your rendered image within the comfortable confines of Revit?

The four skyscraper images in this article (at right) were rendered using a night scene and a few artificial lights. The original rendering is on the left. The remaining three images were all generated by tweaking various elements of the exposure adjustment options within Revit.

Once everything is to your liking, and more importantly, receives the approval of your client, it is time to export the image. If you rendered the image, first select the Save to Project button, which will add that rendering as a new view to your project browser. You can then choose to export the image as a JPG or other image file format. The other option for exporting is via the main File menu by choosing Export>Images and Animations>Image.

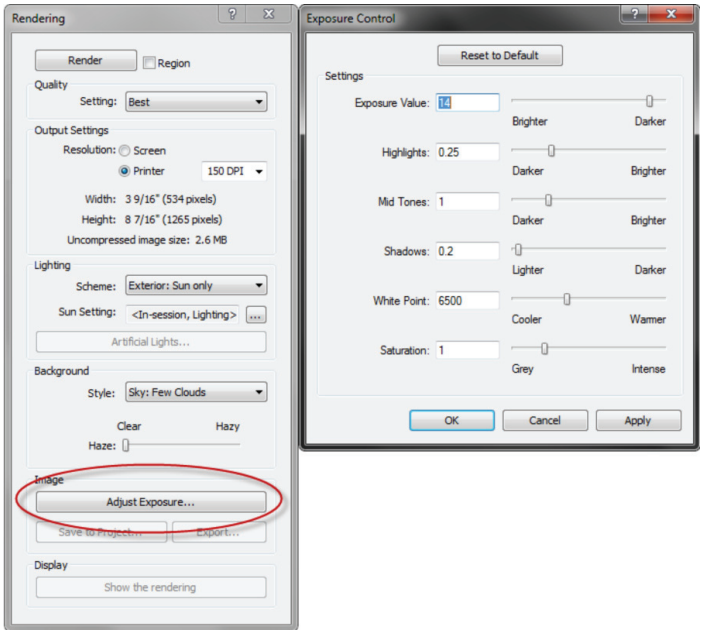


Figure 13: Post-render exposure adjustment settings.

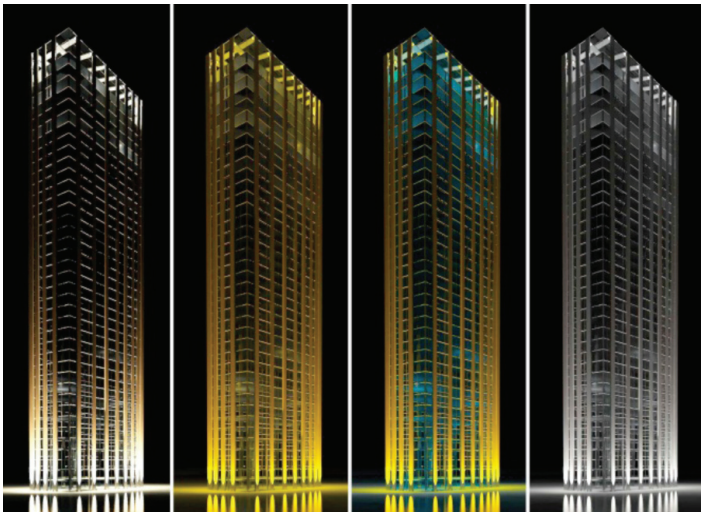


Figure 14: Effects of exposure adjustment.

I recommend using a draft quality and/or a rendering region on your first few renderings. This will ensure you are getting the image you desire based on the materials and shadows being generated without using a lot of time.

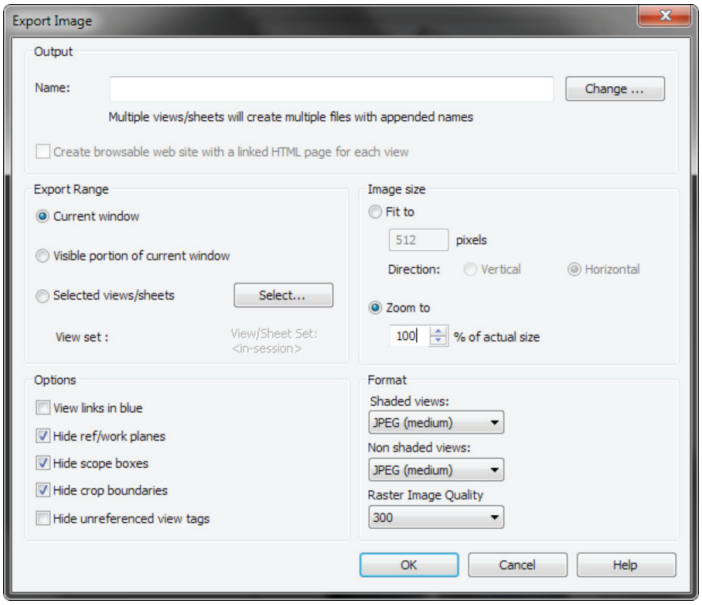


Figure 15: Image exportation settings.

You will see a dialog box that allows you to select the settings of your choosing for exporting. For good quality images to use in presentations, I recommend using the "zoom to" option, which will export your image to the exact dimensions you made the crop region around the view and setting the quality to 150 or 300 DPI. All non-rendered images in this article were exported in this manner.

Creating a Presentation

Now that we have all these high-quality, outstanding, presentation-worthy images, what are we going to do with them? Assuming we don't know programs best suited for this task such as Adobe Photoshop or Illustrator and we are not well versed in Microsoft PowerPoint, why don't we keep it in house? After all, we have done everything else in Revit so why not create a presentation board within our Revit file? Great suggestion! Let me explain how.

Just as we produce construction documents using text and views within our project browser, we can create a custom title block to use as our presentation board template. Then it is just a matter of using our creative juices to combine text, project images, inspirational images, and other elements to create a polished, professional presentation.

Figure 16: Revit-created presentation board.

Conclusion

As you can see, you do not need to possess a degree in graphic design or be well versed in a plethora of design software to create good looking, client-pleasing, design-review-committee-satisfying presentation boards. By experimenting with the numerous presentation-oriented tools provided in Revit, you too can design and create high-quality images to add to a presentation board using the exact same program you use to generate construction documents, schedules, and everything else projects require.

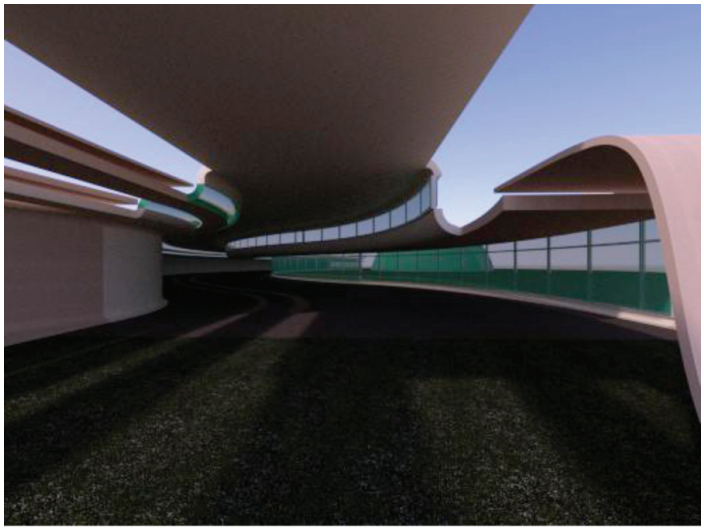


Figure 17: Reflex Render Image (Courtesy of aAECs).

At the time this article was written, there were rumors of a new Revit add-on program named Reflex Render by Advanced AEC Solutions (aAECs) www.aaecs.com, being released in time for Autodesk University. This is said to revolutionize the design presentation process as we know it. If the previews I have seen are any indication of Reflex's power, then it might just be the next big design software boom. It's worth it to expand your software knowledge to add the ultimate rendering program.

Kyle Benedict (M. Arch.) is the founder of RADiCaL Design Solutions, a design studio which specializes in handicap accessibility design and consultation. He also established therevitcollection.com, an online assortment of modern Revit components. He resides in Atlanta, Georgia, USA, and can be reached at kyle@radicalds.com

Super Families: A Kit of Parts

Building Information Modeling (BIM) revolves around data, and in Autodesk® Revit® most of that data is stored within families. Unfortunately, the family editor within Revit is one of the most difficult things to master. However, breaking it down and standardizing an entire category can help to simplify this.

Standardizing one category into a single family or group of families can make it more intelligent and easier to use. This standardization is typically referred to as a Super Family.

Using a door as a case study, we will walk through the basic outline and process of super-sizing any category.

Define Your Requirements

The first thing to do with any Revit family is define what you want out of it. This means that the end goals of the family determine how and what is built.

In the case of doors, I knew the following.
Most of the editing occurs within schedules. Historically, the bid and contract documents are based on the schedule. This has led to a workflow where data is input into a schedule and the graphical ramifications are not necessarily checked. This means that the scheduled data needs to directly control the graphics in order to take advantage of Revit's links between the plan, elevation, and schedule data.

The doors need to be tied to exiting and code analysis. Generally people expect to be able to pull things such as exiting width and door signage directly from the door. While this complicates the back of house creation and maintenance of the door (you need to know the code and associated formulas as well as understand shared parameters[1]) it makes things significantly easier for a project and end user.

The end user controls need to be simple. In general, you get to pick what part of the family is complicated and what part is simple. This means that simplifying the end user controls complicates the back of house set up or vice versa. Fortunately the back of house set up is typically a one-time process or at a minimum is accessed significantly less than the day-to-day work on a project.

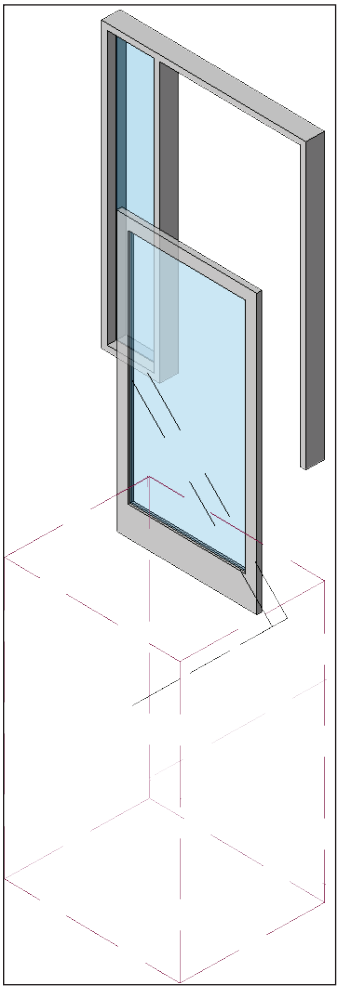


Figure 1: Super Families, creating a door's kit of parts.

Based on these requirements, a single family controlled primarily by instance parameters[2] seemed to be the best fit. This set up allows drop-downs and check boxes within a schedule to control the graphics, construction, and code analysis without accidentally changing other objects.

In addition, the door was broken down into its main parts: panel, frame, and swing. Each one of these parts is created and manipulated separately and then loaded into a host[1] or container family. This limits the number of objects that need to be created while allowing any number of combinations amongst them.

Back of House Set Up

These constraints led to the use of shared parameters[1] and family type parameters[1].

Shared parameters allow the door to be manipulated from the schedule as well as providing a unified system for controlling and tagging the parts.

