



Diamond Sponsors



# AUGIWorld

The Official Publication of Autodesk User Group International

September 2015

## 14th Annual AUGI Salary Survey

### *Also in This Issue*

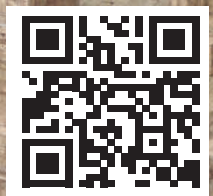
- Process Evolution in Revit MEP
- 3ds Max: Bringing Characters to Life
- Instant-Impact Tips in AutoCAD Architecture





# PROJECT SOANE

A worldwide BIM crowdsourcing effort to virtually reconstruct Sir John Soane's treasured Bank of England.



projectsoane.com  
#projectsoane

By courtesy of the Trustees of Sir John Soane's Museum





# contents

## product focus



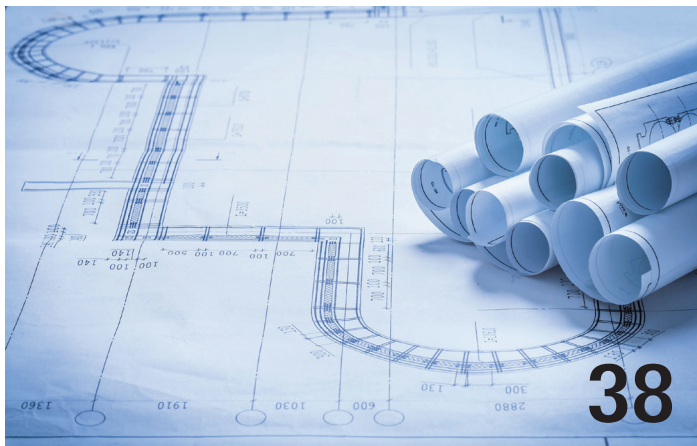
**10 AutoCAD** A Trio of Dimensioning Tips

**22 AutoCAD Architecture**  
Instant-Impact Tips for ACA

**26 AutoCAD MAP** Harnessing the Versatility  
of AutoCAD Map 3D

**30 Revit MEP** Process Evolution

**34 Revit Architecture**  
An Interview with Daniel McFarland

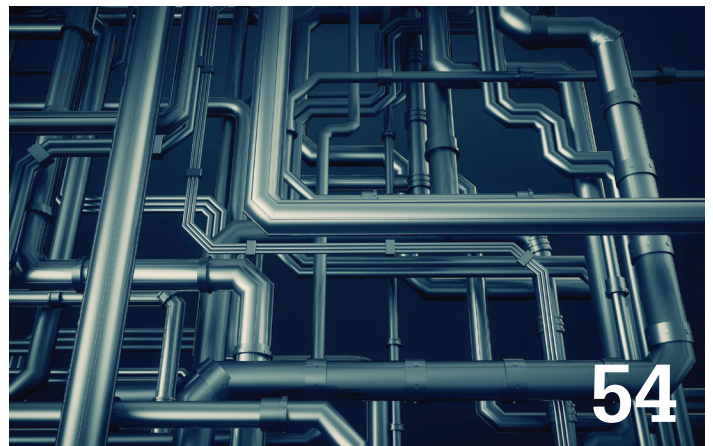


**38 Revit Structure**  
The Rise of the Structural Modeler

**40 AutoCAD Civil 3D** LiDar Scanning:  
Using a ReCap Workflow within Civil 3D

**46 3ds Max** Bringing Characters to Life

**50 Inventor**  
My Top Five Tips for Inventor Tube & Pipe



## columns

- 4 Letter from the President**
- 6 CAD Manager: Testing 1 – 2 – 3**
- 8 Tech Insights**

- 12 Special Feature:**  
**14th Annual AUGI Salary Survey**
- 54 Inside Track**



# Letter from the President



## IS IT CONFERENCE SEASON?

I am writing this letter only a few days after the conclusion of the Revit Technology Conference for North America, held this year just outside of Washington, DC. The event was yet another success\*. For those of you who might not know about RTC, the conference is a three-day event that focuses on Revit, BIM technology, and collaboration. AUGI is a proud sponsor of RTC.

The event is intentionally kept at a relatively small size because the committee firmly believes that the true value of the event is in the networking that occurs between that classes and into the evening—very, very late into the evening!

A perfect example of the sort of networking that can occur is something that happened to me at this last event. Right after one session a friend of mine was talking to me in the hallway and had mentioned that she had a conversation with two gentlemen about the conference. She did not get their names but mentioned that they both had British accents. Another session was starting so we went our separate ways. At lunch, which was right after that session, I got my food, found a table with an opening, and starting talking with the three other folks there. Imagine my surprise when the two men at the table happened to have British accents! Yes, they were the very same gentlemen with which my friend had conversed earlier. In another coincidence, one of them had attended the same session I had just prior to lunch. So I had the chance to not only discuss the conference in general with them, effectively continuing their discussion with my friend, but to also discuss the stimulating session we had just attended.

This kind of networking is what makes RTC such a great event to attend.

RTC sold out this year with quite a bit of time left before the event so registration was extended to allow 600 total folks to attend. This was a bit of an experiment to see if the size of the event was close to the “maximum” that the committee felt would still allow the sort of networking that is the priority. We are happy that this larger size still met the goal, but it is doubtful that it will be allowed to grow larger. This means that if you want to attend this event, or any of the other RTC events, you should register early.

Speaking of registration...

Autodesk University, which AUGI is also proud to sponsor, is rapidly approaching. Several months ago I wrote about the AUGI registration code (AUGITRK) for AU. You should have seen several reminders about this code in emails and on AUGI's website by now. Have you used this code when registering for AU?

Using the AUGI code, AUGITRK, benefits both you and AUGI, so please remember to use it when registering.

I hope to see you at AU, which will be here before we know it!

R. Robert Bell  
AUGI President

*\*Disclaimer: I serve on the committee for RTC North America.*

Autodesk, AutoCAD, Autodesk Architectural Desktop, Autodesk Revit, Autodesk Building Systems, Autodesk Civil Design, Autodesk Inventor and DWF are either registered trademarks or trademarks of Autodesk, Inc. in the U.S.A. and/or in certain other countries. All other brand names, product names, or trademarks belong to their respective holders.

## AUGIWorld

[www.augiworld.com](http://www.augiworld.com)

### Editors

#### Editor-in-Chief

David Harrington - [david.harrington@augi.com](mailto:david.harrington@augi.com)

#### Copy Editor

Marilyn Law - [marilyn.law@augi.com](mailto:marilyn.law@augi.com)

#### Layout Editor

Debby Gwaltney - [debby.gwaltney@augi.com](mailto:debby.gwaltney@augi.com)

### Content Managers

3ds Max - Brian Chapman  
AutoCAD - Walt Sparling  
AutoCAD Architecture - Melinda Heavrin  
AutoCAD Civil 3D - Shawn Herring  
AutoCAD MEP - William Campbell  
BIM Construction - Kenny Eastman  
CAD Manager - Mark Kiker  
Inside Track - Brian Andresen  
Inventor - John Evans  
Revit Architecture - Jay Zallan  
Revit MEP - Todd Shackelford  
Revit Structure - Kimberly Fuhrman

### Advertising / Reprint Sales

Kevin Merritt - [salesmanager@augi.com](mailto:salesmanager@augi.com)

### AUGI Management

#### President

R. Robert Bell

#### Vice Presidents

Scott Wilcox  
Kate Morrical

#### Treasurer

Walt Sparling

#### Secretary

Melanie Perry

#### Management

Kevin Merritt - Director of Communications  
July Ratley - Director of Finance  
David Harrington - Director of Operations

### AUGI Board of Directors

R. Robert Bell	Kate Morrical
Shaun Bryant	Melanie Perry
Chris Lindner	Walt Sparling
Curt Moreno	Scott Wilcox

### Publication Information

AUGIWorld magazine is a benefit of specific AUGI membership plans. Direct magazine subscriptions are not available. Please visit <http://www.augi.com/account/register> to join or upgrade your membership to receive AUGIWorld magazine in print. To manage your AUGI membership and address, please visit <http://www.augi.com/account>. For all other magazine inquiries please contact [augiworld@augi.com](mailto:augiworld@augi.com)

### Published by:

AUGIWorld is published by Autodesk User Group International, Inc. AUGI makes no warranty for the use of its products and assumes no responsibility for any errors which may appear in this publication nor does it make a commitment to update the information contained herein.

AUGIWorld is Copyright ©2015 AUGI. No information in this magazine may be reproduced without expressed written permission from AUGI.

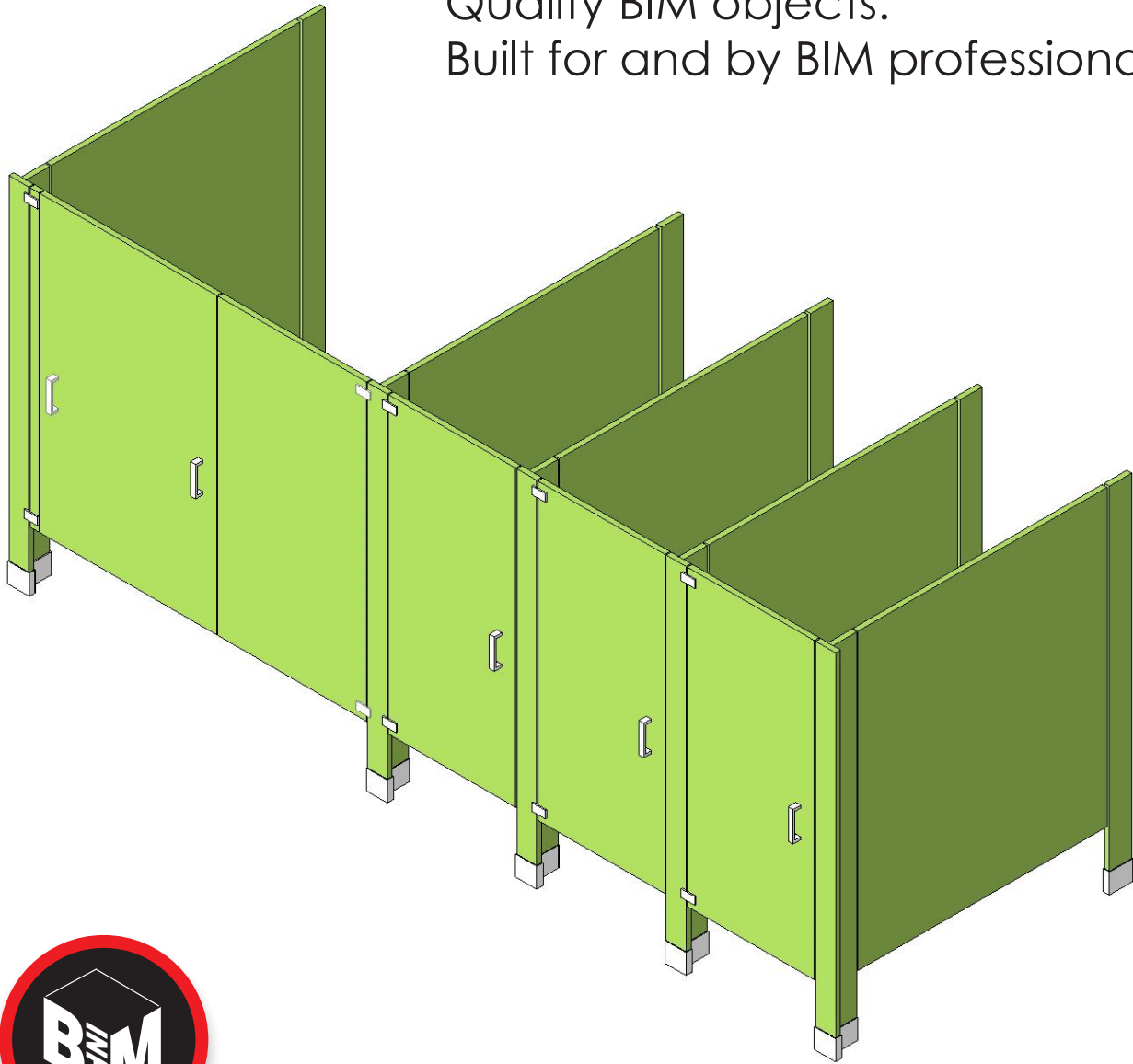
All registered trademarks and trademarks included in this magazine are held by their respective companies. Every attempt was made to include all trademarks and registered trademarks where indicated by their companies.

AUGIWorld (San Francisco, Calif.)  
ISSN 2163-7547





Quality BIM objects.  
Built for and by BIM professionals.



***“We put the info in BIM”***

This object, plus thousands more, have all been developed by ARCAT BIM experts, so you can rely on them as you do for ARCAT specs and SpecWizards. These 3D objects are packed with all the critical product data you need, and are free of charge like all of ARCAT services!

Formats: RFA- Revit Object | RVT- Revit System | DWG and DXF - AutoCAD, Sketchup - all cad software | DGN- Bentley

**No fees.**  
**No subscriptions.**  
**No registration required!!!**







Moving an idea to reality takes effort and planning. It also takes a bit of testing. What may start as a flash of insight may be just a flash in the pan unless it is nurtured and progressed along.

Here are the four main steps I follow to take an idea from infancy to maturity, or abandon it along the way. In the August issue, we talked about step one—the Idea. We will now move into the action steps two through four. They include the following: Proof of concept, Pilot, Proliferation. They really are a formal way to test, test, and test again. Ideas that survive the testing will be empowering to your team.

We discussed the Idea phase last time, so we can move into the next step quickly. Taking the output of the idea refinement process and selecting a really good candidate, we now want to find out if the idea has any merit in reality.

## STEP TWO - PROOF OF CONCEPT

In this step, you take the idea and see if you can make it work at least once in the real world. It is the step that proves the achievability of the idea. Let's say you have a desire to see if you can eliminate the end user need for hunting down and inserting blocks from a



standard library. Many users have no idea where the library of parts is located, they do not remember what was used in prior projects, and they often redraw items that are readily available. This may be a programming effort that includes creating LISP routines, menus updates, CUI files, and more. Before you start down the path too far you have to outline and repeat the steps needed to pull and insert the block. Can I pull blocks from a library? Can I set the proper insertion parameters? Can it be programmed? Can it be automated? Will it change the workflow? How will everyone embrace this new process?

Write down the steps you think it will take to do it manually and then review them to see if any or all can be replaced by some customization work. Most on the list may be readily defined and easy to create. Others may take a little effort to “prove” that it can be done. This is when you prove it. Create little routines and menu bits that automate the process. Once you think you have the incremental steps down, then move to the entire process. Program it and have others try it out. Listen to their concerns and refinement ideas and put them in place.

Enlist a few users to help out. They may be the ones that helped nurture the idea or some that have no clue what you are trying to achieve. By running it past a small team, you get a quick feedback loop going and can adjust quickly to bumps and stalls along the road.

You may find that your idea is not achievable and the proving grounds have uncovered this. While I have chosen a fairly straightforward idea of pulling and inserting blocks, many of your ideas may be ahead of their time and not achievable yet. Or there may be troubles trying to adjust the current data formats, or versions, or naming or.... The things that might derail an idea can be fleshed out in the proof of concept phase with a smaller team and a little measured effort. The end of this step is triggered by a working model or a failed attempt.

The output of this step is a viable process that achieves the results desired. It may be clunky, but it works. It is not fully ready for everyone to start using, but you have proven that the goal is achievable. The other portion of a proof of concept process is buy-in from a larger group. My example here is not really time or money intensive, but some of your efforts may take a good amount of time and budget. By having a proving process, you can go to management with confidence that the idea is achievable and within reach with a little time and money.

This will lead us into the next step with the following questions still to be contemplated. What are people doing now? Will this change the workflow? How will everyone embrace this new process? How can we encourage use?

## STEP THREE – PILOT

The next step is to pilot the concept to a larger group of users. This may be a project team or an office location. It should be selected from

staff that are near you so you can monitor their success or troubles. The pilot staff should know that they are involved in a process. The staff should include not only those who are adventurous in testing new tools, but also some who may resist change. A wide variety of users that reflects your overall staff is what you are looking for—not just the cream of the crop who love every new trick.

Some confuse Pilot with Proof of Concept. They differ widely. While the proof of concept phase does involve a portion of piloting, the arena of the conceptual phase is too small to get a good enough shake down run at the idea. Will it withstand more scrutiny? Can it do what is needed by more users? Is it easy enough to understand and use? Proof of concept usually has such a tight feedback loop that everyone knows what the goal is and what the nuances are in getting the tool to work. Piloting takes us into the unknown.

You pilot a project by taking it to a wider, but still controlled, group. You want to observe the use of a tool or process and see what people do with it. Does it need refinement? Is it too limited in scope and not embracing the needs of a wider group? Does anyone care about using it? Is there any excitement in its unveiling?

The pilot step usually lasts about a week or two. Give it enough time for people to embrace or reject the idea. Give them time for feedback. Give yourself time to make adjustments. The signal that the pilot is done is enthusiasm to use the tool more or a casting aside of it. The pilot fleshes out the viability of this effort gaining ground and becoming the new standard.

The output of the pilot is a stable tool or process that is embraced by the majority of users in the group. The sentiment should be a willingness to embrace and not reject the change. Excitement would be great, but sometimes just a lack of negativity is a positive.

Next time we will look at the final step—Proliferation. How to get the entire firm to embrace the change.



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



*by Robert Green*

# 15" Mobile CAD Power Gets Thin

➡ **C**onventional wisdom says that mobile CAD users have a choice – either use a bulky mobile workstation and get great performance (plus a rut in their shoulder from carrying it through airports) or use a lightweight machine and sacrifice performance.

Well the rules of the game are changing with a new class of HP mobile workstations that deliver robust specs, light weights, and sleek looks while focusing on 2D/3D CAD performance.

For the travelling CAD professional these 15" form factor machines deliver the power to do real work in the field yet look perfectly at home in an executive conference room for design reviews. In this edition of Tech Insights we'll look at two such options.

## HP ZBOOK 15U ULTRABOOK™ MOBILE WORKSTATION

To qualify as an Ultrabook™ the HP ZBook 15u has to meet some rigid criteria set out by Intel, including: being 21mm (or less) thick, having a solid state disk (SSD) boot device, using a low voltage/low power CPU, having USB 3.0 I/O ports, and providing a battery life of up to 5 hours. Meeting these criteria for a general purpose machine is one thing but delivering workstation class CPU and graphics performance for CAD in a 4.23 pound Ultrabook™ form factor is quite another<sup>14</sup>. Here's quick rundown of the 15u's internals:

**CPU:** To achieve CPU compliance an Intel® Core™ i5 or i7 Dual Core processor at speeds up to 2.6 GHz (3.2 Turbo) is deployed. For general purpose CAD usage - where multi-threading is not a priority - the performance of these processors yields surprisingly high performance due to the high clock rates<sup>1</sup>.

**Memory (RAM):** System memory is installed in two DDR3L

SODIMM slots supporting up to 16 GB RAM – an adequate amount for all but the largest CAD projects.

**Solid State Disk (SSD):** To meet the SSD boot device requirement a 256 or 512 GB2 PCIe HP Z Turbo Drive (which is 1.4x faster than a traditional SSD) can be installed in the 15u's M.2 expansion slot thus leaving an open 2.5 inch drive bay for an additional magnetic or SSD device if desired.

**Graphics Processor Unit (GPU):** An AMD FirePro™ M4170 GPU subsystem with 1 GB of GDDR5 memory delivers certified drivers for command CAD applications including AutoCAD®, Revit®, and Inventor®. With OpenGL 4.4, OpenCL 1.2 and DirectX 12 supported the AMD FirePro™ M4170 can work with almost all CAD packages as well as ray trace rendering applications. The GPU also utilizes Enduro™ technology to switch graphics configurations to the integrate Intel HD Graphics GPU when CAD and rendering applications are not in use – thus enhancing battery life.

**Display:** Full HD<sup>3</sup> (1920 x 1080) screens are offered in both standard and wide viewing angles and additional external monitors at resolutions up to 4K (3840 x 2160) resolution can be supported via the DisplayPort 1.2 connector.

## ABOVE AND BEYOND ULTRABOOK™

Beyond the physical characteristics and specs of the Ultrabook standard the 15u provides additional features that will appeal to aggressive engineering and architectural CAD users on the go:

**Toughness:** Though the ZBook 15u is thin and sleek it is not fragile. Installed in a rugged magnesium/aluminum chassis, the 15u is submitted to US MIL STD 810G testing for drops, vibration, and humidity/thermal extremes so the 15u won't break a sweat being bounced around at a job site or in airline overhead bins<sup>15</sup>.



**CAD Certifications:** By working closely with software providers, including Dassault, Autodesk, PTC, Siemens and Bentley, proper operation of software, graphics subsystems, and application specific video drivers is assured.

**3 Year Next Day Limited Warranty:** If anything should go wrong a full three (3) year parts, labor and next day response limited warranty is included. So rather than having to buy extended coverage or shipping your workstation to a service depot (and waiting for a week or more) you're covered and will be back in business the next day.

## HP OMEN PRO MOBILE WORKSTATION



If your software needs tilt towards more graphically intensive CAD work the HP OMEN Pro Mobile Workstation ups the specs and styling of the 15u Ultrabook a notch. The upgrades include:

**CPU:** For CAD users requiring higher end turbo clock

speeds (up to 3.6 GHz) the upgraded Intel® i7 Core™ i7-4720HQ Quad Core1 Processor takes the place of the i5/i7 Dual Core on the 15u.

**GPU:** For more graphically challenging rendering or real time 3D video work a certified NVIDIA® K1100M with 2GB of dedicated GDDR5 RAM takes the place of the AMD FirePro™ M4170. This upgrade elevates the Omen Pro to a high-end video experience as well as great rendering/CAD performance.

**Display:** For Windows 7 and Windows 10 users a FHD UWVA IPS Touch (1920x1080) capacitive touch screen comes standard and an HDMI output is included to facilitate easy hookups to HD monitors or projection units.

**Enclosure:** All the upgrades are housed inside a stealthy black, 4.68 pound, 19.9 mm thick textured metal case that has a distinctly modern looking wedge shape.

With its more robust specs, great looks and extreme portability the HP OMEN Pro Mobile Workstation can get the CAD work done at a job site then zip right into an executive board room for a presentation.

## WORKSTATION MEETS LAPTOP

The HP ZBook 15u Ultrabook™ and Omen Pro mobile workstations neatly straddle the line between desktop power and laptop portability without sacrificing power, rugged construction or reliability. While you may not be able to fit 5 hard drives or a second graphics card in either of these slim machines you will be able to power through most CAD project workflows on the hood of a pickup at the job site or at 34,000 feet flying home.

## ABOUT HP

HP helps you stay ahead of the curve with professional desktop and mobile workstations designed for large and complex datasets, dispersed teams, and tight

deadlines. HP Z Workstations, built for Pros with Intel® Inside®, deliver the innovation, high performance, expandability, and extreme reliability you need to deliver your 3D CAD projects in less time. To learn how to configure a HP Z Workstation, visit the HP and Autodesk page at [www.hp.com/go/autodesk](http://www.hp.com/go/autodesk). Start saving now!

## ABOUT ROBERT GREEN

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



- 1 Multi-Core is designed to improve performance of certain software products. Not all customers or software applications will necessarily benefit from use of this technology. 64-bit computing system required. Performance will vary depending on your hardware and software configurations. Intel's numbering is not a measurement of higher performance.
- 2 For hard drives, GB = 1 billion bytes. TB = 1 trillion bytes. Actual formatted capacity is less. Up to 20 GB of system disk is reserved for Windows 7 and higher system recovery software.
- 3 HD content required to view HD images. 8 HP Client Security requires Windows. 9 HP Drive Encryption requires Windows. Data is protected prior to Drive Encryption login. Turning the PC off or into hibernate logs out of Drive Encryption and prevents data access. 10 Microsoft Security Essentials (Windows 7) and Microsoft Defender (Windows 8) require internet access.
- 4 Not all features are available in all editions or versions of Windows. Systems may require upgraded and/or separately purchased hardware, drivers and/or software to take full advantage of Windows functionality. See <http://www.microsoft.com>.
- 5 The HP ZBook 15u Ultrabook™ Mobile Workstation is preinstalled with Windows 7 Professional software and also comes with a license and media for Windows 8.1 Pro software. You may only use one version of the Windows software at a time. Switching between versions will require you to uninstall one version and install the other version. You must back up all data (files, photos, etc.) before uninstalling and installing operating systems to avoid loss of your data.
- 6 802.11 wireless is an optional add-on feature and requires wireless access point and Internet service is required and is not included. Availability of public wireless access points limited. 6 4G LTE module is optional and requires separately purchased service contract. Check with service provider for coverage and availability in your area. Connection speeds will vary due to location, environment, network conditions, and other factors. 4G LTE not available on all products, in all regions.
- 7 HP Client Security requires Windows.
- 8 HP Drive Encryption requires Windows. Data is protected prior to Drive Encryption login. Turning the PC off or into hibernate logs out of Drive Encryption and prevents data access.
- 9 Microsoft Security Essentials (Windows 7) and Microsoft Defender (Windows 8) require internet access.
- 10 HP PageLift requires Windows 8.
- 11 ePrint requires an Internet connection to a HP web-enabled printer and HP ePrint account registration (for a list of eligible printers, supported documents and image types and other HP ePrint details, see [www.hp.com/go/businessmobileprinting](http://www.hp.com/go/businessmobileprinting)).
- 12 The Computrace agent is shipped turned off, and must be activated by customers when they purchase a subscription. Subscriptions can be purchased for terms ranging multiple years. Service is limited, check with Absolute for availability outside the U.S.
- 13 EPEAT® registered where applicable. EPEAT registration varies by country. See [www.epeat.net](http://www.epeat.net) for registration status by country. 1
- 14 Not all configurations will qualify as Ultrabooks™
- 15 MIL-STD testing is pending and is not intended to demonstrate fitness for U.S. Department of Defense contract requirements or for military use. Test results are not a guarantee of future performance under these test conditions. Accidental damage and damage from MIL STD test conditions requires an optional Accidental Damage Protection Care Pack.
- 16 RGS requires a Windows or Linux operating system and Internet access.
- 17 HP Performance Advisor requires Windows and Internet access.

Microsoft and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries. Intel, Pentium, Intel Inside, Ultrabook and the Intel Inside logo are trademarks of Intel Corporation in the U.S. and other countries. AMD and FirePro are trademarks of Advanced Micro Devices, Inc.

AutoCAD, Revit and Inventor are registered trademarks or trademarks of Autodesk, Inc., and/or its subsidiaries and/or affiliates in the USA and other countries. NVIDIA and

Quadro are trademarks and/or registered trademarks of NVIDIA Corporation in the U.S. and other countries. All other trademarks are the property of their respective owners.

© 2015 Hewlett-Packard Development Company, L.P. The information contained herein is subject to change without notice. The only warranties for HP products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein. [www.augiworld.com](http://www.augiworld.com)

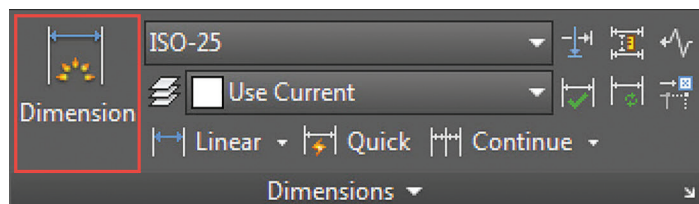
# A Trio of Dimensioning Tips

**W**ith the latest release of AutoCAD® 2016, Autodesk has introduced many new features including enhancements for dimensioning. Although dimensioning is not a new topic, there are some tools which are rarely used or overlooked despite the great features they offer. This article will introduce three dimensioning tools to you, including the DIM command, which is the latest addition in AutoCAD's arsenal.

## DIM FOR AUTOCAD 2016

The DIM command allows you to perform several tasks with only one command. You can use this tool to create linear, angular, radial, baseline, and ordinate dimensions. Once you select any geometry after selecting the DIM (command equivalent of dimension tool), a corresponding output will appear at your cursor. For example, if you select a line, length will accompany the cursor and if you select a circle, diameter will accompany your cursor. Let's explore some options available with the DIM command.

Select this tool using the big Dimension symbol from the Annotate tab, Dimensions panel or directly from the Annotation panel of the Home tab.



Once the tool is selected, bring your cursor close to a line, arc, or circle and you will notice the dimension adapts accordingly, giving you relevant output. You can create vertical and horizontal dimen-

sions by moving your cursor in a vertical or horizontal direction after selecting a line. If the selected line is inclined to a certain angle, then an inclined linear dimension will appear. You can also force this dimension to show a vertical or horizontal dimension by pressing the shift key. Press and hold the shift key and then move your cursor to restrict your dimension to a vertical or horizontal dimension—even if the line is inclined.

For creating angular dimensions, click two lines that are not parallel to each other, then click on the drawing area to place the dimension. If the lines are parallel you will see the distance between these parallel lines instead of an angle.

This command also offers the ability to create baseline and continuation dimensions. For creating baseline dimensions, create a dimension first and then select "Baseline" from the subcommand that appears on the command line, and then select the dimension you created in the previous step and click on consecutive points. Similarly, for creating continuous dimensions, make a linear dimension, then start the DIM command and select "Continue from dimension line" and click on the consecutive points.

You can also use ordinate from subcommands to create ordinate (X and Y coordinates) point dimensions. Select ordinate from the subcommands on the command line and click a point to find its ordinate. Place this dimension horizontally to find out its equivalent Y coordinate and place your cursor on a vertical line to find its equivalent X coordinate.

Using Align from the Options subcommand, you can align dimensions in the same line with respect to the selected base dimension. Start the DIM command, then select Align from Subcommand Options and click on the base dimension whose position and alignment



you want to keep fixed. Then click on other dimensions you want to align to the base dimension and press Enter to exit this command.

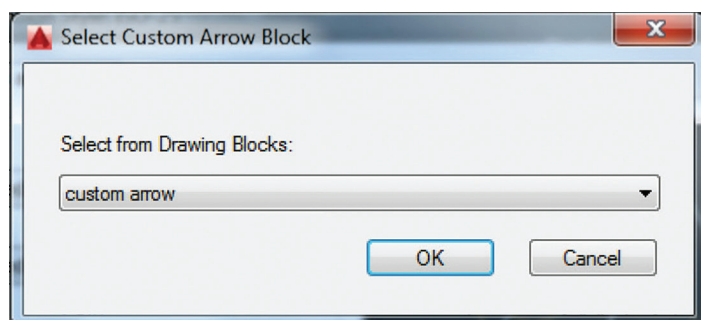
The Distribute subcommand on the command line can be used to distribute multiple parallel dimensions with equal distance between them. This command offers you two options: equal and offset. If you select equal, then all dimensions will get equally spaced in between the most extreme dimensions. If you select offset, then dimensions will get spaced according to the distance set by the DIMDLI system variable. You can change the spacing between dimensions using the DIMDLI system variable.

Using the Layer subcommand you can decide the layer on which your dimension will be placed. You can decide layer assignments of dimension using three options.

- Select the Layer subcommand from the DIM command and click on any object whose layer you want to assign to your dimension, and then make the dimension.
- Select the Layer subcommand from the DIM command and type the name of the layer on the command line and press Enter. Select the object for dimensions and your dimensions will be placed on that layer.
- Before picking the DIM command, change the current layer to the layer on which you want to create dimensions. Then select the Layer subcommand from the DIM command and type "" (excluding quotes) and press Enter twice. This will create your dimension on the current layer.

## MAKING CUSTOM ARROWS FOR DIMENSION AND LEADER LINES

This feature is not new to AutoCAD users, but in my opinion it is often ignored. AutoCAD offers a great feature of adding your own geometrical shapes as custom arrow styles. This can be used if you have a requirement for a specially designed arrow for your new project. You can make custom arrows using AutoCAD blocks and then those arrows can be used in dimensions and leader lines. Annotative blocks can't be used as custom arrows. These arrows also maintain their original scale in a drawing so it is advisable to choose an appropriate scale for custom arrows with respect to overall drawing scale.

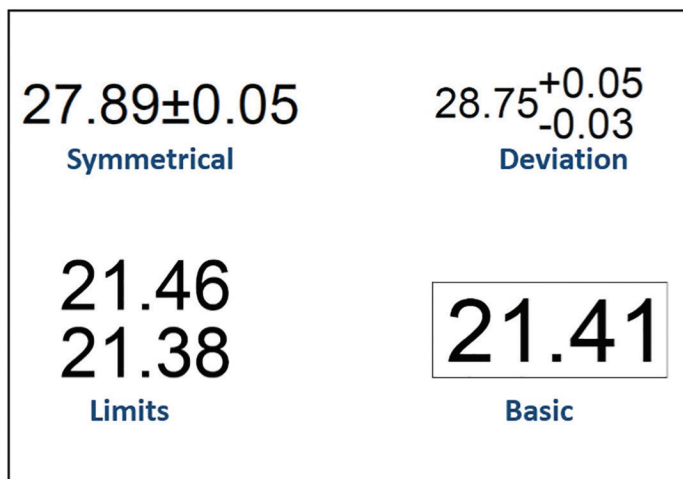


Select the appropriate arrow from this menu, click OK, and close all open windows. Now use the modified dimension style to create dimensions and you will see the custom arrow replacing standard arrows. A similar procedure can be used to create custom arrowheads for leader lines as well.

## ADDING TOLERANCES IN AUTOCAD DIMENSIONS

Tolerance notations can be easily added to AutoCAD dimensions and can be easily modified like common dimensions. To add tolerances with AutoCAD dimensions, type DIMSTYLE on the command line and press Enter. Select the dimension style with which you want to associate tolerance notation and click on the Modify button, then select the Tolerance tab from the Modify Dimension Style window.

Select the method of tolerance from the Method drop-down menu of the Tolerance Format panel. The figure below shows how different formats of tolerances look.



Select your preferred method of tolerancing and then select the precision of tolerance from the Precision drop-down menu. Select the upper and lower value of tolerances from the respective option box. For the symmetrical tolerance type you will observe that one of the tolerance value is greyed, indicating that you need to define only one limit for it. Click OK once you have made all adjustments to the dimension style and close the Dimension Style Manager window.



Jaipakash Pandey is a Mechanical Engineer, blogger, corporate trainer, and educator. He has worked in the diecast industry and many training institutions and delivered training to corporate clients in CAD software, primarily AutoCAD. Jaipakash is currently working as senior analyst (CAD) for Ramboll, a leading engineering and design consulting group. You can reach him with comments or questions at his blog, SourceCAD.

# 14<sup>th</sup> Annual AUGI Salary Survey

Thank you to all of the members who took the time to contribute to this resource *for-users-by-users!*

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



**A**s always, I want to start out by thanking everyone who took the time from their schedule to contribute to this unique resource. A real report on how companies are truly valuing and making use of their staff, your colleagues, is a resource unlike many others.

In 12 years overseeing this report, I do constantly receive and consider feedback from the membership, so, as always (once you've read the FAQ) feel free to send me any suggestions for Hot Topic issues you'd like to see gauged, or other important statistics which may have been neglected. Speak up for your niche, because I confess we have oversights, like omitting Automotive from our list of industry specialties (sorry folks, it will be there next year, promise).

The first question is always on the differences in Cost of Living between various areas. Over 30% of survey participants are from outside of the US, and the metro areas and rural areas can be costly or affordable no matter the country, so be sure to check local resources for those variances. Our dataset is far too small to calculate those things, so I am a big fan of [www.Indeed.com/Salary](http://www.Indeed.com/Salary) and the NACE Calculator can help a little, as well as industry or role-specific surveys from other professional organizations. The salaries reported here (in US dollars, as participants were given a link to a currency converter) reflect salary and bonuses for those who work 40 hours a

week. They are weighted to exclude overtime pay. Negative factors (job insecurity, layoffs, reduced pay) continue to decline slowly, while those starting new jobs are on the increase. Market share for industry specialties hasn't changed much since last year, although there has been an increase in healthcare design and structural work. Keep reading to see which market segments pay the best and which ones are doing the most brisk business.