Family type parameters allow you to create multiple objects, nest[1] them into a host family[1], place only one of them, and then switch between all of them. The downside of family type parameters includes:

- The drop-down list is populated by every family and type of a single category that is nested into the host family. This means that in order to prevent a panel from being used as a frame, each part of the door must be created as a separate category. I use the Generic Model category for door panels, the Doors category for door frames, and the Windows category for the door operation.
- The full name of the family and type is displayed. This leads to the need for simplified names for both families and types. We use A-Z for frames, 1-99 for panels, S for single, and D for double (i.e., a single door panel of type 1 will show up as 1:S in the schedule).
- They cannot be used in formulas. This reinforces the simplified names above.
- Standardize parameters. Any assocated[1] instance parameters need to be standardized between all types within a grouping[1]. If an instance-based parameter exists in type A, but not type B, switching from A to B will cause this parameter to become disassociated. This means that if the height of the door panel is de-

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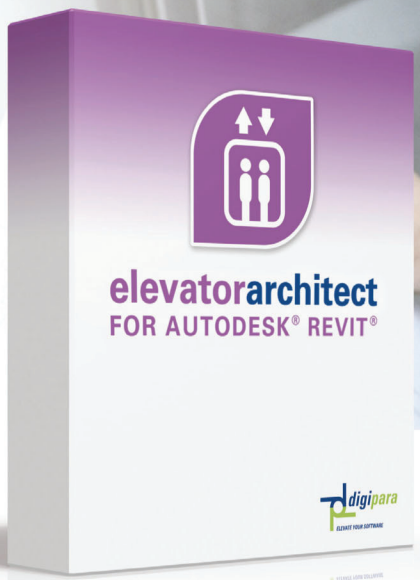

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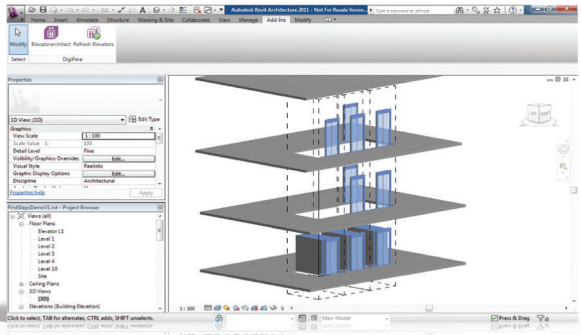

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termined by "height" in one family, but "height" does not exist in another, switching between types will cause A to lose its association to the "height" parameter—even if you switch back to type A.

Note that an instance of the category for which you are creating a family type parameter must already be in the host family. Otherwise you will not be able to create the family type parameter.

Templates

Once you have a road map set up for how to make the parts of your family, a template should be created for each one of them. Each template should contain all of the potential parameters for that part as well as the full range of flexibility that the part may need. This complete integration will help to address the standardized parameters mentioned above.

The panel template is created in the generic model category out of one extrusion with two voids in it. The voids can be "turned off and on" and their extents and infill pieces controlled. This allows for the creation of any number of the panels in Figure 2. Note that all solid geometry should be placed onto an appropriate subcategory (i.e., door panel, door glazing, and door louvers) to allow control within the project.

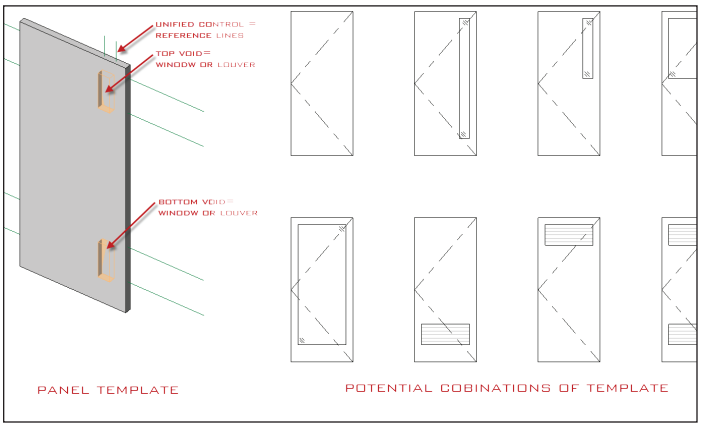

Figure 2: Door panel template.

The frame is created in the door category and made to accommodate sidelights and transoms of any (regular) shape or size. While these parameters may not be used in every frame they need to be there so as to not break the link for those doors that use them.

Note that all solid geometry should be placed onto an appropriate subcategory (i.e., door frame and door glazing) to allow control within the project. Note that this method may need to be modified if you are using copy/monitor extensively for openings.

The door operation family is created in the window category. These tend to be fairly simple families with the plan representation created as annotation lines and the elevation symbol created using model lines. These families should use the same set of standard parameters for height, width, and swing as the other parts. This will help minimize the number of parameters as well as make the families more user friendly.

Note that you may want to switch the line types depending on your graphical and project needs. For example, if door arch lines are to be painted on the ground, the swing line may want to be a model line. Alternately, the elevation swing lines may want to be annotative so they are not constantly showing up in renderings and walkthroughs.

Putting It All Together

Once all your templates are created, they can be assembled into the host family[1].

To assemble your parts, load at least one panel, frame, and operation family into the host. Each one should then be placed and locked to the family centerline. The parameters from each part are then mapped to the host so that they are accessible within the project. The mapping of the parameters includes the family type parameter. This is always set on the instance properties of a family and is called "label."

The host family is also where you set up formulas to be tagged in the project. While you could set these up within the nested pieces, changes would need to be made to every instance of the nested part and could create potential conflicts if one part is overlooked during an update.

I also place some limited geometry within the host family itself. Mostly this just consists of the panic bar, which is a generic block that applies to any door when panic hardware is required. While this could be part of a nested family or even its own piece, it is easier to create and control it once in the host rather than in every panel.

Once the basics are put together, you need to determine the kit of parts that will be used within the project. Additional frames, panels, and operation types can be loaded, modified, and changed within the family. For instance, our template contains a door with types 1-8. If you plan on using only types 1, 3, 4, and 8, the unused families could be deleted and the others renumbered. This is best done at the start of a job; otherwise the parameter value in the project may need to be adjusted as well.

What Comes Next

Make sure you test your family and its parts as you go along. Test them in the family editor as well as a dummy project. Also, be sure that you get the input of others throughout your development process. The worst thing to do with any family is to make it in such a way that no one else can use it.

Once the family is "working properly," place it in your project template and set up legends, schedules, and tags. Remember to place all of your shared parameters into the template as well. This will allow you to manipulate the family in the project as well as use the values in schedules and calculation.

Other parts may need to be added. I have created door access clearances along with a one-button schedule that can be used to check access compliance in plan as well as check for other clearance and compliance issues. This, along with several other items, could be added based upon your project needs.

Using a family in a real project inevitably changes the way you think about it. Start off with a basic kit and add on from there. Over time,

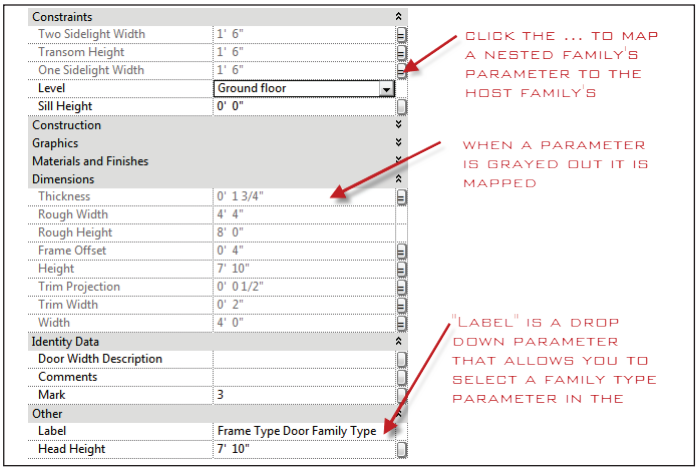

Figure 3: Associating family parameters.

your needs—as well as Revit's capabilities—will change and evolve. Starting out with a modular kit will help you stay in step.

Conclusion

Families may be difficult at first. However, breaking them down into parts simplifies their creation, use, and editing. Plan for what you need now and for potential growth in the future. Finally, remember to document your concepts and process so that others can use what you created.

Samples and Reference Files

[1]*Definitions:*

Family Type Parameter: Switches an instance of a nested family within the host family between other families of the same category.

Host Family: The family that is placed into your project. This family primarily contains nested families, but may contain native geometry as well.

Associated Parameters: Connecting a parameter from a nested family to the host family.

Nested Family: This family is not placed directly into a project, but is instead loaded into a host family. This family primarily contains native geometry.

Nesting Group: Nested families are grouped based on their use (i.e., panel, frame, and operation). Each group is defined by a consistent set of parameters.

Shared Parameter: Are user-created parameters that have a specific ID that allows them to be tagged, scheduled, and edited within the project, not just the family?

[2] **Instance vs. Type:** The projects I work on tend to be less repetitive. If you work on projects that have a significant amount of repetition (i.e., hotels) you may want to use type-based parameters instead.

[3] **Reference Files:** http://db.tt/TqUzQD19

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How Revit Structure Benefits the Construction Estimator

The Building Information Modeling (BIM) community is expanding to embrace the concept of total project delivery. One avenue of interest is sharing the Autodesk® Revit® Structure model with the construction estimator for bidding purposes. This article investigates the translation from Revit Structure to the estimating software Timberline by way of Autodesk® Quantity Takeoff (QTO).

The adoption of BIM into the workflow of the modern structural designer has changed the norm. I have personally experienced immense time savings in project design utilizing the RISA 3D exporter and contract document generation. Although I have seen the light, the next question is: How can others in the design and construction community also utilize BIM to improve their workflow?

One of the many possibilities relates to utilizing the BIM model in estimating practices. Traditionally, the estimating process has required a familiarization and accounting of the proposed building, as well as the materials required by the field staff to construct the project. This method is necessary to form a bid, yet it is inherently prone to human error.

To avoid these potential errors and omissions, designers have wondered whether this newly formed BIM model in software such as Revit Structure can translate to Timberline, popular spreadsheet-based estimating software from Sage. Fortunately, there is a workflow that promotes this beneficial sharing of information.

The Translator

The stepping stone is Autodesk QTO, which can translate 3D BIM elements to a series of descriptors and quantities in the takeoff. QTO offers flexibility with traditional 2D project functionality, as well as 3D BIM projects. This flexibility provides the possibility for an all-encompassing tool in the estimator's toolbox. Projects can be received in a number of formats, and the estima-