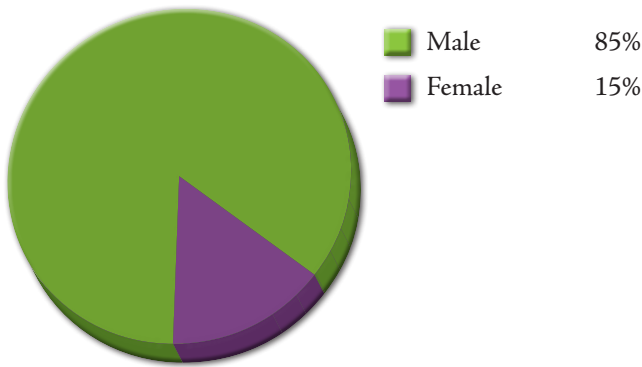
Though BIM adoption hasn't increased markedly, those with some of the highest mobility and feelings of job security are BIM Managers and BIM Coordinators.

Although 74% of our users are still in the same job they had last year, the April job search poll, indicates that 19% of users are currently searching for a new job due to dissatisfaction with their current role, and a further 12% plan to start looking soon. Forty-four percent of us got our jobs through personal connections, so be sure to reach out to your professional network on a regular basis. And, when you get that new job, don't forget to negotiate your salary.

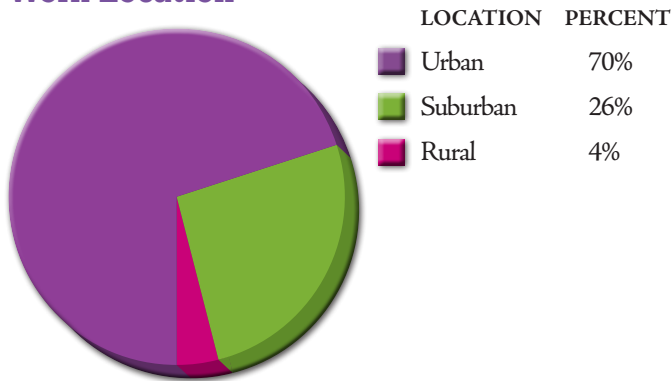
Did you want to contribute to this year's survey, but missed the notifications? Sign into AUGI and click the link for My Account at the top. Ensure that your email address is current, and your Email Subscriptions show you subscribed to AUGI Bulletins. Also, keep an eye out in the Surveys & Polls column in HotNews, and on our social media channels for notices and a link to the survey when it is open.



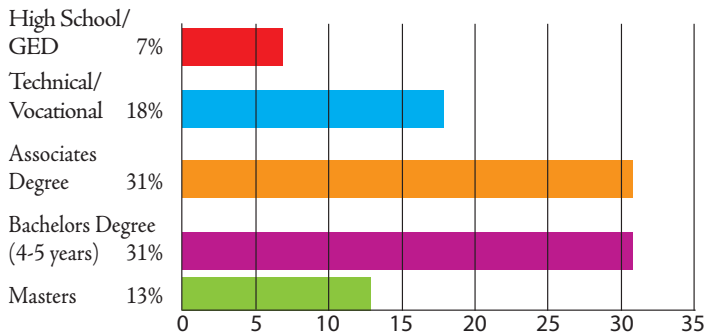
## Employee Gender



## Work Location

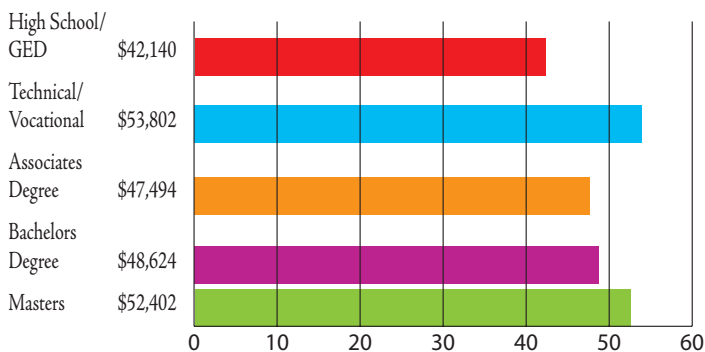


## Education Level

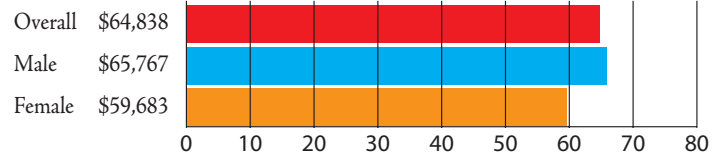


## Average Pay By Education Level

(for those with 5 or fewer years of experience)

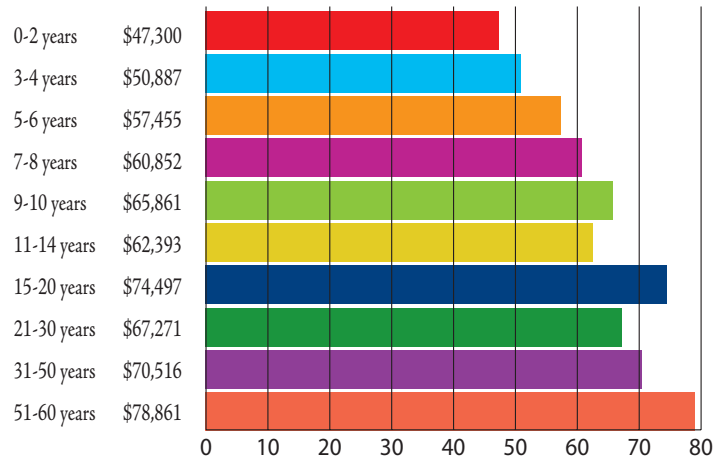


## Average Pay Per Gender



**Rural respondents earn an average of 5% less than those who work in cities**

## Pay by Experience

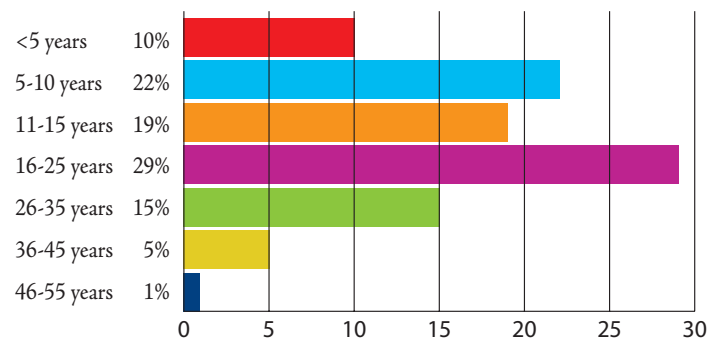


**Check out these resources for additional information on pay:**

- [Indeed.com/Salary](http://Indeed.com/Salary)
- [Salary.com](http://Salary.com)
- [PayScale.com](http://PayScale.com)
- [NACE Salary Calculator](http://NACE Salary Calculator)
- [Glassdoor](http://Glassdoor)

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

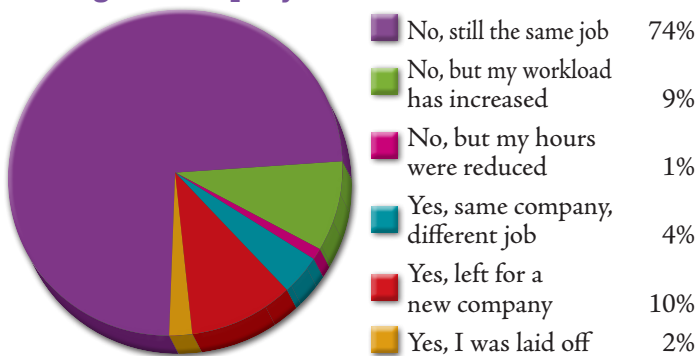
## Years of Experience



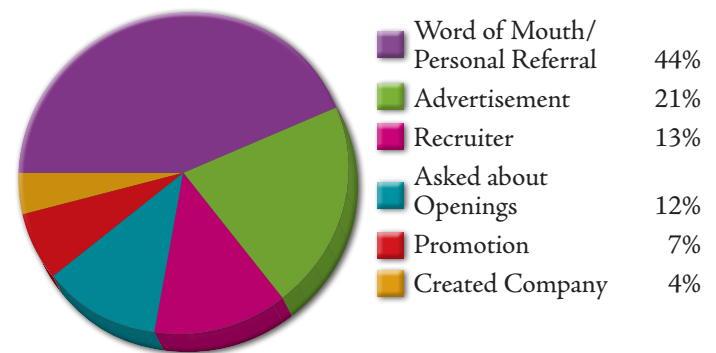
## AUGI 2015 Salary Survey

## COMPANY DATA

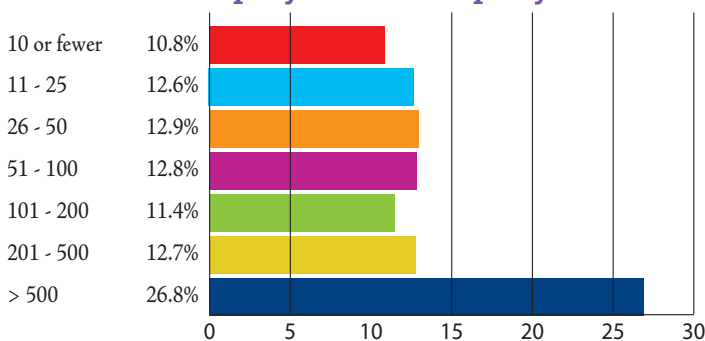
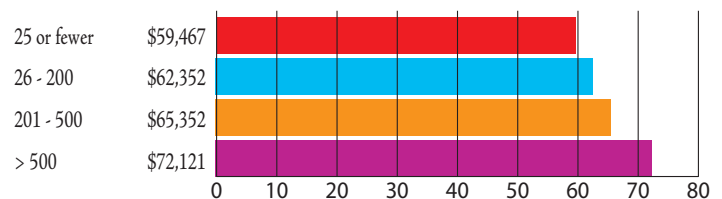
## Change in Employment



## How Our Members Found Their Jobs



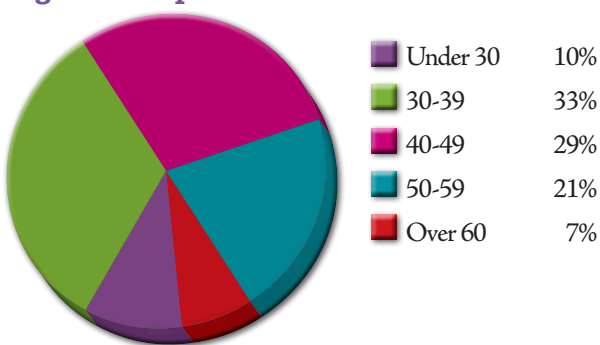
## Number of Employees in Company

Average Pay by Company Size  
(Number of Employees)

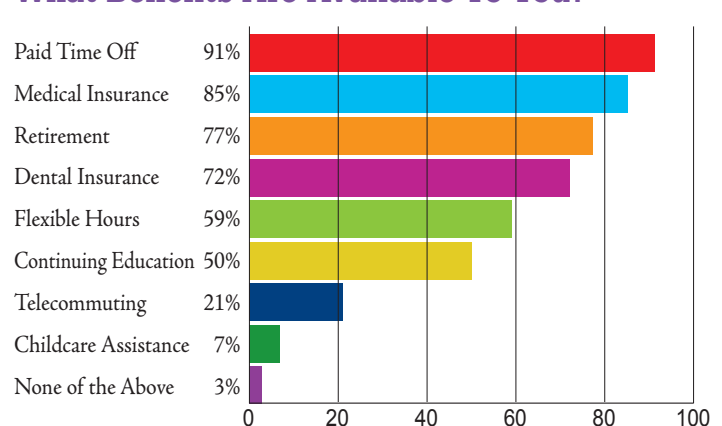
The ability to telecommute has grown from 15% (in 2008) to 21%.

The ability to telecommute translates to job satisfaction 11% higher than the average worker.

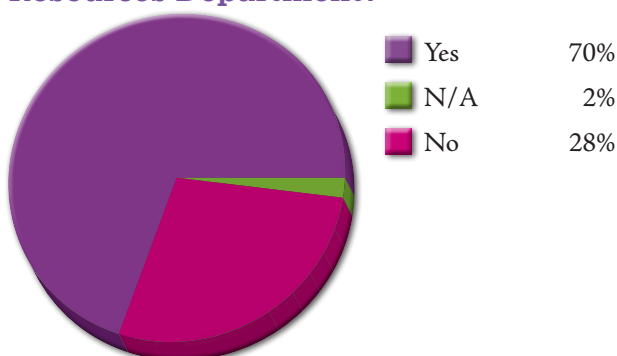
## Age of Respondents



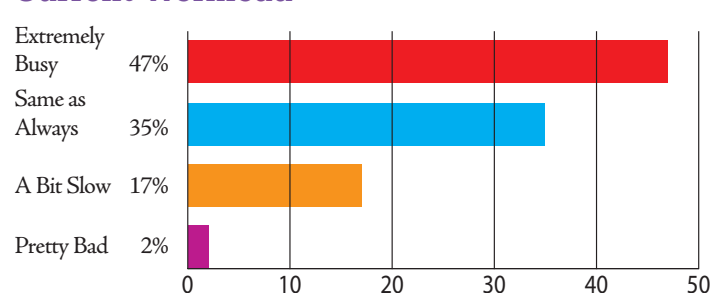
## What Benefits Are Available To You?



## Does Your Company Have a Human Resources Department?



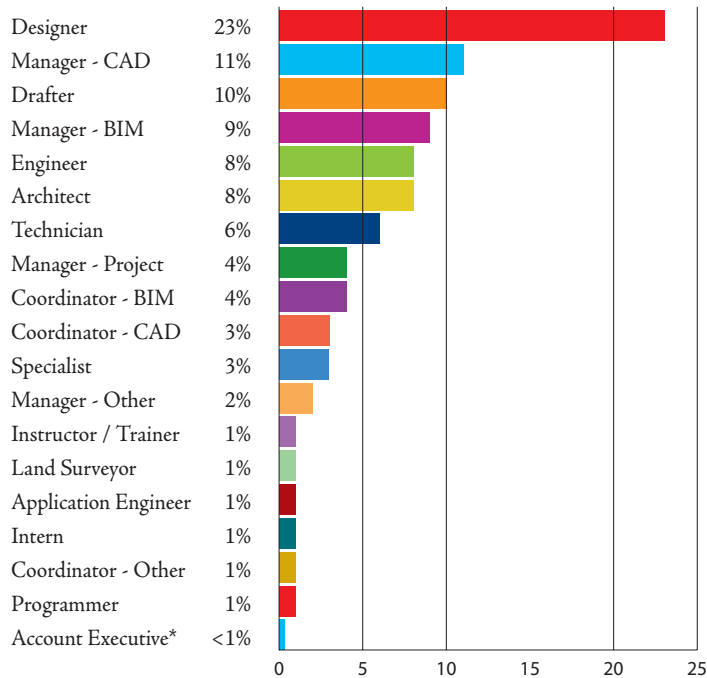
## Current Workload



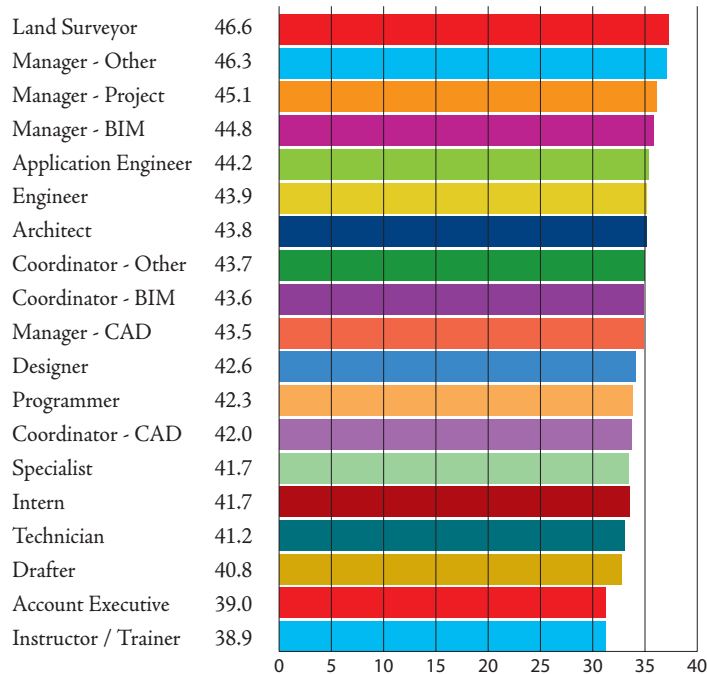


## JOB TITLE

## Survey Participants



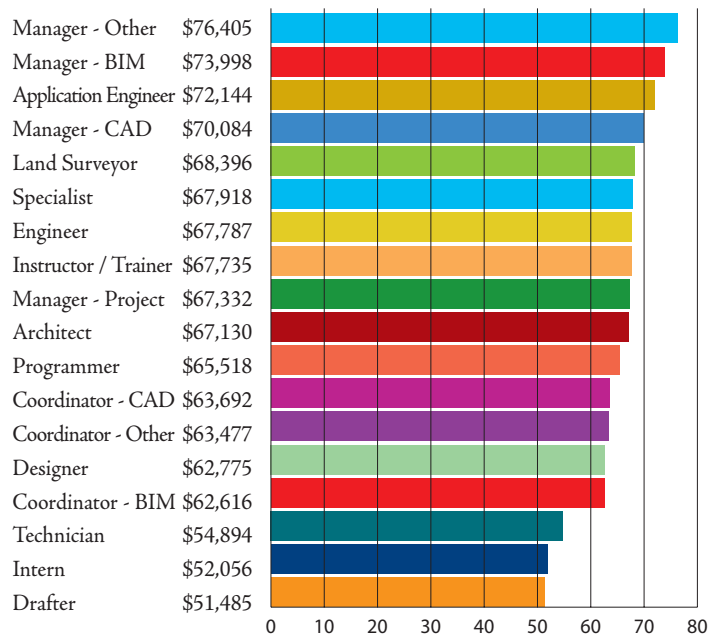
\*Account Executive pay not reported due to small sample size

Jobs that Work the Longest  
(Hours per Week)

The highest job satisfaction is reported by Instructors, BIM Coordinators and Interns, with 82% being Satisfied or Very Satisfied with their jobs.

Designers report the lowest, with only 56%.

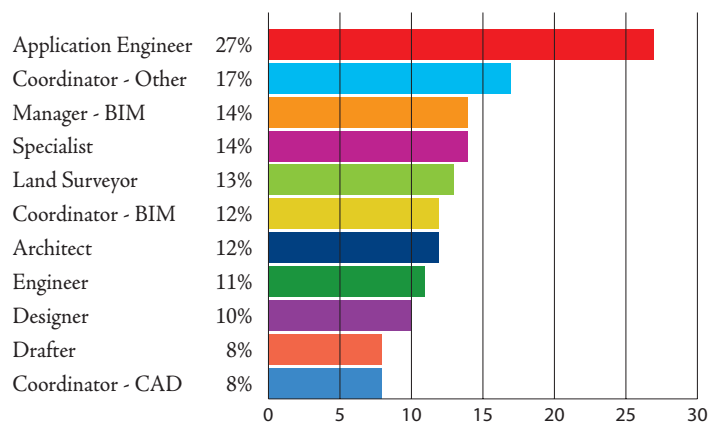
## Average Pay by Job Title/Function



**Reminder: All reported average pay is based upon a 40 hour workweek. It would include potential bonuses, but, workers who are paid hourly should expect their pay to be higher than the average shown here, if they work more than 40 hours.**

## Jobs with the Highest Mobility

(Percentage of Each who Reported Leaving for a New Role)



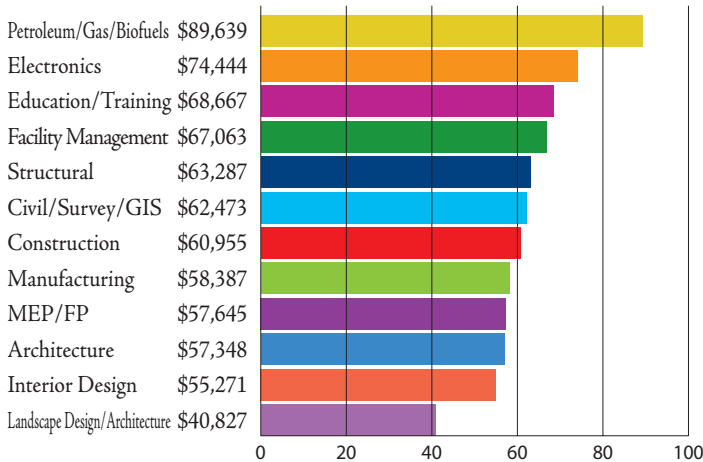
**BIM Managers and BIM Coordinators feel the greatest amount of job security, with 88% of them reporting Secure or Very Secure.**

**CAD Managers and other Coordinators are the lowest with 51%.**

## AUGI 2015 Salary Survey

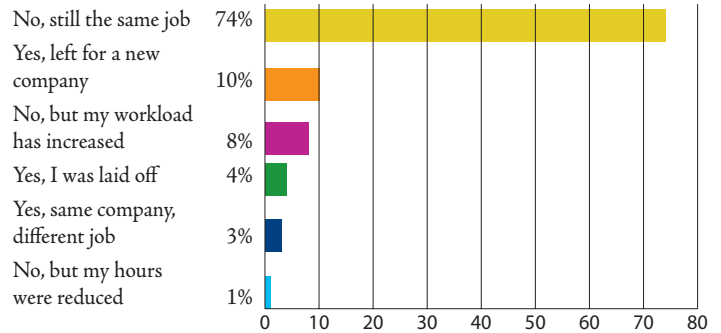
## DESIGNER CLOSEUP

## Average Designer Salary



Average age of Designers is 44.

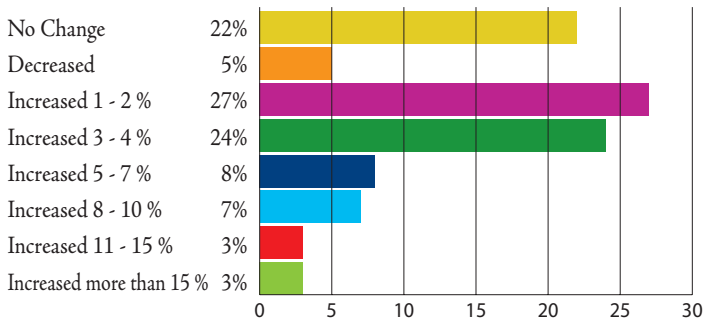
## Employment Change in the Past 12 Months?



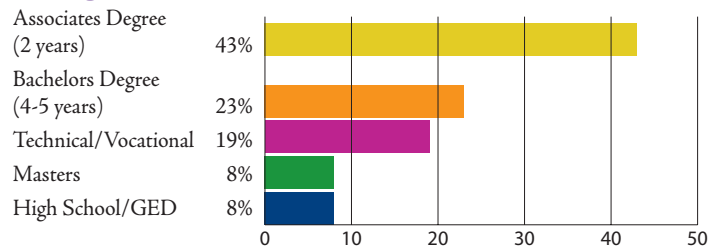
8 Years with Current Company.

Average hours Designers work per week is 43.

## Change in Salary



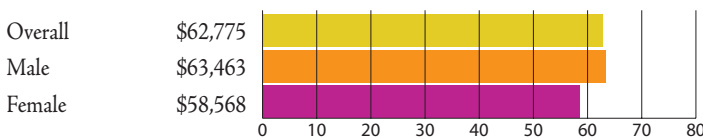
## Designer Education Levels



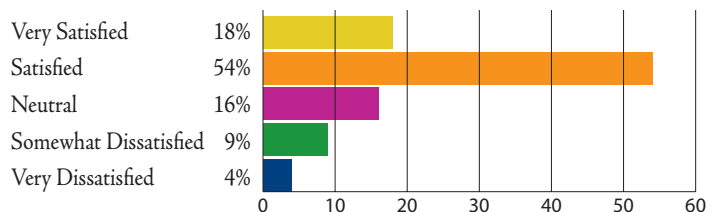
79% of Designers feel Secure in their jobs.

Average Experience of 18 Years.

## Average Designer Pay



## Level of Job Satisfaction

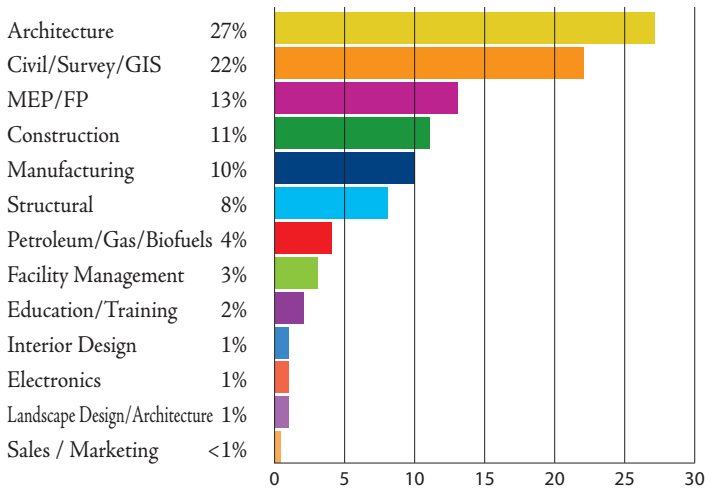


20% of Designers have the ability to Telecommute.

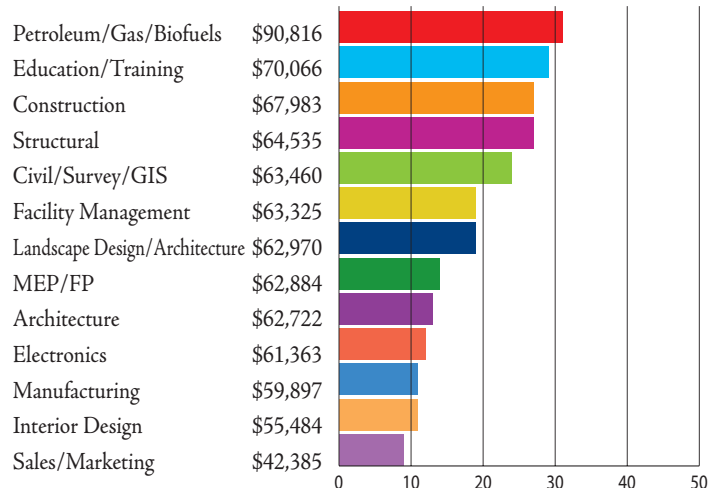


## INDUSTRY/DISCIPLINE

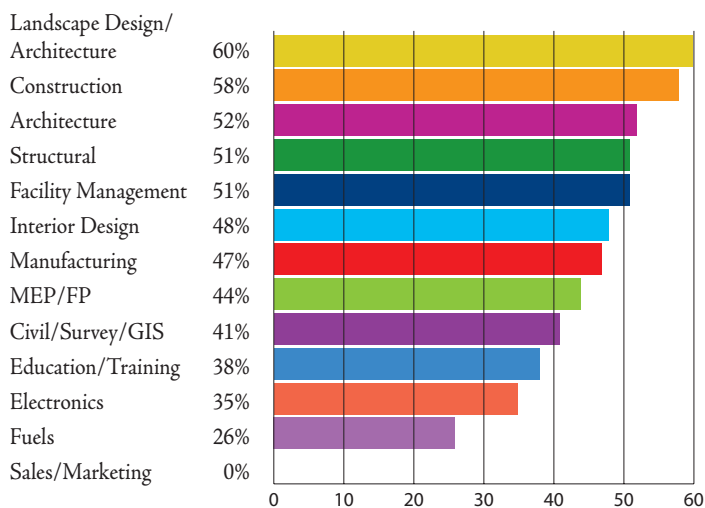
## Survey Participants



## Average Pay by Field/Industry



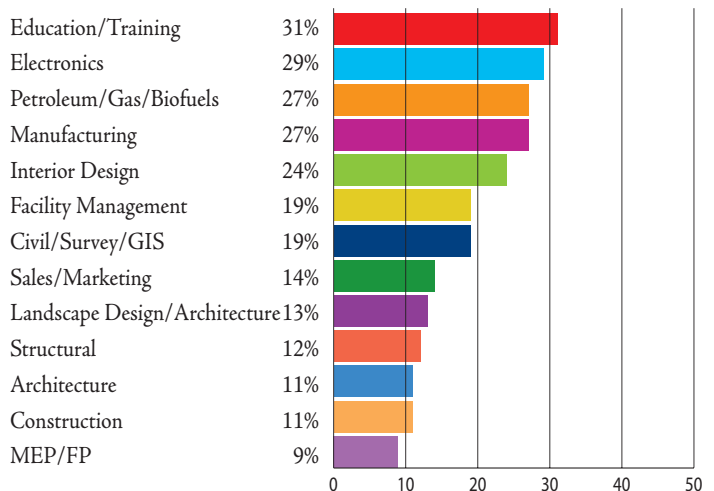
## Percentage Extremely Busy Workload



**Landscape Design/Landscape Architecture has the largest percentage of female employees at 27%.**

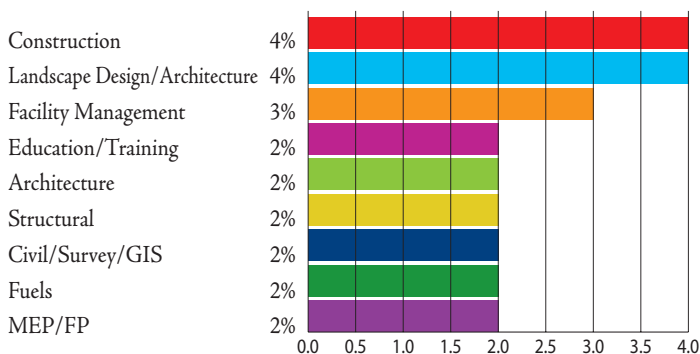
**Manufacturing and Fuels have the lowest at 8%.**

## Percentage Approaching Retirement Age\*



\*Those with ages 55 years and higher

## Percentage in Each Industry Who Report Being Laid Off



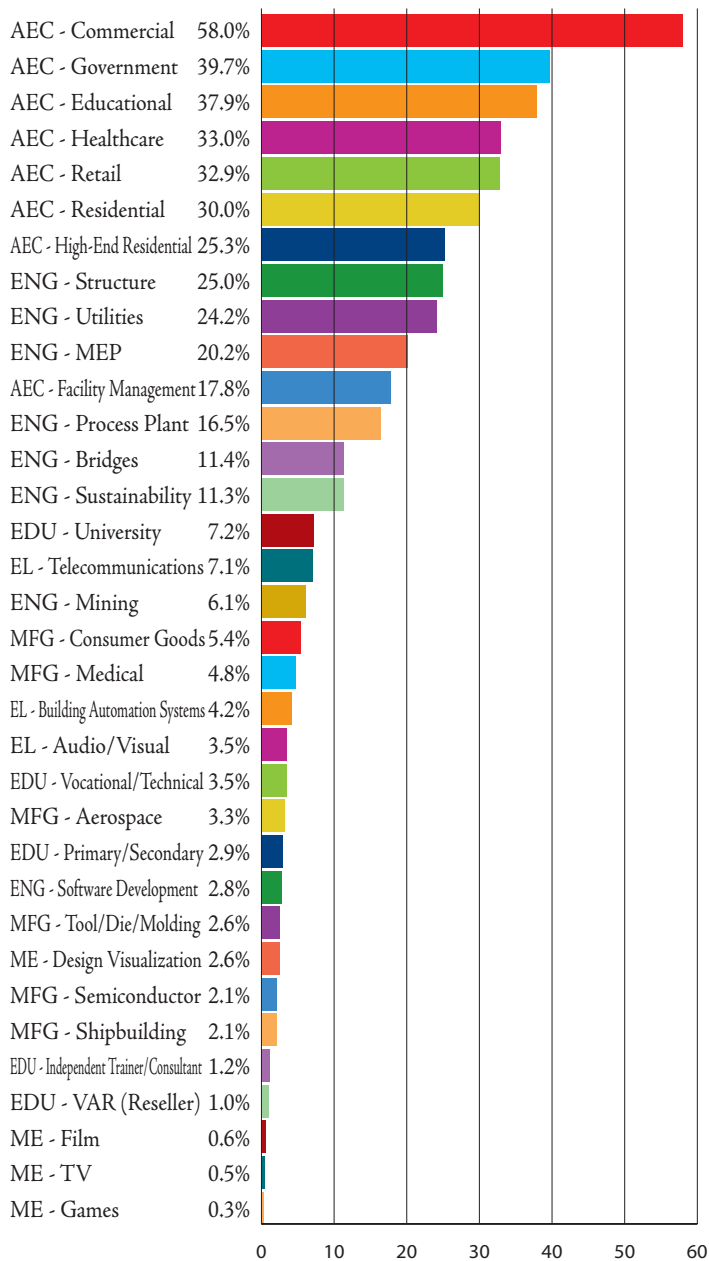
**Landscape Design/Landscape Architecture has the highest Job Security rating at 93% Secure. MEP/FP isn't far behind at 86%.**

**Interior Design ranks the lowest with only 62% Secure.**

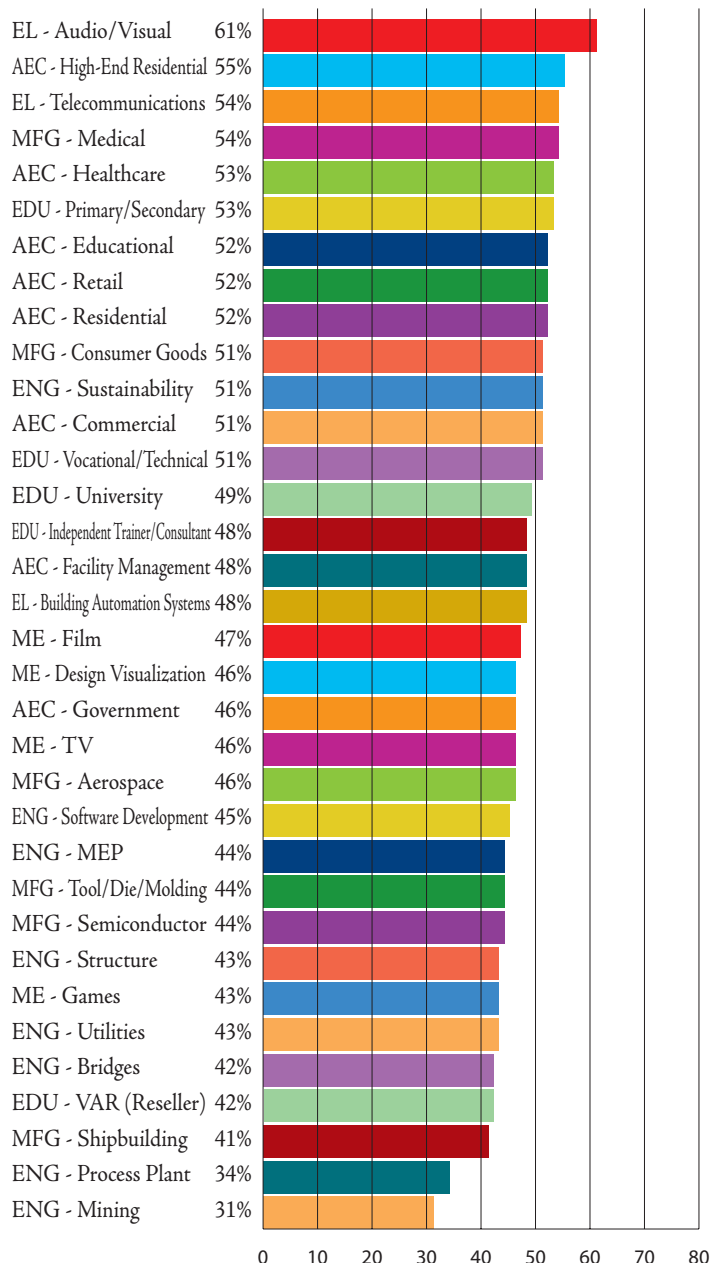
## AUGI 2015 Salary Survey

## MARKET SERVED/INDUSTRY SPECIALTIES

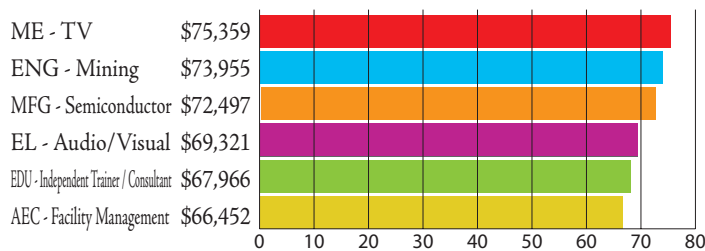
## Size of Market Segments



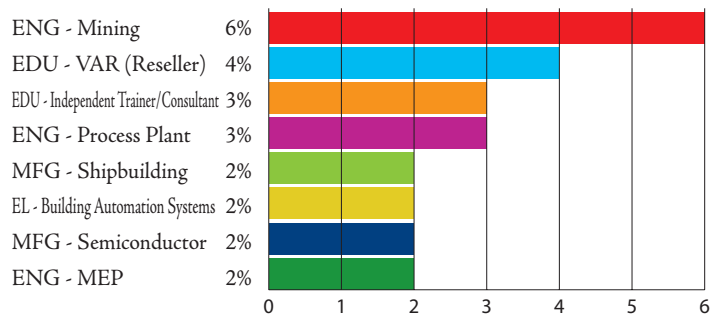
## Percentage of Markets Served Reporting Extreme Busyness