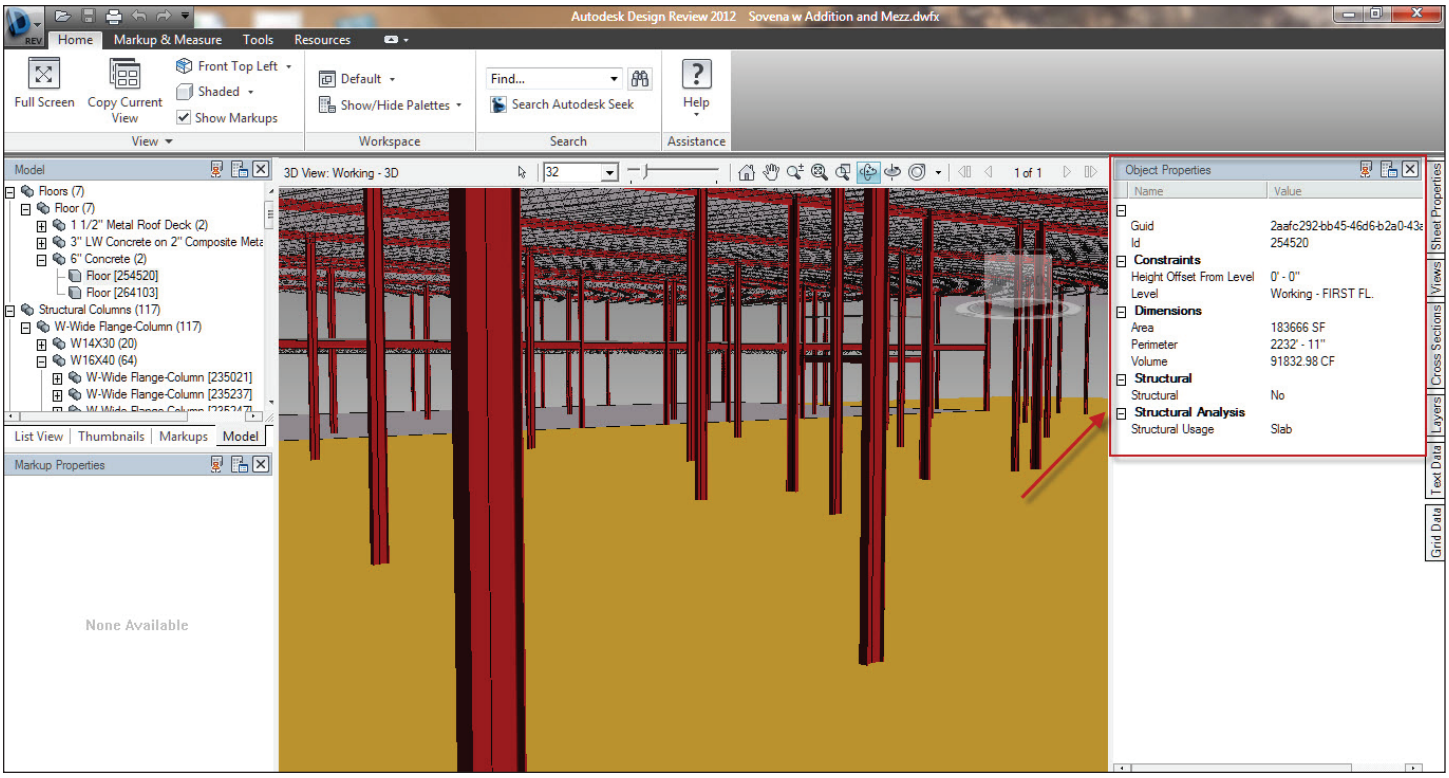


Figure 1: Instance properties

tor has a single tool to accurately and efficiently account for the materials required to construct each project.

In terms of the BIM workflow, what makes QTO so powerful is its utilization of the dwf format. To everyday users such as project managers and scientists, the line between dwf and pdf is blurred, and I am often asked why designers have an affinity to the dwf file type. One of dwf's many advantages is highlighted by QTO's methods of data extraction.

The key is preservation: the dwf preserves the intelligence of the BIM model by storing the element properties with each of the objects, as seen in Figure 1.

Rather than a snapshot of a Revit view, the dwf maintains the material and geometric information key to the quantity takeoff. The result is a condensed file size with rich information you can use.

Autodesk Quantity Takeoff

Let's see how QTO extracts this information. When you first open the QTO software and begin a new project, you are provided with a dialog box that allows the import of various files related to the project, including contract drawing sheets and overall 3D views of the model. You are also prompted to apply a catalog, as seen in Figure 2.

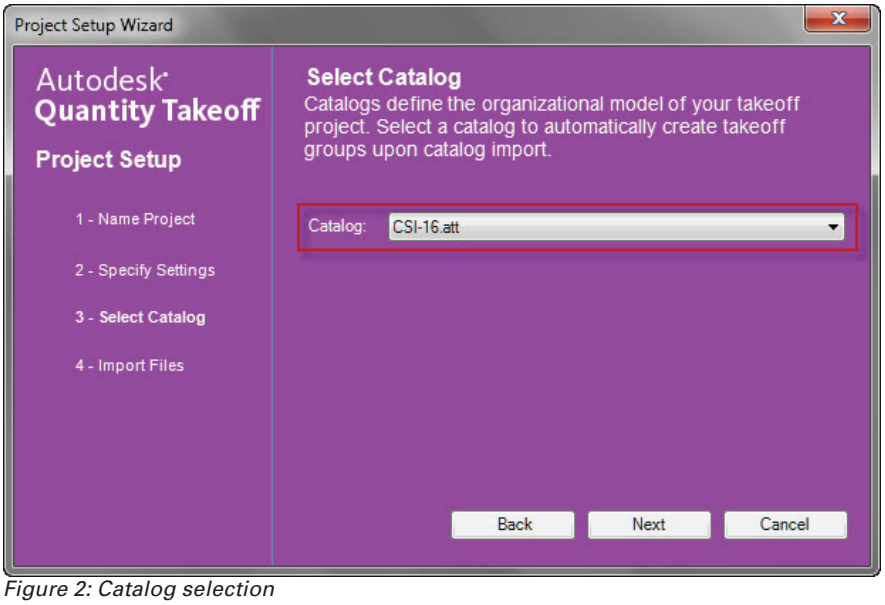


Figure 2: Catalog selection

This catalog, important from the perspective of translating to Timberline, sets up the groupings of materials. A typical material breakdown employs the CSI divisions that logically separate materials into similar working groups and provide a standardized framework across the industry. The catalog is fully customizable for applying preferences of categorization repetitively on all of your projects. This presents an opportunity for consistency amongst estimators and promotes further accuracy of the estimate. The default catalogs that come with the QTO software are shown in Figure 3.

At this point, you can select the various files that are associated with your project in dwf, pdf, or image format. The pdf and image formats are used entirely for manual takeoff, while the dwf format provides the ability for shortcuts. When you begin

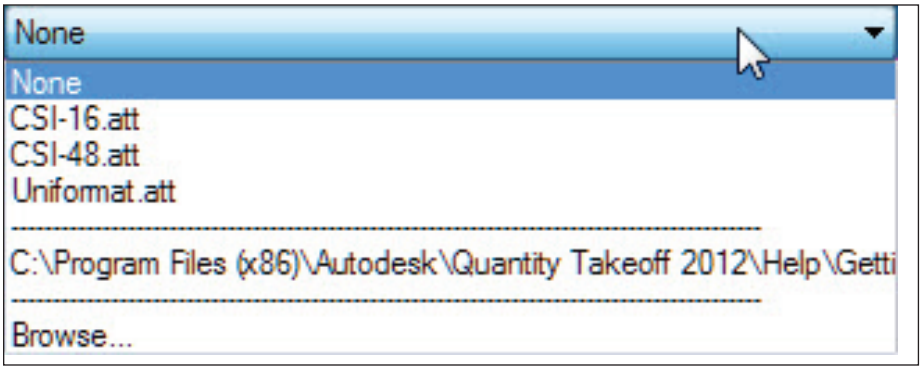


Figure 3: Multiple catalog options

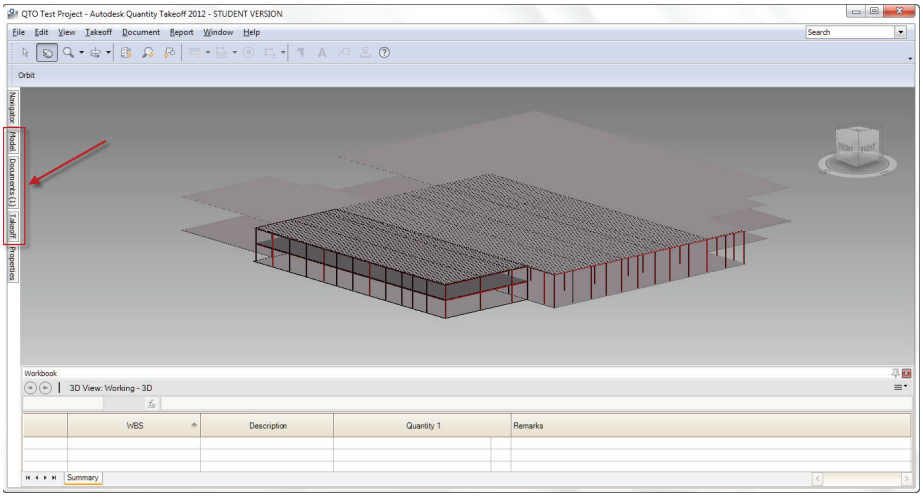


Figure 4: QTO GUI and important tabs

the project with various drawings and views, they are all brought into the project and cached.

Toolbars with various purposes are located on the left side of the screen. One of these toolbars, named Documents, breaks down the project's content into the different files that you initially brought in. This is a good way to traverse from one sheet to another for viewing purposes. Another available toolbar, named Model Tab, is similar to the family breakdown of the project browser from the Revit Structure model. An additional important toolbar, named Takeoff Tab, shows the work breakdown structure that was set up in the catalog selected during project creation. The location of these three tabs can be seen in Figure 4.

As with any software, there are multiple methods to obtain the same end result, but the use of a BIM model works effectively with the automatic takeoff tool. This tool can be found at the top of the screen and is shown as a building with a lightning bolt, seen in Figure 5. You can select the model you wish to takeoff, and this will populate a new category at the bottom of the takeoff window.

The Family organization of Revit is far from the CSI division breakdown that may be desired

Figure 5: Automatic takeoff tool

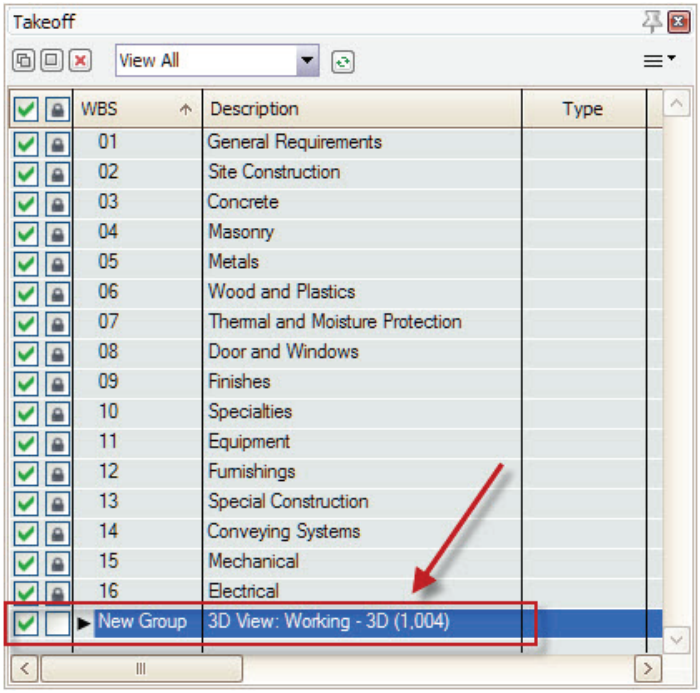


Figure 6: Takeoff palette with unsorted items

for estimate purposes. It is then the estimator's job to manually drag and drop the various instances found at the bottom of the takeoff window to the desired location in the work breakdown structure. The Takeoff palette with the unsorted model elements are shown in Figure 6.

Ultimately, this is a sensitive process that gives estimators the opportunity to apply their own preferences related to how an object is categorized. Since it is only a matter of dragging and dropping, and you may drag and drop multiple items at a time—making this a relatively easy and efficient process.

Once items are moved into the desired category—or during this process—you can adjust the properties specific to QTO. Most importantly, adjust the type that is to be applied to each item, for example the linear, area, volume, or count. This defines how the item is accounted for. Sorted items with their respective type are shown in Figure 7.

In order to obtain the quantity to be taken off, you may need to specify an equation that utilizes other known values such as

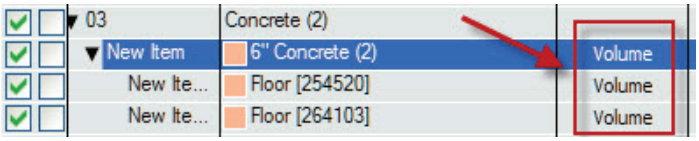


Figure 7: Sorted items with specified type

length and height to calculate the desired quantity type, if it is not readily supplied with the instance data.

At this point, the quantity takeoff is complete, and the process of sending the information into Timberline is addressed. Because QTO is ultimately using an outlined format, you can also easily export to a spreadsheet type file. This can be done through the export tool, which is located under the file menu, as shown in Figure 8. This process will change the format of the QTO work breakdown structure.