## Highest Average Paid Specialty by Industry



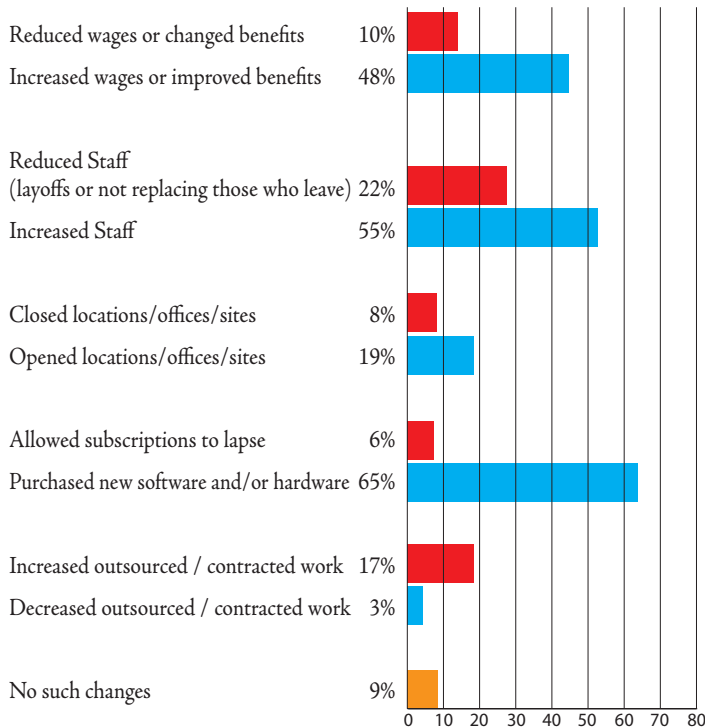
## Markets Reporting Poor Workload





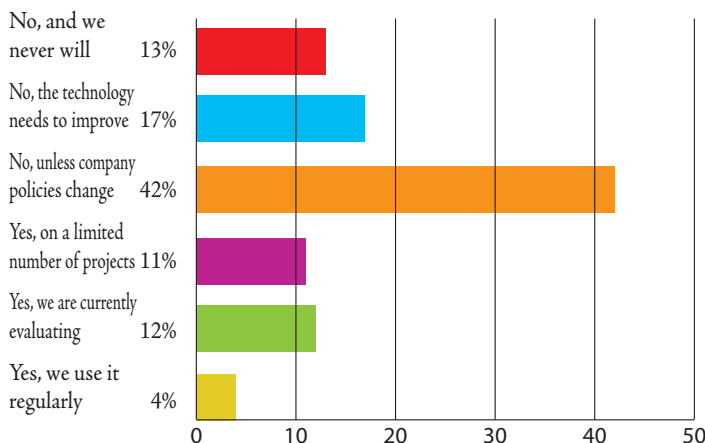
## HOT TOPICS

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



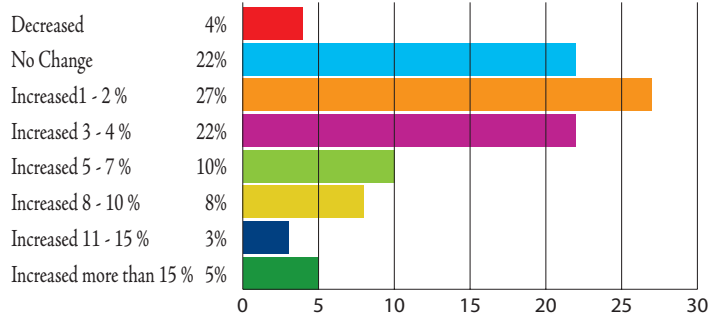
**Percentage of users experiencing “decreased” pay has crept downward, and is nearly as low as it was in 2006.**

## Do You Run CAD/BIM in the Cloud?

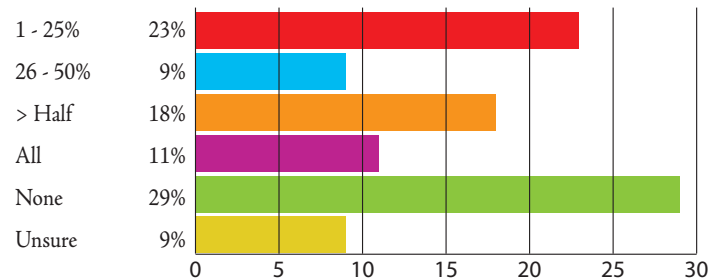


**In 2007, 1.6% of respondents were BIM Managers, that number is 9% today, plus the 4% of respondents who are BIM Coordinators.**

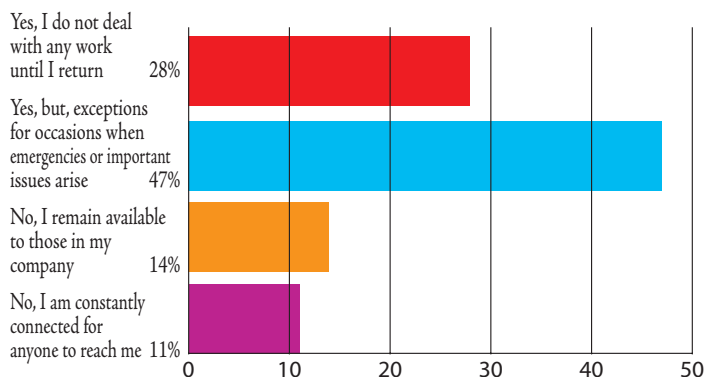
## Has your Salary Changed in the Past Year?



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



## Do You Quit Working When You Leave the Office?



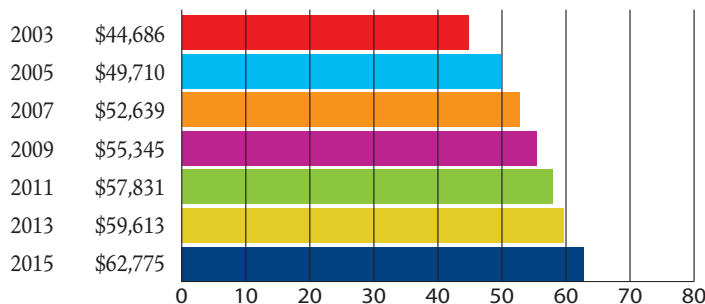
**In 2012, only 49% of respondents indicated that their company had increased staff in the previous 12 months. This year, that number has risen to 55%.**

**48% of companies have increased wages or improved benefits this year, compared to 44% in 2012.**

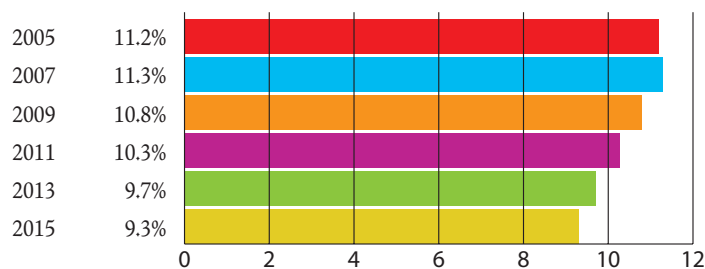
## AUGI 2015 Salary Survey

## A LOOK BACK

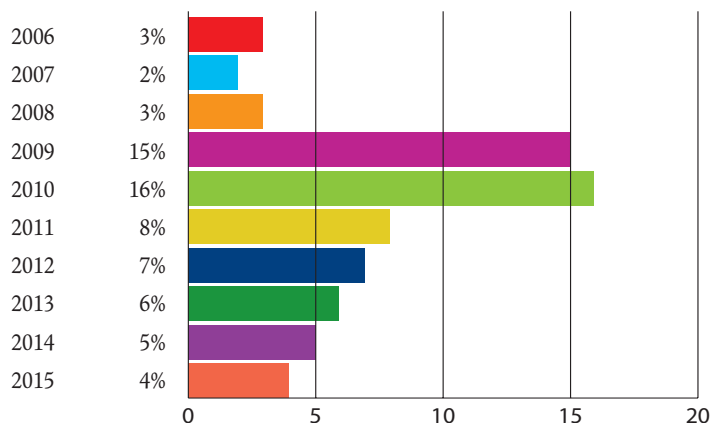
## Average "Designer" Pay



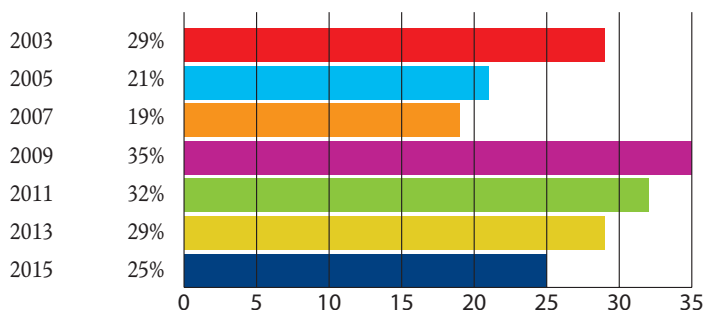
## Percent of Gender Pay Difference



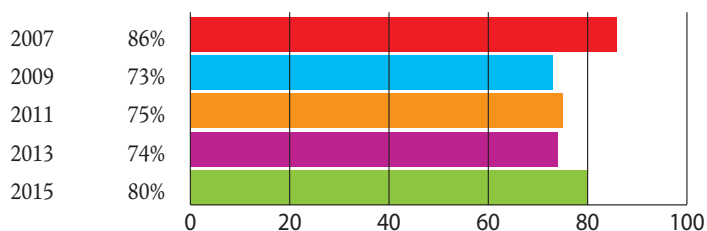
## Percent of Users Who Experienced Pay Decrease



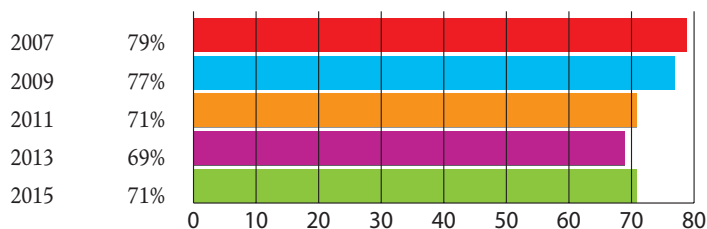
## Percent of Respondents Who Received No Raise



## Percent of Users Who Feel Secure

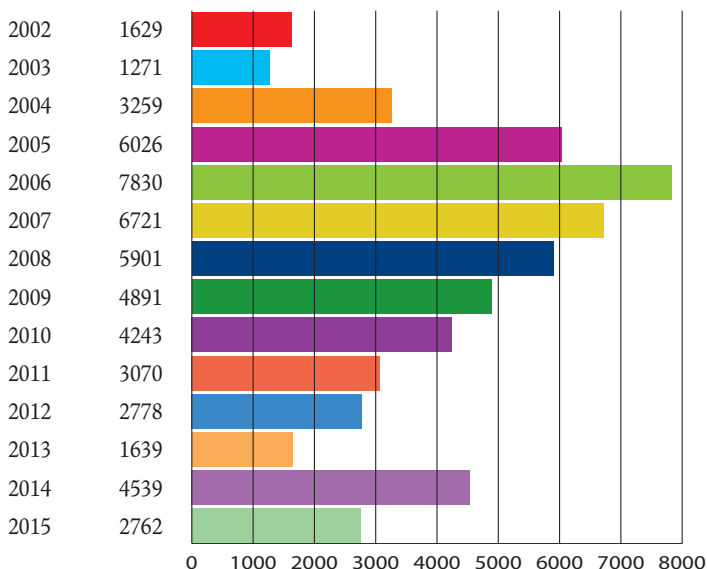


## Percent of Users Who Are Satisfied



**Do you think Salary Survey participation has decreased due to the recession, the growth of other sources for salary information, or another reason?**

## Salary Survey Participation



Melanie Perry is an Archibus System Administrator and Technical Editor in St. Louis, Missouri. She is currently serving her second term on the AUGI Board of Directors. Melanie can be reached at [mistressofthedorkness@gmail.com](mailto:mistressofthedorkness@gmail.com) or found on Twitter as @MistresDorkness

# It's not about the tool



## It's about the time and effort **you** put into it.

RTC is a global series of **BIM** technology conferences dedicated to helping you and your team avoid the expensive mistakes that come from using design technologies incorrectly. Or attendees, speakers and sponsors are globally recognized **AEC** industry experts who can help you choose the best solution for your business needs. **Time is money** and RTC is ready to invest in your business future.

~~Australia  
Gold Coast  
May 14 - 16  
CONFERENCE  
COMPLETED!~~

~~North America  
Washington DC  
Jul 23 - 25  
CONFERENCE  
COMPLETED!~~

Asia

Singapore  
Sep 10 - 12

Europe

Budapest  
Oct 29 - 31

## Register Today



[www.rtcevents.com](http://www.rtcevents.com)

 RTC Events Management

 #RTCEvents

 [secretary@rtcevents.com](mailto:secretary@rtcevents.com)

#### GLOBAL PLATINUM SPONSORS



#### GOLD SPONSORS



#### GLOBAL SILVER SPONSORS



#### BRONZE SPONSOR



#### GENERAL SPONSORS



#### AFFILIATE SPONSOR





# Instant-Impact Tips for ACA



Here are some handy tips you can use in AutoCAD® Architecture 2016.

## START TAB

When you start the program, open a new tab (+) or close the last drawing; a Start Tab is displayed (see Figure 1). Each Start Tab (formerly the New Tab) contains the Create Page and the Learn Page. The Create Page is a quick launch pad to decide what to do. The following sections are displayed on the Create Page:

- ✦ Get Started
- ✦ Start New Drawing
- ✦ Templates
- ✦ Open Files
- ✦ Open a Project
- ✦ Open a Sheet Set
- ✦ Explore Sample Drawings
- ✦ Recent Documents
- ✦ Connect

The Learn page provides access to learning resources such as videos, tips, and other relevant online content or services. For every new content update, a notification badge is displayed at the bottom of the page. It is important to note that if there is no Internet connection, the learn page is not displayed.

You can use Ctrl+Home or GOTOSTART to get to the Start tab quickly. If you don't want the Start tab to display, set START-MODE to 0.

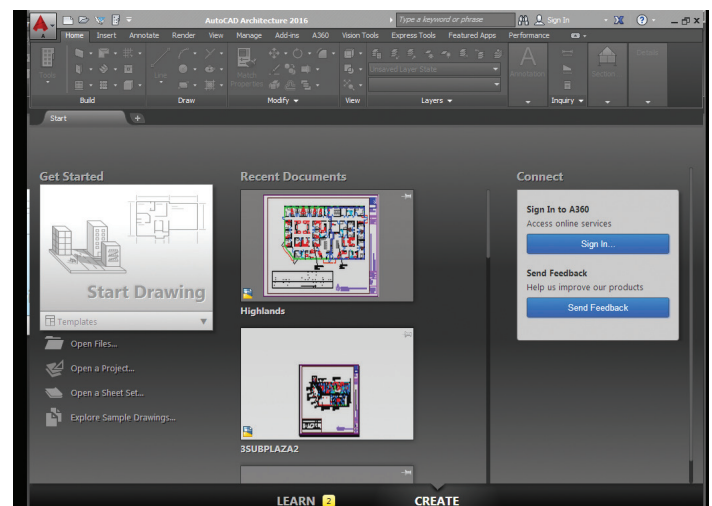


Figure 1: Start tab

## SMOOTH LINE DISPLAY

AutoCAD Architecture 2016 has added a solution to the jagged diagonal lines that you sometimes see in 2D wireframe drawings. The command is **LINESMOOTHING**. This variable can also be found under the Options dialog box, System tab. Click on Graphics Performance and the Graphics Performance dialog box appears. Checking Smooth Line Display removes the jagged lines. If your hardware supports High Quality Geometry, you can select the new “High Quality Geometry” option in the Graphics Performance dialog on the Status bar. Hardware acceleration must be turned on for this to work. Set **LINEFADING** to 1 to automatically fade geometry as you zoom into super-dense drawings. You can control the amount of fading with **LINEFADINGLEVEL**.