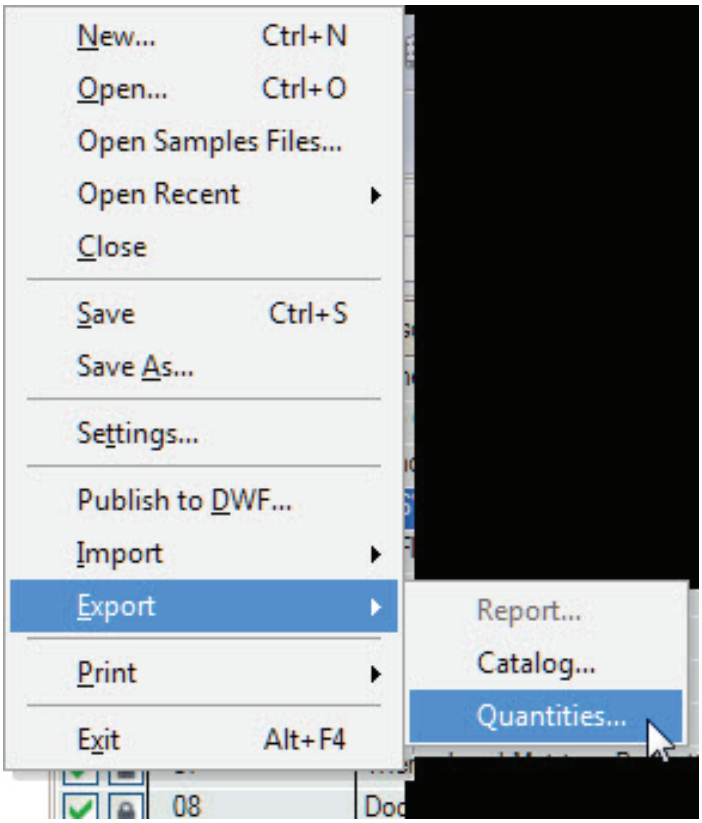


Figure 8: Export selection

When this tool is selected, the option to convert into many different file types is given. For this case, a .pee file (a Timberline native file format) should be selected. This file type is available to those who already have Timberline installed on their machine. From here, you can easily open the file using the Timberline software. Now, if you open the exported file in Timberline, you will see that the various groupings created in QTO retain. At this point, all of the materials are incorporated into the building in an organized way. You can then apply costs and derive products such as reports. The strength of Timberline is its built-up databases of material pricing information. In addition to pre-prepared databases bought with the software, estimators also have the ability to store geographic pricing information for more accurate estimates.

As with any software, there are multiple methods to obtain the same end result, but the use of a BIM model works effectively with the automatic takeoff tool.

Playing to Strengths

The key is using each software product for its strengths rather than pushing the products into uncomfortable realms. For instance, QTO provides support for the entire estimating cycle with options to apply cost data to the quantity takeoff. QTO also has the ability to nicely display this information and perform the math for project costs. However, the user must input each cost without the support of an existing database and as a result, this process becomes tedious. Therefore, I find it's better to utilize the strength of information from Timberline to increase the efficiency of your workflow.

Industry Considerations

It is important to note that there is possibility for complications in the Revit Structure-to-Timberline translation, as the communication between the structural designer and the estimator is crucial and also sensitive to misinterpretation. The two particular project scenarios that highlight issues of responsibility in communication are Design-Bid-Build and Design-Build type project deliveries.

In the Design-Bid-Build scenario there is a logical progression of information. The designer prepares a model containing the optimized structure along with contract documents ahead of the estimating and bidding process. The model could then theoretically be provided to the bidding contracting firms. The question surrounds how the BIM model might legally be shared with the bidding contracting companies to take advantage of the information-rich model.

The concept of BIM inherently benefits the estimator by attaching a tremendous amount of useful information to a geometrically meaningful model.

The BIM model is the intellectual property of the designer and, therefore, the responsibility of the design firm. An issue may arise when considering the accuracy of the model that has been created. When frustration leads to work-arounds by designers and drafters, the end result is an inaccurate model. If the structural model is not a perfect virtualized replica of the building, then errors and omissions are likely to occur in the estimate. With a level of confidence being put into the validity of the model, a contractor can improperly bid the actual cost of construction. And when forces such as these cut into a contractor's profits, discussions of change orders and litigation arise that are damaging to all involved.

The Design-Build project delivery situation has a different sequence. In this case the contractor and the designer are on the same team and as a result, the ownership of the model is less of an issue (keeping in mind that accuracy is still critical). The contractor and designer are bidding the project from square one, so the question becomes: How can you utilize a BIM model for an estimate at the conceptual bid level?

The answer to this question is likely project specific, but I believe that it is reasonable for either the structural designer or the estimator to put together a preliminary BIM model from which to takeoff. For me, the advantage to utilizing a BIM model is that in this modeling environment you can logically construct the project in fairly general terms from the ground up. This may help you to visualize the construction sequence and completely account for all of the building materials. This visualization could cut down on potential errors and omissions and might also shed light on potential means and methods savings.

In addition to accuracy, having this nice 3D BIM model serves other purposes. In this changing time when BIM is relatively new, it could be impressive to show your model with 3D images or a building walkthrough in a presentation to the potential client. That client may appreciate your technical capabilities and be impressed with the dedication shown in the project before it's even won.

Every project provides a unique scenario and sets of constraints, so I believe projects should be evaluated for the usefulness of a BIM model in the estimation process.

Conclusions

Advances in technology offer increased productivity and better efficiency for a project workflow. For structural engineers, the time savings is found in the design optimization and contract document preparation process. The concept of BIM inherently benefits the estimator by attaching a tremendous amount of useful information to a geometrically meaningful model. The process of quantity takeoff has always been to identify materials and their corresponding amounts in global space.

It seems intuitive that this type of overlap should be harnessed to provide time and cost savings. The key is to store this information as accurately as possible to properly depict the building at hand. With this dedication to accuracy and detail, the BIM model becomes a powerful tool for structural engineers and estimators alike.

The advantages of BIM are not limited to the designer; there are other inherent advantages of the information-rich file for members of the design and construction teams. Pushing the BIM process to a total project delivery level is the future of our field and, accordingly, extending the benefits to the entire project team is critical.

Sean Woods is a Structural Design Engineer at O'Brien & Gere (Syracuse, New York, USA) and a graduate student in the Sustainable Construction Management and Engineering Department at SUNY ESF. Sean has played an active role in implementing the Revit Suite of products as well as Navisworks at O'Brien & Gere. He can be reached at Sean.Woods@obg.com.

Wicked Tools for the BUILT Industry

This article continues the Wicked Series begun in the September issue with the Wicked Primer. Last month we looked at Wicked Problems in Construction and this month we explore Wicked Tools for the BUILT industry. Wicked tools exist in every industry—though few use those tools effectively—and the BUILT industry, which lags other industries from an innovation perspective, needs to seize the opportunity to take a quantum leap forward by leveraging wicked tools pioneered elsewhere.

Wicked Tech, Wicked Business Processes, and Wicked Legal represent three categories of Wicked Tools the BUILT industry needs to leverage more effectively. Wicked Tech, characterized by Building Information Modeling (BIM), cloud computing, and efforts to manage information more efficiently through local and worldwide computer networks, rightly captures much of the BUILT industry's attention. Wicked Tech, well advanced in other sectors and expanding in the BUILT industry, arms innovators in the BUILT industry with an impressive arsenal. Wicked Biz Processes arise out of lean business processes such as Six Sigma, Last Planner System™[1] and lean supply chain logistics. Wicked Legal

tools create legal agreements that serve as keystones in overarching legal structures that support and enable the use of BIM and other virtual design tools—i.e., Wicked Tech—on the one hand, and new generation lean business processes—i.e., Wicked Business Processes—on the other.

Wicked Tech

Virtual design and construction, information technology, the Internet, and cloud computing represent a brave new world for BUILT industry professionals. These tools, used for years in manufacturing, finance and other sectors, provide the BUILT industry with exciting, though challenging opportunities. BIM software, manifested in the virtual design and construction arena, often takes top billing, but cannot function effectively in a vacuum.

Dozens of software developers provide BIM software for the BUILT industry. BIM software makers[2] compete vigorously, rapidly commoditizing BIM software tools. The commoditization of BIM software and the inability of many project stakeholders to successfully deploy those tools has led to a rise in BIM consultants[3], capable of overseeing the development and deployment of multiple BIM tools in-house, in the field, and across platforms. The amazing potential of BIM—reflected in the slick presentations of the software makers' sales staff—often clashes with field-level reality. However, as in other industries, reality-potential gaps close swiftly and truly effective and integrated BIM solutions are now emerging in the marketplace.

Wicked problem solvers, like those involved in creating and deploying BIM software, enable integrated teams to identify and test alternative solutions to complex design and constructability conundrums on a scale and with a rapidity never seen before in the planning, design and construction world. A strong team of BIM consultants can help project stakeholders leverage BIM tools effectively.

Wicked Biz

Lean business processes, championed by Toyota and popularized in the US by the Six Sigma and similar tools, are gaining popularity in the construction industry. Six Sigma, lean supply chain management, real- time tracking systems, the Last Planner System™, and similar tools provide stakeholders on major construction projects with new and improved project management techniques. Deploying these tools in technologically antiquated environments, where key metrics languish in handwritten reports and lonely file cabinets, frustrates advocates and novices alike. Thus, few invest in these processes in the absence of a robust and functional information technology environment. In other words, users of Wicked Business Tools rely on Wicked Tech to maximize the value of these innovative new processes.

Armed with Wicked Tech, advocates of lean business processes in the construction industry have set forth to slay the dragons of inefficiency that plague the BUILT industry. Unfortunately, many of the culprits of inefficiency lie in silos beyond the reach of these lean tools. Lean business processes deployed horizontally by a single entity in a factory setting, or even corporate wide, tend to be more successful than lean processes deployed on construction projects where a myriad of disparate, disjointed and too often dysfunctional stakeholders view the effort with skepticism. Innovators armed with BIM and lean processes have now begun forming integrated teams capable of collaboratively delivering in an integrated environment. These integrated teams are now demanding new legal agreements to support their efforts.

New generation legal agreements, crafted, negotiated, and implemented in a collaborative manner by integrated teams, support and enable the intelligent and effective use of Wicked Tech and Wicked Business tools in an Integrated Project Delivery (IPD) environment.

Wicked Legal

The Wicked Tech train left the station long before the lawyers realized a tectonic shift was coming to the BUILT industry. Accordingly, innovative technology dominates the conversation while the legal framework required to deploy advanced BIM software solutions receives short shrift. In reality, resolution of wicked problems requires simultaneous leveraging of technology, legal structures, and new-generation business processes. Integrated teams that invest the time and energy required to hammer out new processes that enable use of these tools—Wicked Tech, Wicked Biz, and Wicked Legal—increase the efficiency with which those teams deliver a wide range of services.

Traditional legal agreements in the BUILT industry, usually negotiated between owners and providers of specific time-limited services, tend to compensate entities for delivery of a designated scope of work and most entities entering into such agreements complete their work in a silo, ignorant of the scope and nature of the work delivered by others on the same project. Wicked Legal Tools enable key stakeholders to tear down those silos, build bridges, collaborate on a cross-disciplinary basis, and deliver functional digital assets in every phase of a project.

Multiparty legal agreements between owners, contractors, and designers—including the ConsensusDOCS 300 Series, the

AIA C195 (Single Purpose Entity), the AIA C191 (Three Party Agreement) Sutter Health's Integrated Form of Agreement (IFOA), Collaborative Construction's IPD in 3D™ Agreement and its Strategic Alliance Agreement, Hanson Bridgett's IPD Agreement and other similar instruments—provide excellent starting points for integrated teams seeking to create an effective legal framework that supports and enables IPD, BIM, and lean business processes. BIM Addenda, Real Time Tracking Service Agreements, BIM Communication Protocols, BIM Implementation Plans, and dozens of other Wicked Legal Tools can be incorporated into multiparty agreements or modified and attached to traditional agreements.