## STATUS BAR

In AutoCAD Architecture 2016, the status bar can now automatically wrap onto two rows when there are more icons than can fit into a single row. At any given time, the model tab and at least one layout tab is always displayed. You can populate the status bar with the tools you want by clicking on the three-stacked lines in the lower-right corner of the editor (see Figure 2). Isolate Objects and Lock UI have been added to the status bar customization menu. The Lock User Interface tool on the status bar enables you to check and uncheck multiple UI elements at one time instead of having to reopen the flyout each time. You can click the icon to enable or disable UI locking. Also, please note that the previous text “Cut Plane:” has been replaced by an icon.

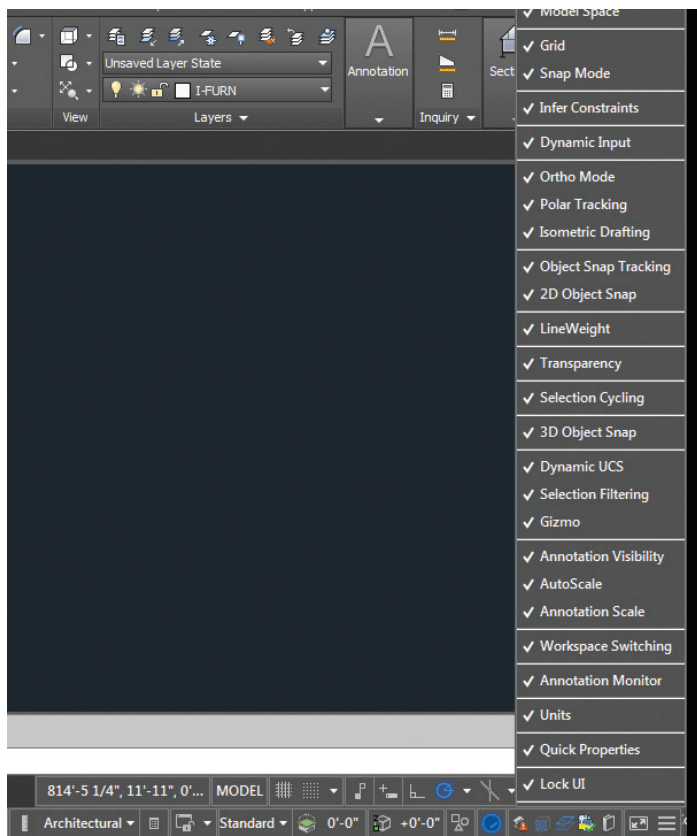


Figure 2: Status bar

## ACA REVISION CLOUD

The Revision Cloud tool is enhanced in 2016 to provide more flexibility. It is accessible from the Annotate ribbon panel and includes three methods of creation—Rectangular, Polygonal, and Freehand—in addition to the Command line option to select an object. The last used creation method is remembered the next time the command is run. You can set your own default creation method using the **REVCLLOUDCREATEMODE** system variable.

Whether you create rectangular, polygonal, freehand, or object revision clouds, editing their size and shape with grips is intuitive and easy. The number of grips displayed for revision clouds has been significantly reduced. The location and behavior of grips is based on the shape of the revision cloud. If you prefer legacy display of grips you can set **REVCLLOUDGRIPS** to Off. In addition to easier editing with grips, a new Modify option allows you to draw new revision cloud segments and erase selected portions of existing revision clouds (put several revision clouds together).

## GEOGRAPHIC LOCATION

Geographic location information in a drawing file is built around an entity that is known as the geographic marker. The geographic marker points to a reference point in model space that corresponds to a location on the surface of the earth of known latitude and longitude. The program also captures the direction of the north at this location. Using this information, the program can derive the geographic coordinates of all other points in the drawing file. You can set a geographic location using the Set Location tool on the Insert tab of the ribbon. Then easily search for an address from a map and drop a marker on the map to mark the spot. Drawing units can be easily modified.

After you insert a geographic marker in a drawing, you can do any of the following:

- ✦ Make the program automatically determine the angle of sunlight when you perform sun and sky simulation.
- ✦ Insert a map from an online maps service in a viewport.
- ✦ Perform environment studies.
- ✦ Use position markers to mark geographic locations and record related notes.
- ✦ Locate yourself on the map in real-time on systems that support location sensing.
- ✦ Export to AutoCAD Map 3D and expect the model to position itself automatically.

You can remove geographic location information from a drawing file using the **GEOREMOVE** command. The geographic marker and GIS coordinate system are removed from the drawing file. However, position markers will continue to remain in the drawing file.



# AutoCAD Architecture 2016

## LASSO SELECTION FOR OBJECTS

Lasso Selection is a new object selection feature that can be created by clicking, dragging, and releasing the mouse button (see Figure 3). You can now drag from left to right to select all objects that are entirely enclosed in the lasso or drag from right to left to select all objects that are crossed by the lasso. Click Enter. You can deselect objects by pressing shift and then clicking the individual objects or dragging across multiple objects. Press Esc to deselect all objects. It is important to note that when using lasso selection, you can press Spacebar to cycle between the Window, Crossing, and Fence object selection modes.

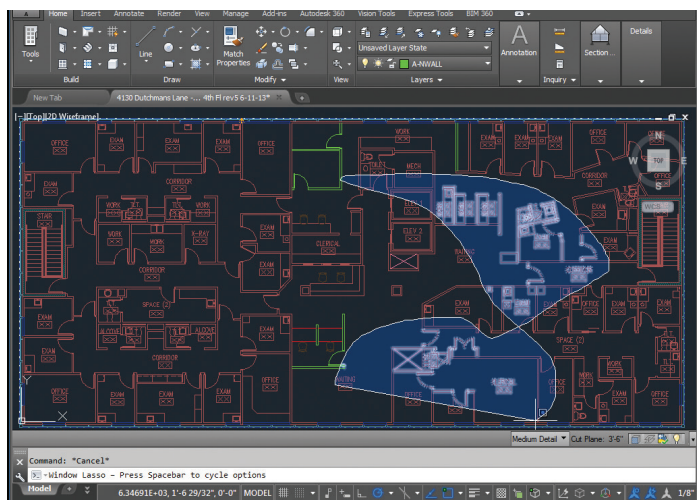


Figure 3: Lasso selection

## DIGITAL SIGNATURES

AutoCAD Architecture 2016 offers extra security controls that help to protect your drawings. You will find a variety of Security Options on the System tab of Options. One option is Digital Signatures, now accessible via the new DIGITALSIGN command. A digital signature is a block of encrypted information that you can add to certain files to identify the originator and indicate whether a file has been altered since the digital signature was applied.

To attach a digital signature to a file, you must either have a digital certificate issued by a certificate authority or you can create a self-signed certificate using one of several utilities. You can examine a file's digital signature. This is important when you are working on collaborative projects or if you receive an executable file. For drawing files, an icon is displayed on the status bar if a drawing file is digitally signed. When you click the icon, you can verify information such as the validity of the signature, the name of the individual or organization that signed the file, and so on.

## PDF ENHANCEMENTS

The updated PDFs in AutoCAD Architecture 2016 are much faster than they used to be! TrueType fonts in MText and Text with any

formatting options as well as Polygonized text, SHX text and Unicode characters are now searchable in PDF output files. The Export to DWF/PDF Options dialog box has been split into two separate dialog boxes—one for DWF and one for PDF. Both are accessible from the Output ribbon tab. PDF Options now include the PDF quality and font handling controls as well as new controls for hyperlinks and bookmarks. The hyperlinks control enables you to include hyperlinks from the drawing in the PDF file. The bookmarks control exports sheets and named views as bookmarks so you can easily navigate between them when viewing the PDF file.

When using the Plot tool to create PDF files, you can now choose from four predefined PDF presets offering a quick way to apply different PDF output options that meet various needs. If you select any PDF pc3 from the Printer/plotter dropdown list, a PDF Options button is displayed, providing convenient access to the PDF Options dialog (see Figure 4). Similar PDF presets and options controls are available when creating PDF files using the Export to PDF and Batch Plot tools.

The Sheet Set Manager has also been updated to support these PDF enhancements. Layout names are automatically displayed as page labels in the PDF file, making it easy to identify sheets when viewing the PDF.

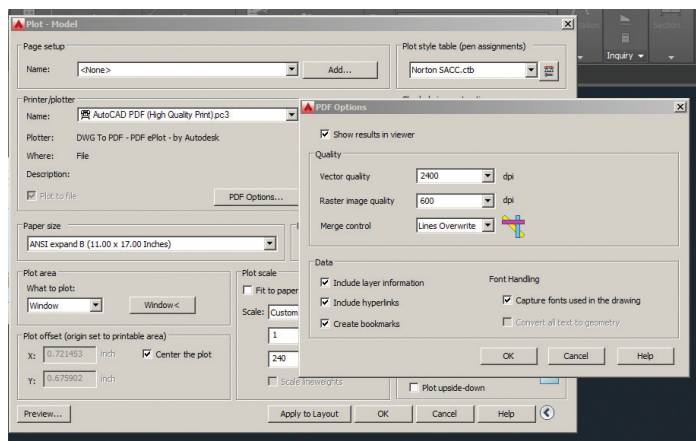


Figure 4: PDF options

## COMMAND PREVIEW

The Command Preview provides you a quick feedback of the active command and shows you exactly how the objects will look when the command is executed. As you make changes within the command, you can instantly preview the final result. The interactive preview applies to the following commands:

- BREAK
- CHAMFER
- FILLET
- EXTEND
- LENGTHEN
- MATCHPROP



- ♦ OFFSET
- ♦ TRIM
- ♦ BLEND
- ♦ ERASE
- ♦ ROTATE
- ♦ STRETCH
- ♦ SCALE

You can enable/disable the Command Preview control on the Selection Tab of the Options dialog box.

## TEXT ALIGNMENT

AutoCAD Architecture 2016 now has a new TEXTALIGN command that allows multiple text objects to be aligned to a base object and provides a preview of the result. After typing TEXTALIGN, the prompt Select Text Objects to Align [Alignment Options] is displayed. Select two or more objects to align and press Enter. With this command, you can easily control the spacing or alignment direction.

## SMART DIMENSIONS

In AutoCAD Architecture 2016, the updated DIM command is now accessible from the ribbon and is smart enough to detect objects and provide various visual dimension options. The DIMLAYER command can be used to create a new layer for dimensioning. You are given horizontal, vertical, and aligned dimension previews when you select a linear object. From these previews, you can simply place the desired dimension. You can also select another non-parallel linear object to display and place an angular dimension. You can specify a type of dimension by using the various dimensioning options in the right-click menu. The default values are automatically assumed for the dimension text and angles, but you can still change them from the right-click menu or command line. The DIM command remains active until you exit the command, allowing you to knock out multiple dimensions at one time.

## RENDERING

The new rendering engine in AutoCAD Architecture 2016 is simpler to use and yields better results. The Render ribbon panel on the Render ribbon tab is updated to support the new rendering engine. It includes a size drop-down where you can quickly select from standard pre-defined render sizes (see Figure 5).

The Render Presets list includes additional options enabling you to control the render quality by setting either the number of levels to render or how much time to render. The new Render Presets Manager is much simpler than the previous Render Presets Manager. You can create, modify, and delete custom Render Presets. Specify Render Preset name and description as well as the dura-

tion and accuracy. You can render directly from the Render Presets Manager, choosing to render in the Render Window, the current viewport, or a specified region in the current viewport.

When rendering in the render window, a drop-down list enables you to select from a list of standard render output sizes or choose More Output Settings to access the new Render to Output Settings dialog box. In the Render to Size Output Settings dialog box, you can specify the image size and resolution. You can also choose to automatically save the rendered image to a file including BMP, TGA, TIF, JPEG, and PNG formats.

A new Render Environment & Exposure palette offers powerful new Image Based Lighting (IBL) environments. When the Environment control is turned on, you can select from pre-defined, image-based lighting environments. The image-based lighting environments automatically apply lighting effects. Some of them include 360 background images that emulate a realistic environment as you orbit around the model. The viewport must be in a perspective view and you must render to see the IBL environment.

A control in the Render Environment & Exposure palette enables you to use a custom background image. Custom images are static and do not emulate a realistic 3D environment as you rotate. Additional controls in the Render Environment & Exposure palette enable you to adjust the Exposure and White Balance. The Exposure slides between Bright and Dark. The White Balance slides between Cool and Warm. The new render window displays the current render process and allows you to save a snapshot, zoom in and out while rendering, and print the rendered image. Render history is displayed in the expanded section of the render window.

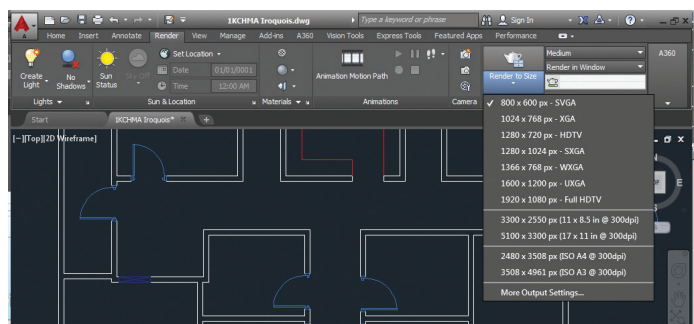
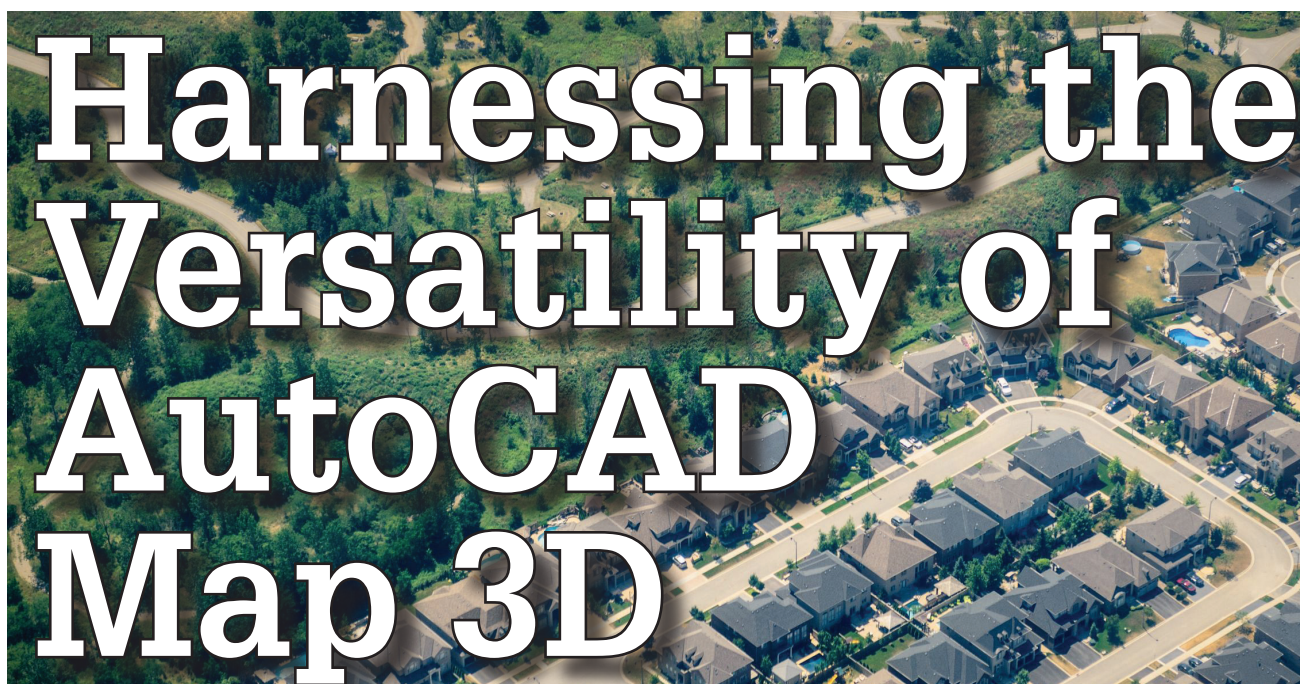



Figure 5: Render to size



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](mailto:melinda.heavrin@nortonhealthcare.org)



# Harnessing the Versatility of AutoCAD Map 3D

 Using AutoCAD® Map 3D at Welland Hydro has helped us ensure maximum efficiency and versatility. In this article, I explain how the Canadian utility has gone from “rags to riches” in terms of asset management, outage management, and GIS software. Thanks to the versatility of AutoCAD Map 3D, Welland Hydro has become one of the leading utilities in Ontario using the advanced technology at a relatively reasonable cost.

## THE BIG PICTURE

Back in 2006, Welland Hydro was in the market for a scalable and powerful yet cost effective tool to keep track of our assets and to do system condition assessments from the field. We had our goals set, but needed to outline the many challenges to overcome:

- ✦ Reducing the number of paper copies being distributed
- ✦ Keep maps and information up to date without editing multiple drawings
- ✦ Keep track of assets and their conditions
- ✦ Keep connectivity active throughout the entire organization
- ✦ Keep information in one central area (database)
- ✦ Increase efficiency and reduce job output time
- ✦ Use proven technology that continues to innovate and allows integration with other systems
- ✦ Obtain a system that maintains data security
- ✦ Ensure ease of implementation and transition of existing data
- ✦ Ensure easy move to new versions

Because AutoCAD Map 3D is layered otop of the existing AutoCAD® framework, a large benefit to using this software is its familiar interface. We are able to streamline our processes with a single application for CAD and GIS. Another benefit to using AutoCAD Map 3D is the open architecture on which it is built as users have the ability to develop better interoperability with other systems and software.

The first step in becoming “digital” was deciding an efficient way to input all of our records into AutoCAD Map 3D. Since many of the drawings were drawn by hand in the late 1940s to 1990s, the utility was able to scan the files and input them into the GIS using AutoCAD Raster Design. This helped greatly with converting the information from paper to digital and it allowed the worker to ensure all data was correct prior to input.

While entering the information, we needed to also ensure connectivity between all devices and conductors in the software in order to create a proper electrical and structural topology. This allowed us to create electrical connectivity traces from breakers all the way to the meter and also enabled the us to reconfigure circuits and phasing, all from the comfort of our own office chair—a benefit in seeing the entire system in one big picture. Now, I know what you’re thinking... Yes, most utilities do have some type of GIS or asset management software, but what makes AutoCAD stand out from the rest?

## ASSET MANAGEMENT, ASSESSMENTS, AND MAINTENANCE

Welland Hydro is responsible for the safe delivery of electricity to its customers. The assets the utility looks after includes 8,000 poles, 2,500 transformers, and almost 500 kilometers of



overhead and underground cable. Being a smaller utility servicing approximately 22,000 customers, Welland Hydro has a slight advantage on many other (larger) utilities in that less man power is needed to do such assessments. We make sure to keep track of any maintenance or replacements to assets in order to conform to regulatory demands.

Once the information from the external drawings was entered into AutoCAD Map 3D, it was time to start looking at the data as one big picture and create an Asset Management Plan. Managing our assets and conducting system condition assessments are important to ensure that the utility meets regulatory requirements and keeps operating with minimal outages due to asset failure. These assessments can now be done via mobile devices (smart phones and tablets) and the information is written directly to the GIS database (Oracle). All accompanying documents are also scanned and attached to the asset in AutoCAD Map 3D.

With a few clicks of the mouse, we can produce a drawing and a report displaying assets within the system boundaries that need attention or have surpassed their "useful life." A report like this is

important because it gives the utility a good idea of what areas will need attention before others. This also plays a key role during the budgeting process.

## OUTAGE MANAGEMENT AND ANALYSIS

Welland Hydro's newest project with AutoCAD Map 3D software was implementing a procedure to receive filtered outage and restoration alarms from residential smart meters. The information is then displayed graphically within AutoCAD Map 3D. Because of the software's versatility, Multispeak is used to direct the alarm traffic into the GIS database, which then displays an alert for every meter without power. Users have a live view of the distribution system and are notified when an outage does happen, all within AutoCAD Map 3D. Cool!

Our line crews in the field have full access to any map, and can view it directly on their truck tablets. The "geo-location" feature is also a handy tool as it gives them a great visual on where the outage is happening,

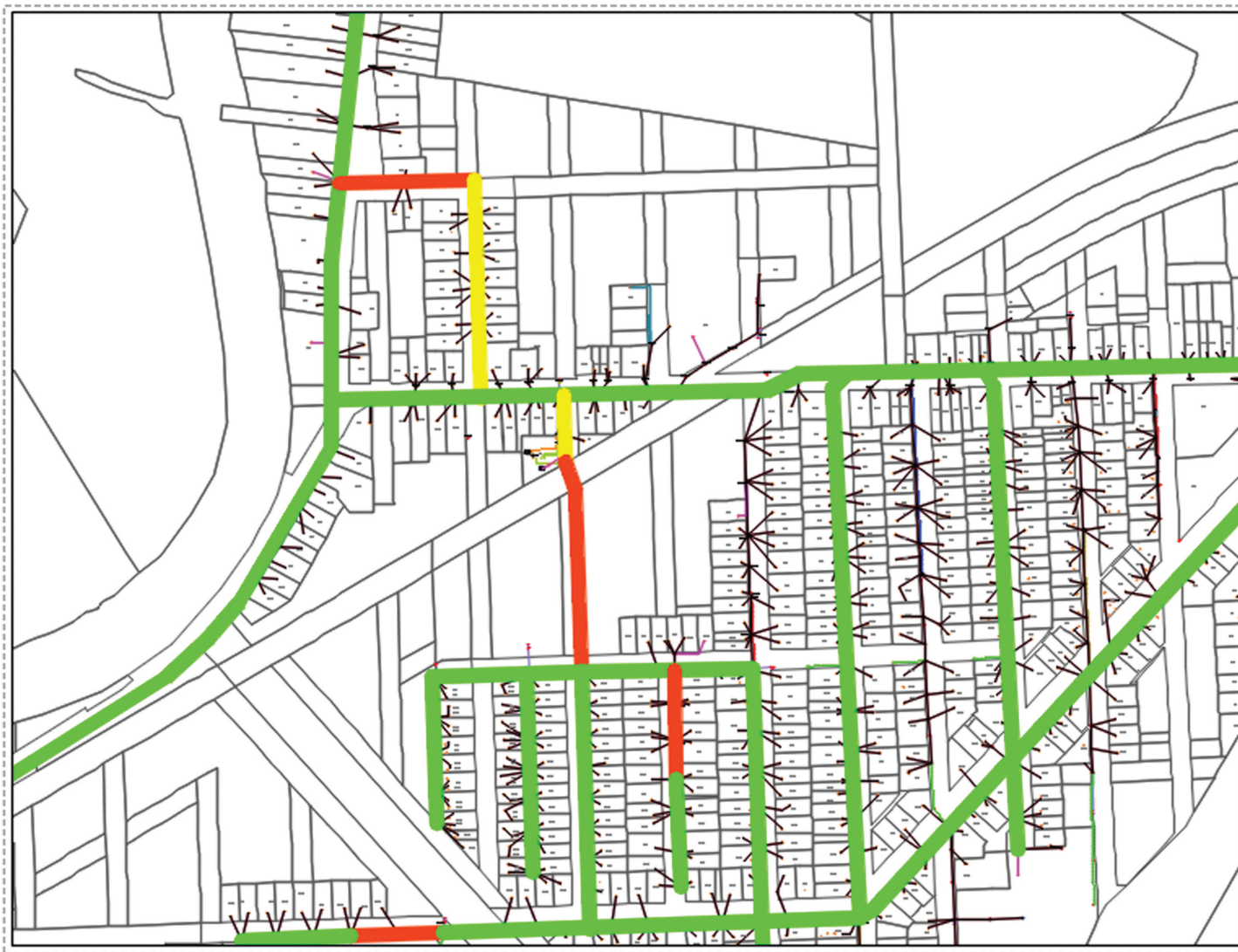


Figure 1: A snapshot of Welland Hydro's Distribution System displaying age and condition results after a System Condition Assessment. These assessments are completed every few years as a precaution to ensure that our system reliability remains high. An assessment usually takes 3-4 days.



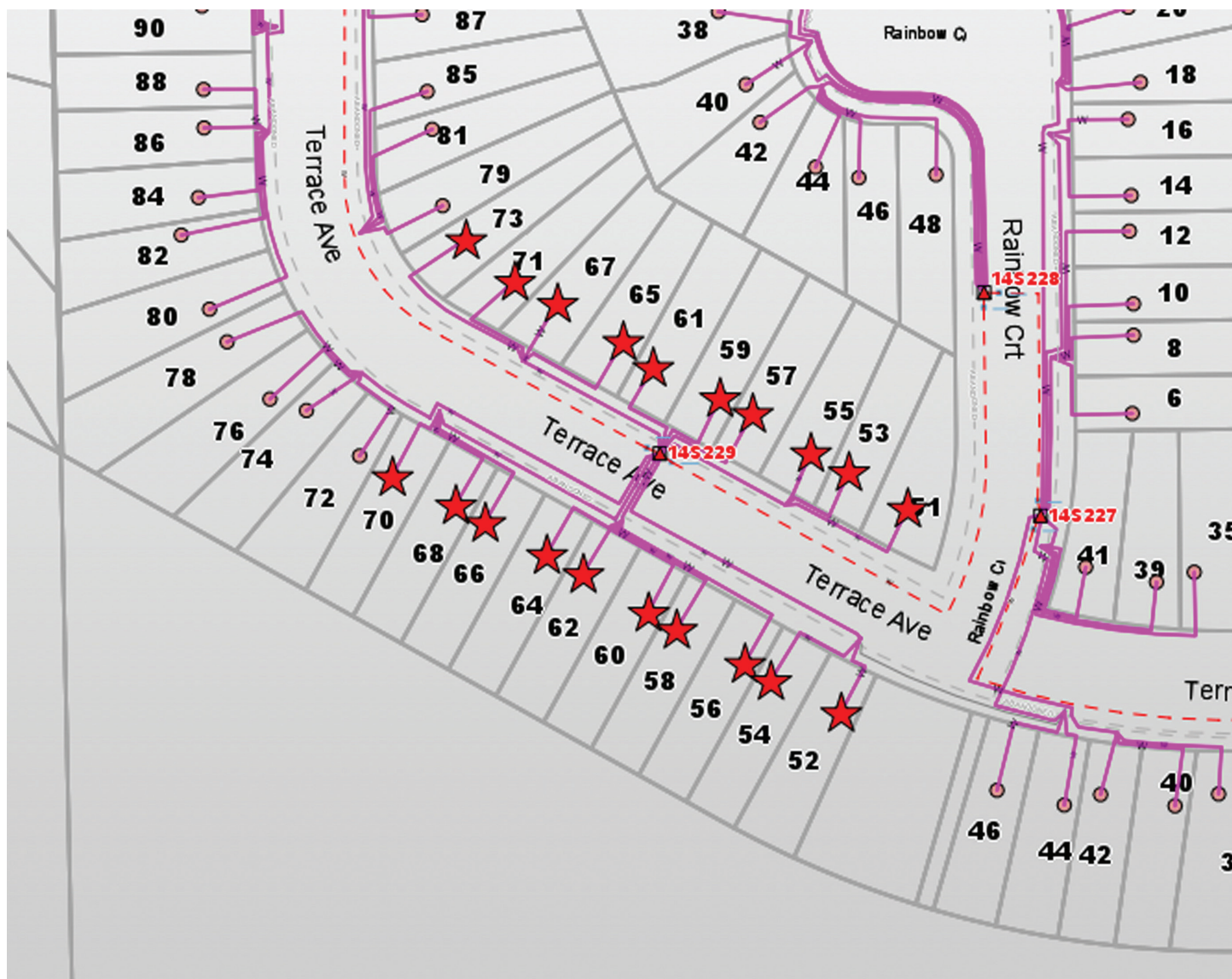


Figure 2: Outages can be viewed on the Internet via AIMS (Autodesk Infrastructure Map Server) and on mobile devices using the Mobile Viewer. The stars indicate an "outage."

and how to get there in a timely manner. Our Operations department houses two large TV screens which run the outage viewer through the Internet. As the crews work on the outage and start bringing customers back in power, the outage icons on the map will disappear and all of the restorations are logged with a time stamp so we can generate our Outage Statistic Reports for regulatory reporting requirements. Being able to physically visualize the outage makes it much more efficient for the operators to dispatch crews to the right areas. This ultimately reduces the outage time for the customers and we can visually verify that all customer's power has been restored.

In the future, Welland Hydro plans to write in an algorithm which will automatically suggest what the problem may be (e.g., transformer, fuse, switch, etc.). This will further enhance the Outage Management System and enhance the SCADA (Supervisory Control and Data Acquisition) alarm notifications.

Having AutoCAD Map 3D implemented at Welland Hydro has proven to be one of the best engineering and operations invest-

ments the utility could have made. With the software's power and versatility, the sky is the limit with customization and having the program do exactly what you want it to do. And the best part? Being able to modify and customize the program to your company's taste from your own office at no extra cost.



Thomas Wilga currently works as an Engineering Technician and GIS Coordinator for Welland Hydro Electric System Corp. He is an Autodesk Certified Professional and his experience with Autodesk products spans more than 15 years. His first taste of the 'CAD world' was with R.14. Thomas is also a regular attendee of Autodesk University and was a first-time speaker in 2013. He can be reached at [twilga@wellandhydro.com](mailto:twilga@wellandhydro.com).



# New 6TH Generation Core™ i7 to 4.50GHz



## Xi PowerGo Laptop @ 4.40Ghz

As tested by Desktop Engineering our newest workstation scored record performance numbers against all contenders and is defined: "once again the best bang for your buck". Our CAD Laptop@ 4.4GHz & Quadro Video up to the K5100M are the most powerful ever. In Stock new "Skylake" based Workstations! Save \$1000+ over "Boutique Box Builders" prices. Proudly Custom Built in the US & sided by a superior domestic technical support & the best warranty, for 25+ years Xi® Computers delivers the best performance and value.



**NVIDIA.**  
**QUADRO®**

### MTower PCIe      PowerGo XT      MTower 2P64X

- |   |   |   |
|---|---|---|
| <ul style="list-style-type: none"> <li>- Intel® Core™ i7-6700K to 4.5GHz</li> <li>- Intel Z170A C.S. PCIe 3.0</li> <li>- 16GB-DDR4 2666/3000MHz</li> <li>- NVIDIA®Quadro® K620 2GB 2H</li> <li>- 256GB SSD M.2 PCIe 2150MB/s</li> <li>- 74 in 1 Card Reader, USB 3.1</li> <li>- Xi®MTower Ultra Silent Tower</li> <li>- MS Windows® 7/10 Prof. -Linux®</li> </ul> | <ul style="list-style-type: none"> <li>- Intel Core i7-2.5 to 4.40 GHz</li> <li>- up to 32MB Cache, 4/6 Cores</li> <li>- 8GB DDR3 1866MHz to 32GB</li> <li>- NVIDIA®Quadro® K1100/5100M</li> <li>- 500GB SATA6 Hybrid 8GB SSD</li> <li>- 15.6/17.3" 1920x1080NR LED</li> <li>- Speakers, Camera, Mike &amp; Wi-Fi</li> <li>- Microsoft® Windows® 7/8.1-64Bit</li> </ul> | <ul style="list-style-type: none"> <li>- New E5-v3 Intel Xeon®Processor</li> <li>- 10/35MB L3Cache, C612 Chipset</li> <li>- 16GB DDR4-2133 ECC to 256G</li> <li>- NVIDIA®Quadro® K2200 4GB</li> <li>- 250GB Samsung® EVO™ SSD</li> <li>- 27" 1920x1080 LCD Monitor</li> <li>- Xi®MTower 750/1300W Thor</li> <li>- MS Windows® 7/8.1Pro®-Linux®</li> </ul> |
|---|---|---|

4-Core i7-6700K 4.10GHz \$ 1,989	i7-4710MQ 15.6 K1100M \$1,549	1x4-C E5-1620v3 3.6GHzTB \$2,449
4-Core i7-6700K 4.50GHz \$ 2,499	i7-4790K 4.4GHz K3100M \$2,499	2x14-C E5-2695v3 2.3GHz \$8,169



**Render-RT™ water cooled personal HPC**  
**w/36 XEON®cores & NVIDIA®Tesla™ K40 GPU**  
**Visit our website & configure yours now!**



Xi®Certified for AutoCAD®2016, 3ds Max®, Inventor®, SolidWorks®, Maya® & Revit®. Custom built in the US from 100+options to match your applications and your budget. Business Lease from \$ 59/month.

**www.xicomputer.com**  
**1-800-432-0486**

Core Inside, Intel, Intel Logo, Intel Core, Intel Inside, Intel Inside Logo, Xeon, and Xeon Inside are trademarks of Intel Corporation in the U.S. and other countries. MS, Windows, are registered trademarks of Microsoft Corporation. NVIDIA Maximus available on selected platforms. Xi and the Xi logo are registered trademarks & MTower, NTower, NetRAIDER, WebRAIDER, PowerGo, Render-RT are trademarks of @Xi Computer Corp. Prices do not include shipping and are subject to change without notice. For more details about Xi warranty and service call or write to sales@xicomputer.com. Prices and specifications are subject to change without notice. All other trademarks of their respective companies. Copyright © 2014 @Xi Computer Corp.

# Process Evolution

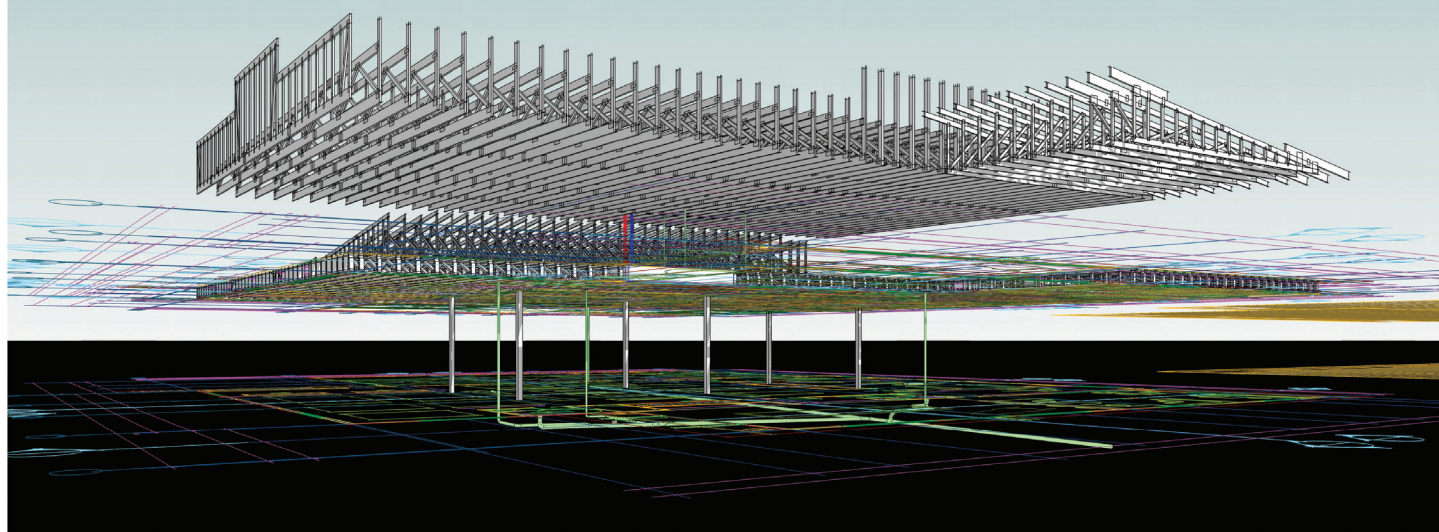


Figure 1: Revit – AutoCAD Coordination Plumbing Model

**I** work for Harvey's Plumbing and Heating, which provides services for a wide range of high-end custom residential homes. The homes range from 6,000-30,000+ sq feet. The following process may seem impractical on the implementation side for these smaller homes, but has proven to save time and increase understanding in the field. It has also led our bids to be immensely more accurate, and allowed for efficiencies of communication in the field.

I began working at Harvey's in November 2014, and over time I have been developing ways of integrating our database with Autodesk® Revit®. I wanted to be able to use the data that's in our bidding process to be passed through to our design to assist our models, with information, for a hand-off deliverable to our plumbers in the field and eventually to the owner.