Integrated teams that utilize integrated multiparty agreements enjoy greater success than the disjointed adversarial teams found on traditional projects. Collaborative creation integrated agreements that support and enable BIM-enabled teams capable of operating in an integrated lean business environment provides one of the best mechanisms available for successfully wielding Wicked Tech, Wicked Business, and Wicked Legal tools on a project.

Conclusion

Typical construction projects give rise to a series of Wicked Problems. Those problems manifest themselves throughout the lifecycle of the planning, design, construction, operation, and maintenance of a facility and any supporting infrastructure. Wicked Tools required to solve Wicked Problems exist, but few in the BUILT industry deploy those tools effectively. The combined use of Wicked Tech, characterized by BIM, the web, cloud-based computing and other information technology-related advances, Wicked Business, including Six Sigma, the Last Planner System and similar processes, and Wicked Legal agreements empowers integrated project teams to deliver services more efficiently.

The challenge of using the Wicked Tools effectively will be the topic of next month's BUILT – BIM to FM article. We will explore Wicked Solutions in that article, including enterprise-level software tools, collaborative workshops, and industry-wide initiatives.

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

Characteristics of a Wicked Problem

Evolving definitions.

The definition of a wicked problem evolves, triggering solutions that, in turn, change the definition of the problem.

Continuous solution cycle.

Because the definition of the problem continues to evolve, solutions emerge continuously, concluding when problem solvers run out of time, energy, money, or some other limiting resource.

Perfect solutions prove elusive.

Objective solutions elude wicked problem solvers with most ranging from best to worst or acceptable to unacceptable.

"One off" problems.

No two projects are alike and thus, no two wicked problems are the same.

One shot solutions.

Wicked problems feature one-shot solutions as every solution impacts the problem and everything the problem touches.

Creativity and judgment drive solutions.

Pursuit and implementation of wicked solutions depends on the creativity and judgment of the stakeholders.

[1] The Last Planner System™, developed by the Lean Construction Institute, is specifically tailored to the needs of the construction industry.

[2] Autodesk, Bentley, Archicad, Nemetschek, VICO, Tekla, Onuma, Inc., Primavera, Beck technologies, and EcoDomus are a few of the several dozen such software tools available on the market.

[3] Design Atlantic, the BIM Education Co-op, IPROBLUE, Virtual Building Logistics, MySmartPlans, PhiCubed, Summit BIM, PlanIT, BIM Elevations, and dozens of similar consulting firms offer a wide range of BIM consulting services and innovative insights into the intelligent and effective use of BIM software tools.

By: Tom Cipolla

Archviz Rock Star

An Interview with Victor Erthal

"AU is amazing. We're treated like rock stars here."

I recently had brunch with Victor Erthal at a restaurant called Lucky's Lounge, a local favorite here in Boston. It was a casual conversation about life and business, artistic inspiration, the creative process, and human nature. We touched on the future of archviz, new media, and the role that Autodesk University (AU) plays in developing tools and learning.

For the past five years, Victor Erthal has been a senior digital artist at Neoscape, www.neoscape.com. He has, all told, more than 10 years of architectural visualization experience. Born in Brazil, he graduated with a degree in architecture from the Rio De Janeiro Universidad Santa Ursula in 2000, and moved to the US in 2006. His rendering and animation career has encompassed a wide array of projects, from large-scale master plan films in Bahrain and Egypt, to residential promotions and luxury hotels, as well as animations for PBS's *Nova* series. He has collaborated with many high-profile clients, including the internationally acclaimed design firms Studio Daniel Libeskind, Callison, KPF, and Safdie Architects. Victor is also an instructor of Autodesk® 3ds Max® rendering and animation at the Boston Architectural College.

BishanTowers

Inspiration

Victor got seriously interested in 3D while earning his degree. "After school I interned for a healthcare design company called RAF," he explains. "Doing mostly CAD work, I got into 3D CAD and was soon the go-to guy in the office."

With impact studies of new projects being required, rendered images were essential to the approval process. It was not long before Victor got the chance to experiment with 3D Studio. Perhaps his first inspiration came much earlier, when watching *Tin Toy* in his teens. "I remember not having a clue of what exactly I was seeing, but it fascinated me." It had been a while since I had seen the film myself, but upon seeing it again I saw the appeal: all the cinematic elements of archviz are there—storytelling, animation, 3D characters and sets, lighting, cameras, and so on.

After graduation, Victor was hired to work at ARCHIGRAPH, a studio owned by his former professor. "There were just four of us when I started, and we grew to about 12 by the time I left," he says.

The Next Level

In early 2005 things began to slow in the market and it was time for Victor to consider new options. He collected his portfolio and made connections with production houses outside Brazil. While attending a reception sponsored by CG Architect in 2005, Victor met Lon Grohs of Neoscape. "I asked him if he'd take a look at my work. After looking through my book for a few minutes, Lon said, 'You're hired. No, really, I mean it'. And that was it."

Skylofts, Neoscape.

Lake Library

Victor Erthal

As senior digital artist at Neoscape, Victor took the next step in his career, and since then, he has collaborated on projects that focus on the vision and mission that have cemented Neoscape's reputation in the industry. "Someone joked that working here is like going to an Ivy League school," he says. Truth be told, there may be no better pedigree in archviz.

Last year Victor attended AU, representing Neoscape. "There is no doubt in my mind this was one of the most valuable events in my professional career so far," he says. "The number of knowledgeable speakers and the ability to learn first hand from both experts in the industry and from Autodesk itself makes this event worth every penny. For most of the week-long conference, I attended classes on various subjects ranging from quality control and color management to parametric modeling."

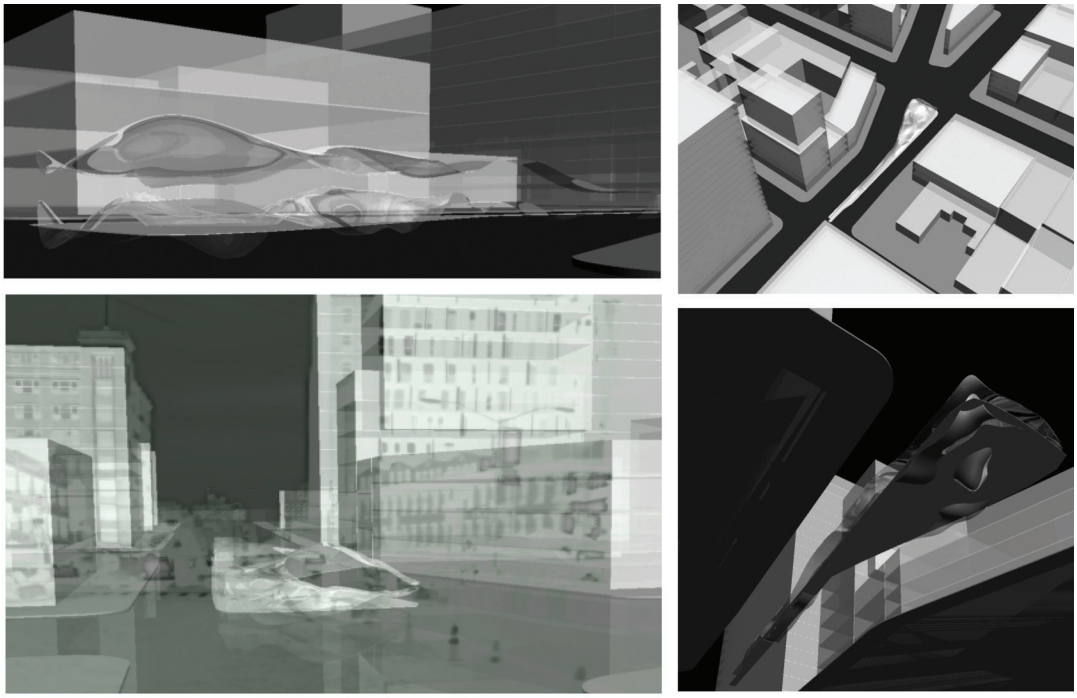
BuenoNetto Berrini Fachada Trifuga

These days there is a new crop of digital artists every year, armed with degrees and certificates and some truly amazing skills. Having trained colleagues and taught at the BAC, Victor is in an excellent position to gauge how the field of archviz is evolving. Personal success doesn't change, though. He says, "I tell my students the two most important ingredients to success are self-criticism and vanity. First you need to uncompromisingly assess your work and be sure you are not satisfied too easily. Make a list of what needs work, etc., and be methodical. You need to be vain about your talent, too; be confident that each new project will outshine the last. You don't want to hear someone ask, 'is this your best?' unless it actually is."

Looking Ahead

I asked Victor for his view of what lies ahead in the industry. "Essentially, it is becoming very hard to draw a line where design ends and visualization starts. From study images, daylight analysis, rapid prototyping, etc. it is becoming difficult to tell when our role in a project starts. Many in-house companies have had very competent viz teams working directly with the design team for years and coming up with solutions where visualization is a design tool rather than a final product display," he says.

"There are tons of new media devices and technologies that

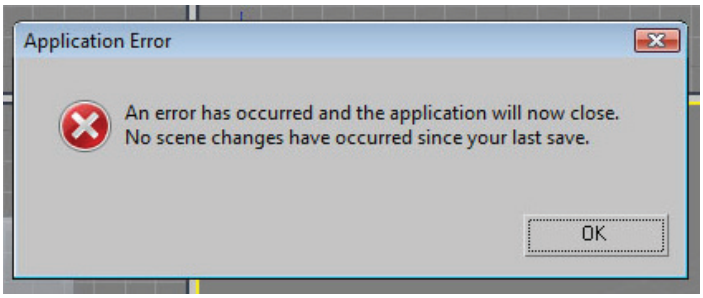


Augmented Reality X-Ray views

Berrini One in São Paulo, Brazil

require exploring," continues Victor. "The old formula of short movie and still images does not work as often as it used to, and we need to explore new frontiers of what is possible to integrate into our products. Using design visualization integrated with smart design tools and new media like iPads, e-book readers, augmented reality, real-time cloud computing, etc. will help us all push the envelope just like when we first thought about using visual effects to render something that was done in watercolor or airbrush."

And what lies ahead for Victor? He is moving forward once again. He is joining up with the Sao Paulo-based powerhouse Digital Light, http://www.digitallight.com.br/.



Max Crash...

"Change is very exciting," he says. "In one of my roles I will be an international liaison. There will be a lot of travel; in fact I leave for San Paulo on Friday. I will be helping develop improved ways of interacting with clients. To me, client management is a matter of establishing trust. I like to use the steak analogy: If you're in a restaurant and you order a steak medium-rare, you should trust the chef to do his job. If not, you'll keep going back to the kitchen to ask 'how it coming? Or, I want to change my order.' Every one becomes frustrated, but more importantly, the end result will suffer. It is best to cultivate confidence and trust because it allows you to do the best work possible."

A Final Word

Asked if he has a 3ds Max wish list, Victor replies, "The only thing I would like to see is improved stability. I've been a Max user since the beginning, and while other 3D packages have been rewritten from the ground up, Max has been 'added to' version after version. I'm not sure, but I think this is in the works."
You can contact Victor Erthal at victorerthal@gmail.com

Tom Cipolla is a digital artist specializing in architectural visualization. Born in New York, he trained as a sculptor and began working digitally in 2000. A seasoned Max user, he has trained and taught 3DS Max for years. He has written numerous articles and tutorials, and is currently a Content Manager for AUGIWorld. His studio, Onion3d, is a consulting and animation company located in South Boston, Massachusetts. Visit www.onion3d.com, and contact him at tm.cipolla@gmail.com.

By: Scott Moyse

The True Meaning of CAM in the Industry

2011 has been an exciting time for Autodesk® CAD users across many manufacturing industries. They have been releasing some pretty crazy stuff, most of which has been free. Watching the 123D series of software mature and expand at a massive rate of knots has been enthralling, some of the Autodesk Labs technology previews provide a window into the future of what may be on offer by Autodesk, and the recent 'Everything Changes' marketing push from Autodesk has also been creating quite a stir. Not to mention the growing array of severely cool mobile apps being published for both the Android and iOS operating systems. It's obvious Autodesk is focusing a great deal of its resources on real-time collaboration and rapid prototyping, all the while encouraging a new breed of software users in the maker community with 'plug & play' style applications such as 123D maker and 123D catch.

With the advent of some of these tools, you can now capture an image of an object with a camera, import it into CAD software, then either clean it up or modify it to suit your desires and prepare it ready for 3D printing. The best bit is it's all free. 3D printing certainly is cool and with huge leaps in 3D printing materials technology and cost, it has become feasible to use 3D printing to manufacture low-volume runs of actual parts and products instead of just one-off prototypes.

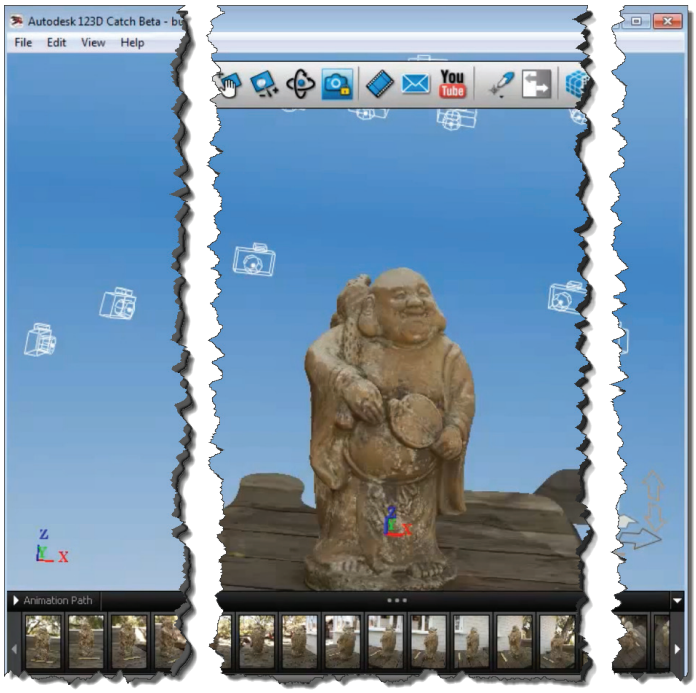


Figure 1: Autodesk 123D Catch Beta http://www.123dapp.com/catch

Setting the scene

What about the more traditional manufacturing industries? Some might say the ones who don't make

"toys" such as the hundreds of thousands of manufacturing companies around the world that use a vast array of CNC and manual machinery to produce wonderful products day in and day out. There is an obvious void in Autodesk's arsenal of software solutions when it comes to getting the Digital Prototype into production. This is interesting because I recently watched a video of Carl Bass talking about the Suites of software solutions Autodesk started offering this year. He was presenting from within the Autodesk Gallery and had the following to say.

"One of the interesting observations we had, when we looked at the kind of designs that were highlighted in the Gallery and is typical of the work our customers do around the world, is the range of software tools they need to use to accomplish their tasks. As the design complexity has gone up, as the demands on our customers to create better, more innovative products and bring them to market more rapidly, as we saw the wide range of tools our customers were using to accomplish their tasks, it inspired us to bring to market the Design & Creation Suites."

He continued:
"What we want to have is the ability for people to work with our suites and move their data effortlessly and seamlessly through our products, so they can more effectively get their design tasks done. So we carefully studied how our customers worked, what tools they needed to accomplish their job and the suites represent a combination of tools that we saw our customers using."

Carl said two things that caught my attention: *"..bring them to market more rapidly.."* and *" So we carefully studied how our customers worked, what tools they needed to accomplish their job."* Autodesk definitely has provided us tools over the years to achieve both of the points Carl states and the Suites certainly are awesome on so many levels. However, a massive and critical part of the job of designers, engineers, and drafters is to get the product into production as quickly as possible once the design itself has been finalized. It's in this area that Siemens has been focusing for the last 15 years, but Autodesk seems to have been neglecting it in favor of the more sexy and marketable features.

For this article, I have had the valuable opportunity to ask John Evans (from DesignandMotion.net) a number of questions. He has a broad spectrum of experience and knowledge, which allows him to offer up relatively unbiased responses. Therefore, here are a few of the questions I asked him and his responses:

Q: Do you think Autodesk is missing a trick by not making various forms of CNC machining prep become seamless from CAD to CAM? At the end of the day, actually making the stuff is equally as important as creating and verifying the design.

A: Good practices in Inventor to reduce the bottleneck are to get a feel for what a manufacturer can and can't do and aim for that. Keep geometry as simple as possible, with nominal radius sizes when reasonable. For example, if weight isn't a problem, tight fillets can be enlarged, requiring far fewer passes to accomplish. Material selection is also an issue. We can't grind aluminum quite the same as steel, and in either case, some alternate methods like pre-prepared shafts can take the place of milled structures if considered early in the design.

Q: Can you imagine any software tools that Autodesk could create to aid in the transfer of data from CAD to CAM? Or direct to CNC?

A: I think we need a couple of things in this arena. I would like to see the Granta Eco Materials advisor add strength to their list, so you can filter materials by minimum strength, and then by other factors such as price and 'eco-ness.' I think it could be introduced into a Manufacturability tool + Eco mat advisor combination—this would be sweet. Then if you went with bar stock aluminum, it would warn you the component is larger than standard stock or the material used has other cheaper alternatives in this alignment and strength configuration, etc. That would be a great project.

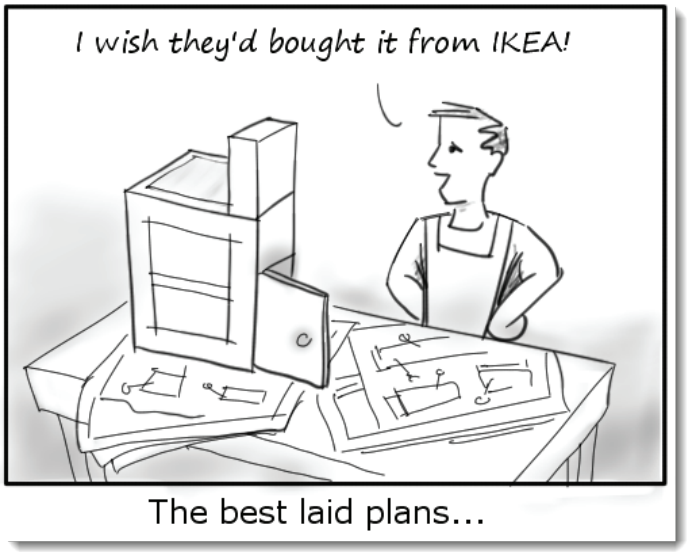


Figure 2: Image courtesy of Paul Munford www.cadsetterout.com.

To summarize, it appears John would like a feedback mechanism to provide information about what geometry is the easiest to manufacture. This would include a range of options so he can optimize his designs and receive some advice on which materials would suit the application and the manufacturing process intended for the part while achieving the Eco and sustainability goals required. I personally think this is a thoroughly reasonable thing to desire and expect from a digital prototyping and engineering software package.

Therefore, I'm going to put to you the suggestion that Autodesk could create some cool software tools to aid an array of manufacturers worldwide in their daily battle to get their designs seamlessly from CAD to CNC or production. Improve data reuse into manufacture, decrease the differences between the designed component and the manufactured version, and ultimately break down the 'Us and Them' culture between the design office and the workshop floor.

The Challenge

To start with I think Autodesk could do a lot more to allow Autodesk Inventor® to prepare its output 3D data in a more effective manner. The first thing they could do is provide the user with the option to define base planes for the part, which are independent from the WCS. These base planes serve to represent the work surfaces the parts will be fixed to during manufacture. The result will not only allow accurate analysis of the parts dimensions relative to those planes for the BOM and further manufacturability analysis, but also greatly improve the export quality of the data for CAM.

I had the good fortune to have an e-mail discussion with Bryan Dreibelbis from Siemens Americas Channel Enablement. As a result, I can tell you that defining a 'manufacturing' base plane is the first thing a designer is asked to do in Siemens CAD software (Solid Edge and others), before they create any model geometry or PMI data (Product and Manufacturing Information). This ingrained requirement is reinforced by a comment Bryan made.

"I believe that in today's Engineering environment, for engineering tools there is a stronger focus on process, workflows, and embedded intelligence. The ability to quickly identify and reuse data regardless of its source and to configure the data to a company's process."

In my opinion, this is also a view that Autodesk should be taking because, after all, Inventor is a key component of Autodesk's manufacturing division.

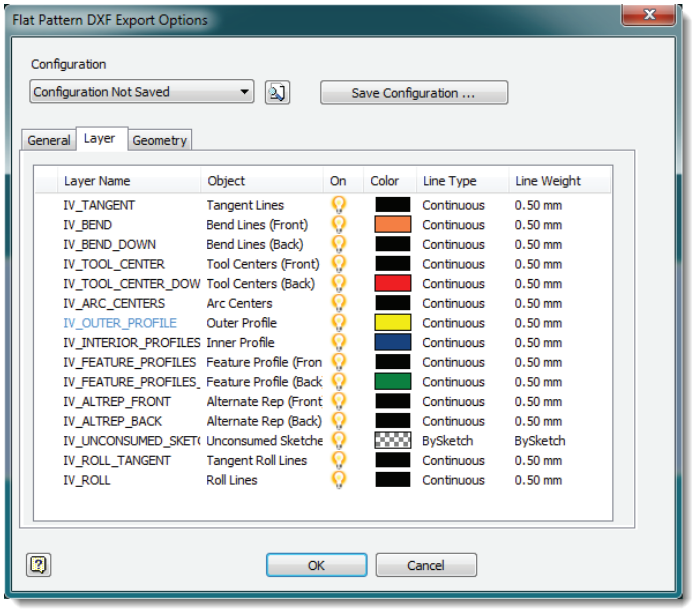


Figure 3: Inventor's DXF Export options.

Another example where Autodesk could improve the lives of staff that have to work with the data Inventor produces is in the sheet metal flat pattern output. In my opinion, It needs more customizable options. The flat pattern tool currently does a wonderful job of analyzing internal and external loops, along with visible features and hidden features. Nevertheless, it would be nice if you could get it to:

- include the feature name in the dxf layer names.
- analyze the depth of features and include that information in the dxf layer names.
- include an exportable flat pattern sketch with part numbers, etc., which could be etched onto the part.

This would allow many CAM packages to use the dxf layer names to apply tool paths automatically, straight from the Inventor data.

The knock on effect here would likely result in the flat pattern tool being used across multiple industries to generate their CNC cut files, even if their parts don't need flattening. As it stands, there are too many obstacles to do this when you can get the job done via other means, which have other benefits.

This leads nicely to the issue of getting the components dimensions into the BOM and parts list. Unless you have components that are designed parallel to the origin planes and axis, then Inventor's boundary extents information doesn't represent the overall size of the part. Using the example of a 4x4x4 cube modeled when its faces are 45 degrees from each of the origin planes, then Inventor's internal method of using a 3D boundary box returns a result that is a lot bigger than the stock required to make that part. It, in fact, returns an overall size of 5.66x6.83x6.83 (using the 4x4x4 example). In addition, if you happened to forget to turn off some work features then it further distorts the overall dimensions.

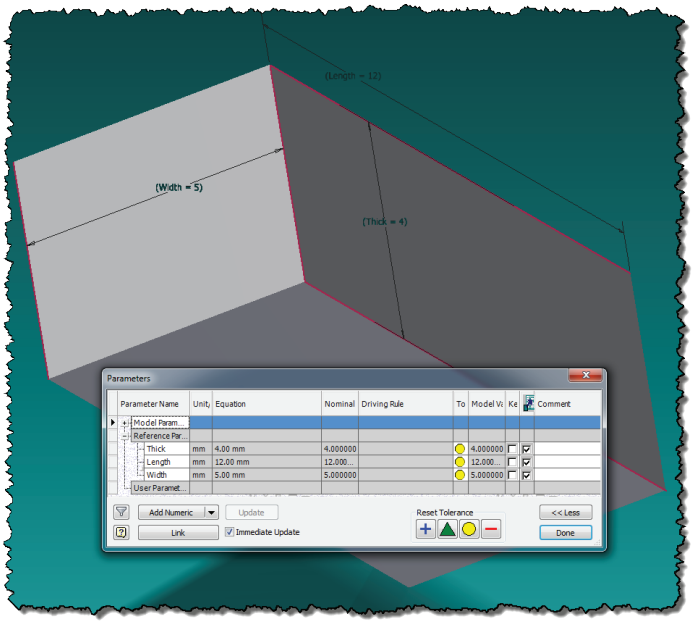


Figure 4: Creating Length, Width, and Thick custom iProperties.

In all reality, this isn't a practical way of obtaining this information. I would say just about every Inventor user on the planet is expected to created at least two reference sketches and attach driven dimensions, name them, and export them to create custom iProperties—just so you can create an accurate BOM for your company's ERP system and a parts list for your drawings.

That is elementary stuff. I understand different industries may want to measure the parts in different ways and with complex

parts it's far from clear cut. This is where defining a 'manufacturing' base plane that is separate from the origin information would provide a lot more accuracy and allow a reasonable degree of flexibility.

When Autodesk revealed the custom UCS tool a few releases back I got very excited, hoping it would enable this kind of workflow. My hopes were premature and I was left disappointed. The only tool in Inventor that will provide accurate overall dimensions most of the time is the sheet metal flat pattern; however, this doesn't work when you use multibody modeling techniques since the thickness has already been defined. Linking the bodies' thickness parameter from the source file through to the sheet metal parameters results in that workflow falling into the "too hard" basket.

When you think about it, it's incredible how far accurate Length, Width, and Thickness (LWT) information can take you. If Autodesk made this a really easy or even automated task to carry out then we would be able to focus on more important tasks, such as using tools which help the designer/engineer to assess the manufacturability of the part they are designing. LWT has a direct impact on which machines will be able to manufacture it, if the part needs to be sub-contracted out to be made, whether or not there is stock available as standard in that size and grade, and if it will require any specific processes to be carried out or treatments applied.

We don't use it in my industry, but I'm well aware that decent GD&T support is lacking in Inventor. Once again this is related to LWT. It's more than feasible with the current system for an engineer to specify two conflicting tolerances between two parts, which would result in them interfering with each other to the point where they won't even fit together. It would be embarrassing having all these amazing simulation and analysis tools at your disposal, but then manufacturing rework is caused due to a lack of GD&T analysis or ingrained intelligence upon application.

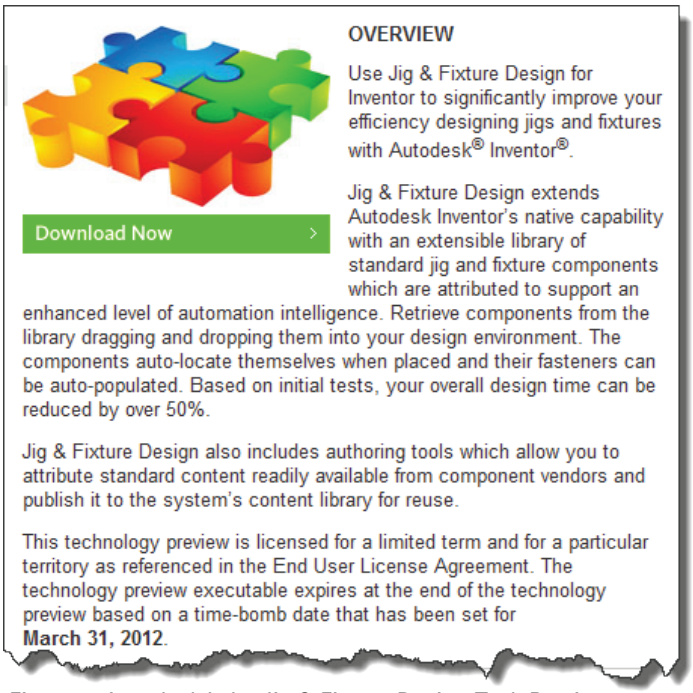


Figure 5: Autodesk Labs Jig & Fixture Design Tech Preview.

Earlier this year Autodesk Labs released the Jig & Fixture Design technology preview. It's awesome… for those who use those kinds of fixtures and fittings. However, I have to applaud them for including the ability to build your own assets—it's exactly the kind of functionality that's needed with the other design accelerators. But here's the thing, most companies will want to use standard jigs over and over again simply because of the time it takes to set them up. This would also be true in design. Wouldn't it be great if defining a manufacturing base plane also tied it into a predefined jig and fixture type? I think so, since the designer/engineer would be immediately considering how to manufacture this thing they are designing. Of course there will be times when you just need to create custom jigs and fixtures and that's to be expected.

I really hope Autodesk Labs understands the limitations this tech preview has and continues to push it to the incredible heights of which it is capable.

CAD to CAM

I thought I should include Wikipedia's definition of CAM to start off this section.

Computer-aided manufacturing (CAM) is the use of computer software to control machine tools and related machinery in the manufacturing of work pieces. This is not the only definition for CAM, but it is the most common. CAM may also refer to the use of a computer to assist in all operations of a manufacturing plant, including planning, management, transportation and storage. Its primary purpose is to create a faster production process and components and tooling with more precise dimensions and material consistency, which in some cases, uses only the required amount of raw material (thus minimizing waste), while simultaneously reducing energy consumption.

CAM is a subsequent computer-aided process after computer-aided design (CAD) and sometimes computer-aided engineering (CAE), as the model generated in CAD and verified in CAE can be input into CAM software, which then controls the machine too.

I have highlighted two sections of that definition which I feel are pertinent. CAM is more often than not referred to as Computer-Aided Machining, because of its use in the name of the software

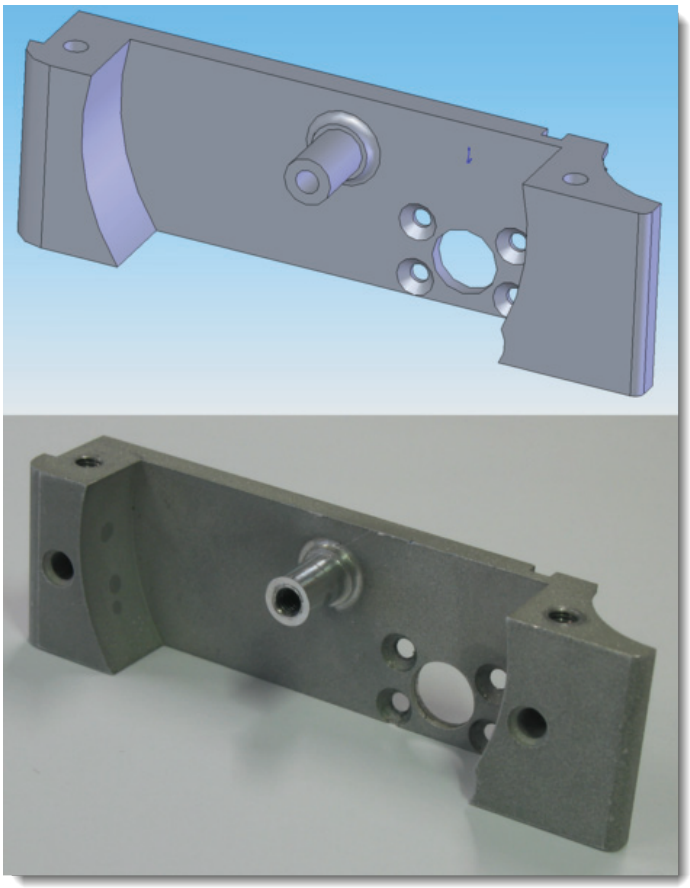


Figure 6: CAD/CAM part vs. actual part.

used to program CNC machines. In fact, it stands for Computer-Aided Manufacturing, the first highlighted section explains its much broader definition, which in a way is more important in the grand scheme of things and yet there is very little software on the market to specifically tackle the issue during design.

Which brings me to the second section I highlighted. Traditionally CAE has been carried out as a check at the end of the design process prior to giving it the green light. In the past 24 months, Autodesk has commendably been changing this and with the use of Cloud technology I'm sure it will be a success. That is, CAE is now quite firmly becoming part of the conceptual/pre-design stage via iterative optimization. I hope it's going to be CAM's turn soon—how a part is going to be manufactured and how it is going to move through that process in the factory should be just as much part of design process as simulating how it's going to perform under load in the field.

On that note, I asked John Evans if in his experience CAM has always been a separate department from the CAD guys. He answered, *"Yes, CAM is a separate world. With the exception of EdgeCAM perhaps, CAM is not integrated into CAD and design. This has never presented too much of a problem because of one factor—CAM guys have to think in terms of what a machine can do, and tell the machine how to behave. Having separate software, or at least separation from a CAD platform, is the norm."*

John's view is true and certainly representative of what is going on in the workplace; however, I would like to see a world where all designers and engineers understood or were helped to understand these CAM and manufacturing processes by the tools they are using for design. This will ultimately challenge manufacturing conventions and lead to better, cheaper, faster, and more easily manufactured products.

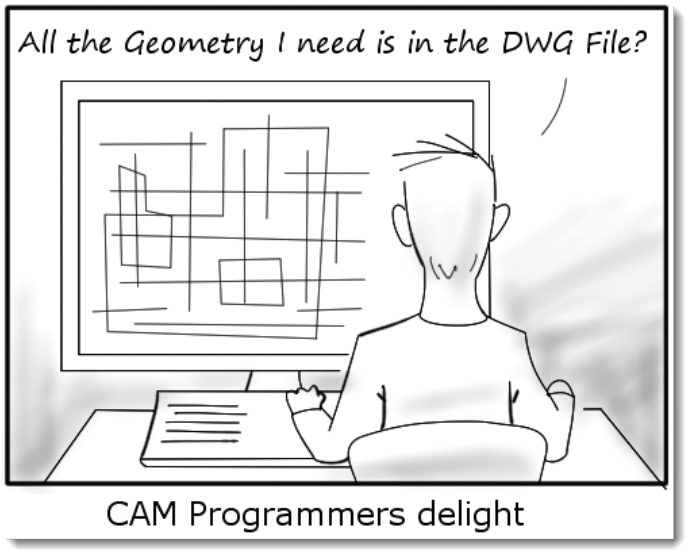


Figure 7: Image courtesy of Paul Munford www.cadsetterout.com.

One of the stumbling blocks is that the CNC industry seriously lacks standardization. Each CNC manufacturer has its own interpretation of what is best; ISO CNC code isn't even standardized. There are some guidelines, but they aren't enforced, plus the ISO code standard has a tone of open standard to allow for variation in hardware and machine configuration. This makes it very difficult for software houses like Autodesk to do anything to help smooth out the flow of data from CAD to CNC. Although off topic, a great example of this problem is Autodesk's stance on OpenGL versus Direct X. The overhead required to support the annual certification of their applications on as many graphics cards as possible was a massive problem and they are still stuck with it in some sectors of their organization. What this shows is if they can use a standardized and benchmarked system then they will, even if it means taking a slight performance hit.

So this would be a tricky situation for Autodesk. CAM is a difficult thing to nail. For a start, the CAM industry itself can't get it right and largely seems to be stuck in a rut. Many packages insist on extracting 2D geometry from a 3D solid, so it can apply 3-axis tool paths. Eventually those packages usually end up using the solid geometry for 3D surfacing toolpaths, but they demand a series of wasteful steps to define 2D geometry most of the time. This kind of approach is archaic.

Siemens NX CAM doesn't require the user to extract 2D geometry from the 3D solid, but does provide that functionality to define boundaries or if the user wants to machine 2D geometry. Misler Topsolid also just gets on with it and applies tool paths

to the faces of the Solid CAD model straight out of its CAD environment. I have seen that software do things others can only dream of; honestly, every time I look into it again, I loathe what Autodesk put us through with Inventor.

The point is it's a very volatile environment for Autodesk to get into. Doing so would require a great deal of risk by attempting to revolutionize the way CAD to CAM is handled and perceived. The reverse of that is—if anyone can do it, then Autodesk can.

In my opinion, unless Autodesk buys a company such as Planit, MasterCAM, InventorCAM, or any of the other traditional CAM packages, then it should steer clear of this area and instead focus on providing all the tools necessary to ease the CAM programming pain. CAM software developers will then need to tap into those.

Summary of Future

To enable computer-aided manufacturing to commence during the design phase within the design software itself, the top five suggestions I have for the Inventor developers to implement, in no particular order, are:

- Increasing customization of the Sheet Metal Export pattern tool, along with support for compound surface flat patterning and additional sketch export.
- Manufacturability and Eco Analysis at the part and assembly level.
- LWT—define a manufacturing base plane for a part, allow comparison of its size against a customizable but templated database of known stock sizes and process limitations.
- GD&T Active Tolerance checking and verification.
- Increasing PMI via the use of 3D annotation, which can be reused seamlessly within the drawing environment and made accessible for third parties.

Conclusion

When I asked Bryan Dreibelbis which part of the Inventor package he was jealous of and wished was part of Siemens CAD software, he replied:

"Unfortunately I am not very current on Inventor's marketplace. I do not see very much of it in the Manufacturing/CAM area. Is Inventor being sold as an integrated Design/Engineering/Mfg solution?"

He then clarified:
"For me a manufacturing engineering system is focused on CAD>CAM quality and manufacturing process all interfaced and as associative as possible."

I agree entirely with Bryan's definition of a manufacturing engineering solution. Autodesk peddles Inventor and Vault as digital prototyping and manufacturing tools and yet they are crucially incomplete in key manufacturing areas. I personally believe that until Autodesk rectifies the situation, Inventor will continue to be in the shadow of the likes of Siemens and Dassault Systèmes when it comes to providing holistic manufacturing design solutions.

It's not all doom and gloom, though. Bryan also said the following about PMI when I asked if he saw PMI as the largest advantage Siemens CAD software had over Inventor:

"I don't believe we see PMI as a competitive advantage to Inventor. I believe we probably think all CAD vendors have PMI at some level."

He is correct—Inventor does have iProperties. These can be customized in a number of ways and then leveraged by Vault, iLogic, VBA, and third-party applications. All of these options mean you can generate a lot of information about your parts for manufacturing and your company's ERP system.

In addition, I know of a couple of packages that are heading in the right direction, Granta Eco Materials Advisor and DMSI's Validus software.

The Eco Materials Advisor in its basic form ships with all versions of Inventor, but to get the full database and tool set you need to pay for the upgrade, which at this stage in its early development is fair enough. However, I would like to see Autodesk fully integrate this technology into Inventor in the not-too-distant future. To reiterate what John Evans said earlier in this article:

Figure 8: Granta ECO Materials Advisor Dashboard.

"I would like to see the Granta Eco Materials advisor add strength to their list, so that you can filter materials by minimum strength, and then by other factors such as price and 'eco-ness.' I think it could be introduced into a Manufacturability tool + Eco mat advisor combination—this would be sweet. Then if you went with bar stock aluminum, it would warn you the component is larger than standard stock or the material used has other cheaper alternatives in this alignment and strength configuration, etc."

You can read more about it in its current guise here: http://inventor.grantadesign.com/e2/index.asp and of course on Design&Motion.net.

It's DMSI's Validus 2.0 software that really has me excited. Al Dean over at Develop3d.com has written a great article taking a first look at the new version, so I won't go into too much detail

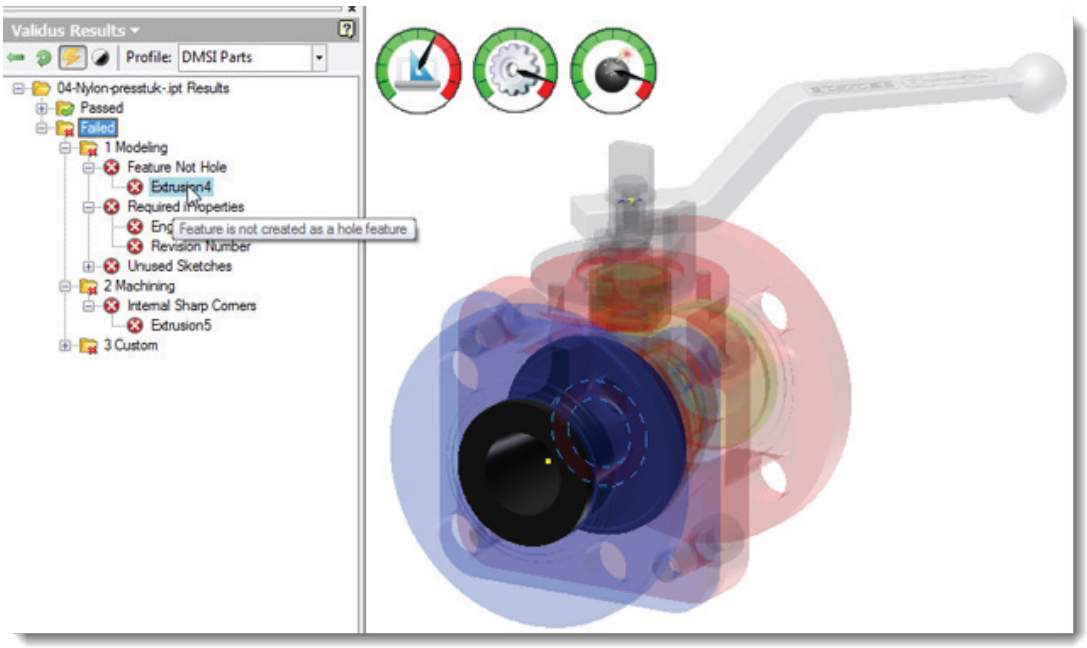


Figure 9: DMSI Validus 2.0 Inventor add-in.

since I haven't been able to put it through its paces yet. Nevertheless, it really is a great start, covering some of what I have described in this article. It is still in the early days, though, and personally, I think they should steer away from some of the iProperty checks since Autodesk Vault and the extremely good value iPropWiz can do a lot of that stuff already. They need to focus more on the manufacturability of the 3D geometry and then pass on process information to ERP systems. I love the idea of their profiles, since this will allow support for different manufacturing plants or maintaining agreed standards with subcontractors.

Overall there is hope, but I am looking forward to the year when Autodesk openly starts supporting some of these initiatives and, of course, I would be happy to offer my services to help that along. It may be that Autodesk Nexus 360 is the first step down this essential path for Autodesk. Fingers crossed.

I would like to take this opportunity to thank Paul Munford from CadSetterout.com for his great contribution to this article with his cracking pictures. Also thanks to John Evans for answering a whole host of questions, most of which turned out to be irrelevant, but were still valuable in the form of a great discussion.

Author's Note

Many sources were interviewed during the course of writing this article. Key Autodesk program managers were unavailable until after this article was written. Their comments were found to be quite relevant and are included here.

Pete Lord and John Callen, product managers for various Autodesk manufacturing features in Autodesk Inventor, met with me at Autodesk University and afterward to discuss the nature of PMI in Inventor designs. They noted that substantial efforts have been made throughout the development cycles of Autodesk Inventor to gauge the needs of their customers. PMI has been a recurring topic at Autodesk; however, customers often indicated that they were still evaluating the use of PMI alongside traditional documentation tools.

Recently, the Department of Defense (DOD) has begun a campaign to encourage (force) contractors to include this technology in their submittals. This has prompted Autodesk to jump to action on behalf of their customers and begin working with the DOD to ensure that Inventor models include every aspect of the DOD requirements. Lord and Callen stated that this effort is already in progress. Hopefully, this will include PMI metadata embedded in features as well as exportable through the newly adopted Step file protocol.

Lord and Callen revisited a year-old conversation with me about the Inventor 3D Annotation preview. This preview allows users to annotate information directly to features in the Inventor part file such as datums, dimensions, and tolerances. While this adaptation of PMI may not be exactly what the industry needs, Autodesk wants to remind users that this is the primary feedback channel that they are eagerly watching for customer needs and comments.

I met with Shaan Hurley and Scott Sheppard of Autodesk Labs recently and during our discussions, the topic of how the feedback channel works with Labs came up. They noted that they scour the web daily for any feedback related to the Labs offerings. Every single comment and email is read by them. Autodesk is very serious about the Labs previews, and uses this feedback as a gauge of customer needs. If you want more manufacturability features included in new Autodesk engineering software, there has never been a better time or place to do that than with the 3D Annotation preview.

Scott Moyse is the Design Manager for SMI Group, a Super Yacht Interiors company in New Zealand. His background is in Motorsport Engineering & CNC programming. Scott has been using various Autodesk software for 9 years, most recently he has been implementing Vault Pro. He can be reached using Twitter @scottmoyse & scott_moyse1@hotmail.com

Thank You!

Listed on this page are all 2011 authors from *HotNews* and *AUGIWorld*. The AUGI Board of Directors and AUGI members in general very much appreciate their contributions to the growth and success of AUGI publications. Without their help we would not have content to publish! The editors of *AUGIWorld* and *HotNews* sincerely wish everyone a wonderful holiday season and a happy new year! See you in 2012!

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Scott Moyse
Paul Munford
David Munson
Dario Passariello
Melanie Perry
Phil Pleiss
Beth Powell
Stephen Preston
David Reynor
Phil Russo
Frank Ryan
James L. Salmon
Damian Serrano
Marcello Sgambelluri
Todd Shackelford
Elizabeth Shulock
Richard Sincovec
Michael N. Smith
Robert (Bob) Smith
Juan F. Soto
Walt Sparling
Bryan Tanner
Bryan Thompson
Tench Tilghman
William Troeak
Mitchell Voss
Sean Woods
Matt Worland
Darren Young
Jay Zallan

Been to the Library?

If you've visited www.AUGI.com recently, then you've seen a highly visible improvement in AUGI's member interface. But one of the most exciting features is still flying under the radar and that is the Library. The Library is the home for articles and whitepapers that the membership contribute to the organization. There is a tremendous amount of material generated by members and until now that content 'shelf life' was pretty short. Since magazines come out monthly, an article's time in the spotlight is brief. Well, no longer! As issues of *AUGIWorld*, *AUGI | AEC EDGE* are replaced by new ones, the staff at AUGI will be posting article content on the website in HTML. The magazine PDFs will stay, of course. Consider the AUGI Library a new area to read some great content. Finding articles from past issues is a breeze, because searching and categorization can now be applied to these articles. In addition, the Library is the real home for *AUGI HotNews*, an email-based monthly publication.

Are you ready to write?

AUGI, through the contributions of members, produces monthly magazines such as *AUGIWorld*. Well the articles in these magazines don't grow on trees! The content comes from members willing to contribute. If you are an AUGI member, you probably use an Autodesk product. Do you know your product pretty well? Have you ever sat down with someone else to explain how Paper Space works, or how to explode polylines, or customize the CUI? These messages you share casually with others are the same messages that others outside of your area need to hear. Just imagine… even though you have been using AutoCAD since R9, today, somewhere in the world, someone started using AutoCAD for the first time. And that expert level change you made to your CUI to work better with your PGP today? Tomorrow someone else will begin that exercise as well and you could save them some time with your insight. So, get out there and join the fun – contribute to your magazines and your fellow members. Share your knowledge and expertise with beginners and advanced users alike. People are ready to hear what you have to say. For more details contact david.harrington@augi.com