Since beginning in late 2014, there have been a few victories along the way, which have helped us evolve our process and are quickly getting us to where we need to be. We have built several Revit-based assemblies of our plumbing systems, courtesy of our utilization of SysQue, and have them in our template file for placement.

## REVIT MEP WORKFLOW

Harvey's Plumbing Assembly Library Example (Figure 1) – Each plumbing assembly is referenced to our accounting software, which in turn is tied to an assembly number. This example illustrates our kitchen sink assemblies and how our assemblies look after placement. We have other categories such as tubs, showers, toilets, etc. Fittings courtesy of BuildingData and automated through SysQue (Figure 2).



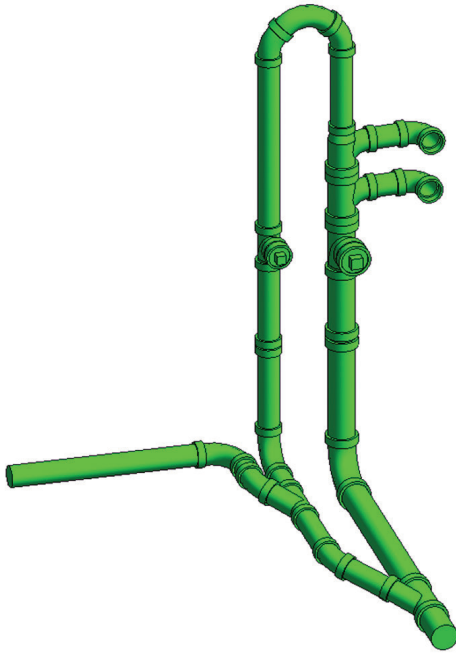


Figure 2: An example of one of our plumbing assemblies.

The next goal, after getting the groundwork laid with our template, was to figure out how to tie this data to the deliverable in the field. We began by giving spool sheets to one of our plumbers to take out into the field. We realized quickly that the problem with doing this were design changes out in the field or clashes—i.e., studs, floor joists, and roof trusses—that

are simply not accounted for in the architectural drawings and/or in the office due to the structural engineer not having a 3D model to coordinate with.

One way we began to mitigate this was by contacting our local lumber yard to figure out what software they utilized for their roof trusses and floor joists. They let us know that they use MiTek Sapphire. After some research we realized the structural framing model was modeled in 3D, and through coordination, communication, and now collaboration we have opened the door to allow for those files to import into Revit by simply requesting a 3D .dxf from the local lumber yard.

The beauty in this is that the architect's model can be leveraged to coordinate with the 3D structural drawing, and in turn our mechanical drawings can fit right in place. Of course, on the other side of this coin is when you receive a 2D drawing or if the structural engineer has provided only a 2D drawing and isn't ordering the lumber from a 3D generated model. We leverage as much as we can into understanding the drawings, but this leads us to wonder how this can be fixed or adjusted in the field.

## COORDINATION OF PLUMBING ASSEMBLIES & BRANCH LINES WITH FLOOR JOISTS

After a long conversation with Jay Ayala of Autodesk, we were able to get a little more clarity on this particular problem. He suggested a point layout system that would allow us to leverage the data in the field back to our design.

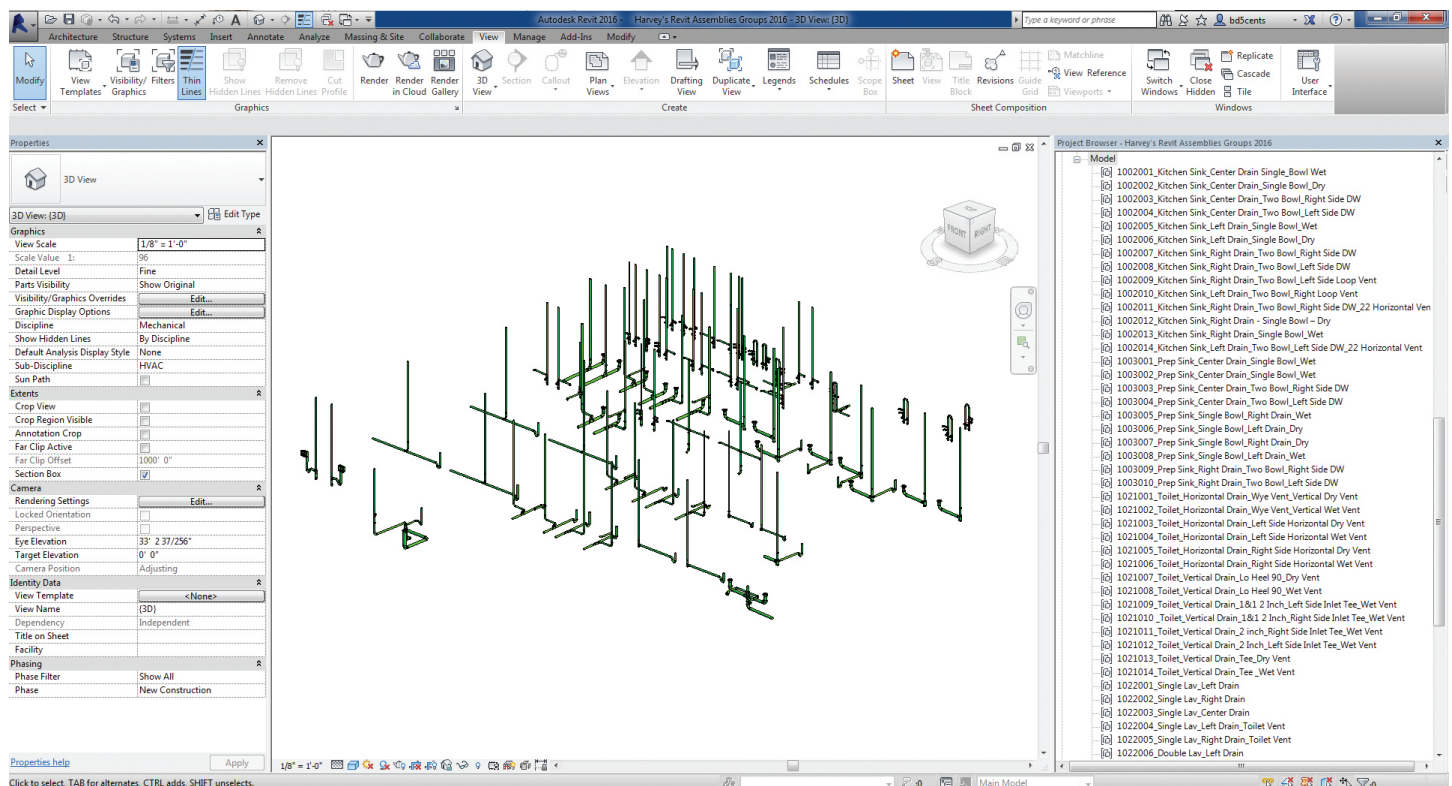


Figure 3: Plumbing Assembly Template

# Revit MEP

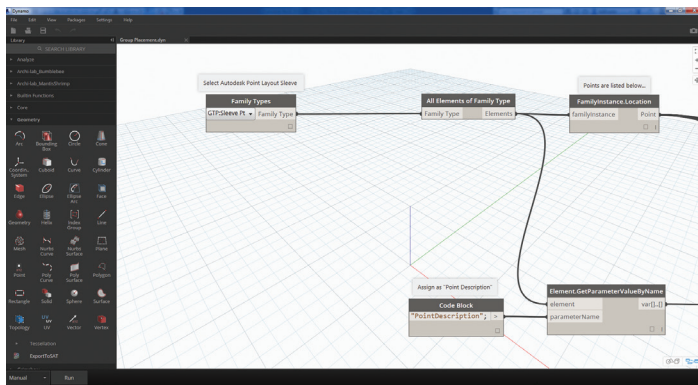


Figure 4: First portion of dynamo fueled script.

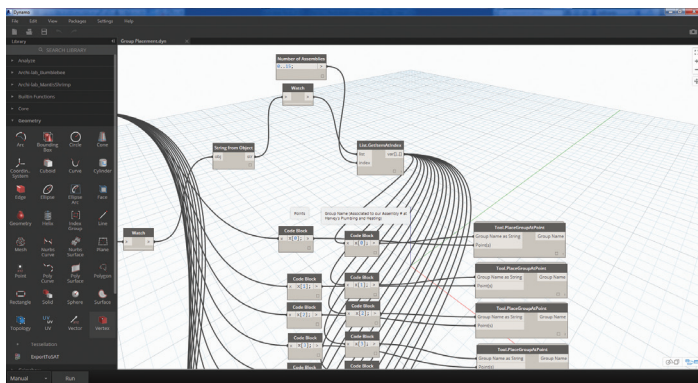


Figure 5: Second Portion of Dynamo Fueled Script. Rows can be added or subtracted to accommodate the number of assemblies in the drawing.

After this conversation a few questions ran through our heads. How can we leverage these points into our plumbing assemblies, and how can that data adjust to our current workflow? Also, what can we do

to our current workflow to allow for this sort of interaction between field communication and drawing communication? As for now some of the questions remain unanswered, and that's why I'm posting this article! This also allowed us to think a little more outside of the box.

## DYNAMO SCRIPTING FOR ASSEMBLY PLACEMENT

After diving into Dynamo, I was able to make a discovery of how we might be able to leverage it into the equation to resolve some of these questions. Bear in mind I am not a coder, and have only done a little visual scripting in college using Grasshopper for Rhino. What I'm trying to say is, if something I've done can be achieved in a better script I would love to see it and implement it!

First I decided to see how I can select the points and place an assembly.

- Place a SysQue sleeve (points already embedded into the family) or an APL sleeve (point/trimble point in each location of the assemblies).
- Have Dynamo choose those points to place the groups and place the assembly tied to the selected point.
- Place Group by Selection(s) – selecting the node and placing the group that is listed in the string. Obviously, all groups must be loaded into your Revit project.

The above node worked well, but we ultimately wanted to be able to select each sleeve in the project and have that tied to every point in the project. So, I began stringing some lines and thinking about the end goal with a starting point in mind. It led me to connect the

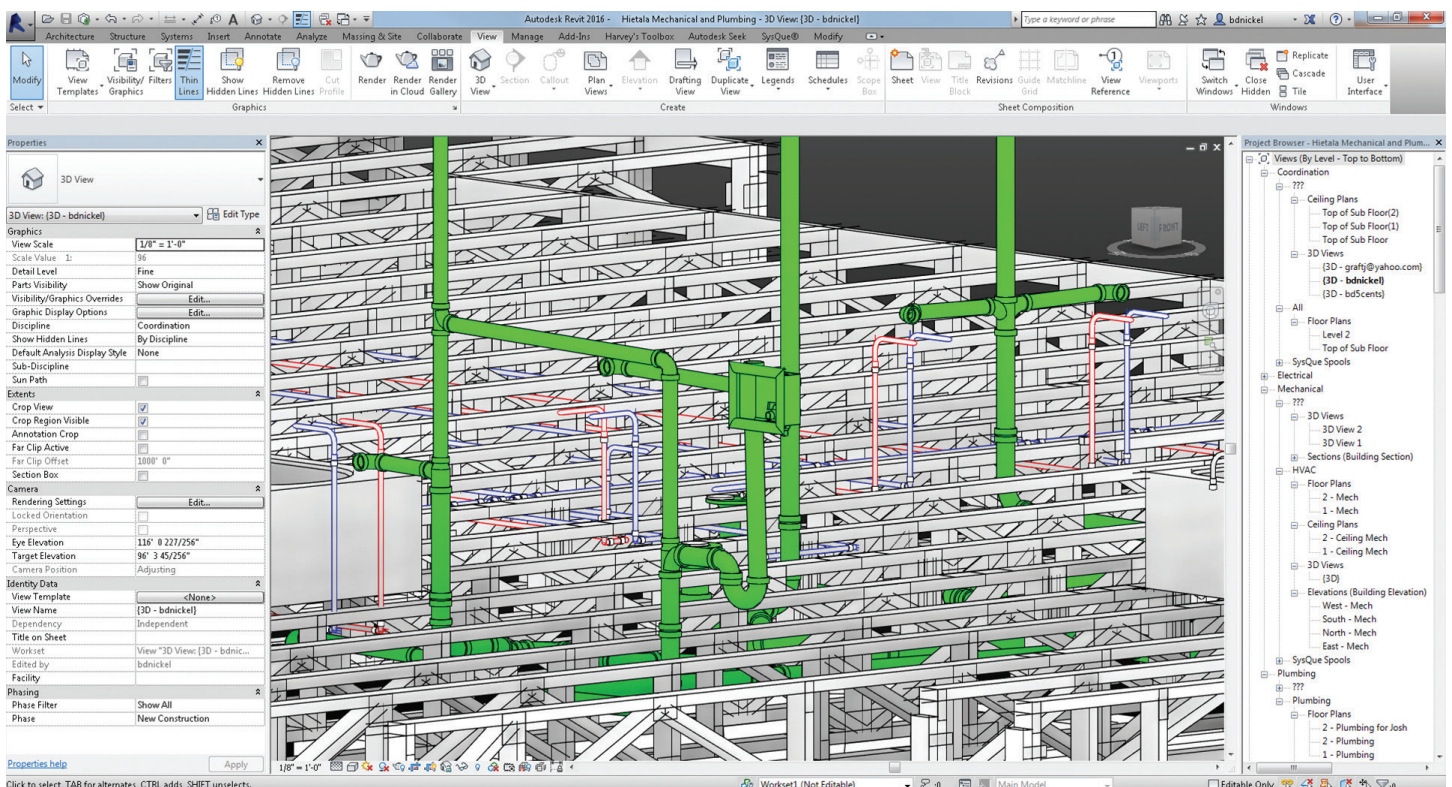


Figure 6: Coordinated Revit Model with local lumber yards three dimensional truss from MiTek Sapphire software.



dots, and in turn find a successful solution. I decided to follow the following steps this time around.

- Select the model element Sleeve or Pt
- Attach the string code block “PointDescription” to allow for the point description to fuel the data being used for placement of the families. The PointDescription parameter within each sleeve family contains the values of our matching assemblies on file, referenced back to the original accounting software.

## PLACING MULTIPLE GROUPS ASSOCIATED TO A PARAMETER

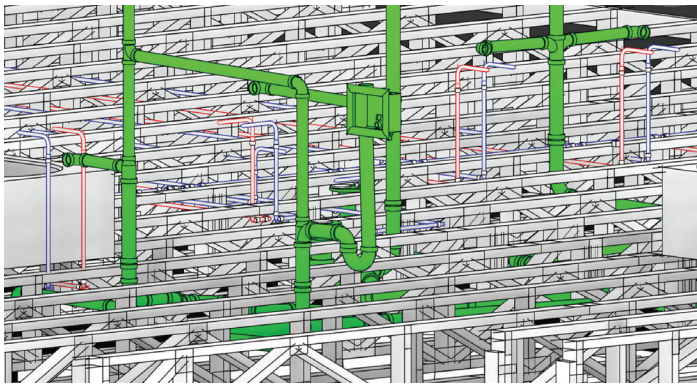


Figure 7: Assembled Systems in context of model for coordination of pre-engineered truss system and eventual fabrication.

The method in Figure 7 allows us to count the number of groups in the assembly provided by the master plumber, and then to type a sequence code block that then fuels the other code blocks to reference the point description and family point locations. All this data places the groups on the associated sleeve that the family needs to reside. Ultimately we are looking at automated assembly placement and rotation after placement, associated potentially to another parameter. At this point in time it hasn't been further developed.

I still believe there may be a more streamlined approach towards accomplishing this, but the goal is to allow for the point data in the field or manually entered points to automate our assembly place-

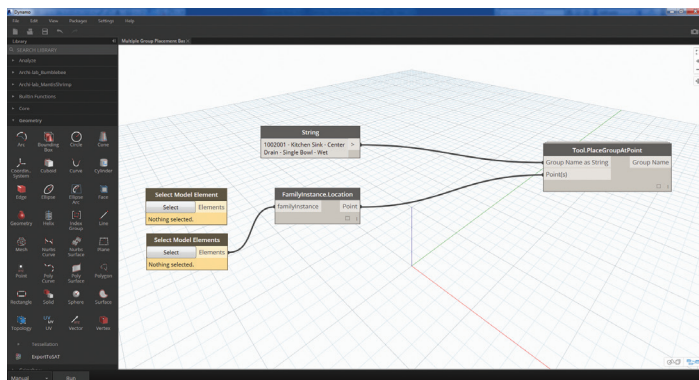


Figure 8: Select Model Element(s) place group by string of Assembly Name. This can also be modified and broken down through the use of lists.

ment. This data ensures that our plumbing assemblies are being placed in the right locations, and also allows for that coordination between the bidding, design, field coordination, and fabrication all fueled by Dynamo. (See Figure 8 for the installed assembly.)

Name	Date modified	Type	Size
1002001_Kitchen Sink_Center Drain_Single Bowl_Wet	7/14/2015 11:30 AM	Revit Project	2,300 KB
1002002_Kitchen Sink_Center Drain_Single Bowl_Dry	7/14/2015 11:30 AM	Revit Project	2,300 KB
1002003_Kitchen Sink_Center Drain_Two Bowl_Right Side DW	7/14/2015 11:30 AM	Revit Project	2,320 KB
1002004_Kitchen Sink_Center Drain_Two Bowl_Left Side DW	7/14/2015 11:31 AM	Revit Project	2,320 KB
1002005_Kitchen Sink_Left Drain_Single Bowl_Wet	7/14/2015 11:31 AM	Revit Project	2,304 KB
1002006_Kitchen Sink_Left Drain_Single Bowl_Dry	7/14/2015 11:32 AM	Revit Project	2,304 KB
1002007_Kitchen Sink_Right Drain_Two Bowl_Right Side DW	7/14/2015 11:32 AM	Revit Project	2,316 KB
1002008_Kitchen Sink_Right Drain_Two Bowl_Left Side DW	7/14/2015 11:32 AM	Revit Project	2,316 KB
1002009_Kitchen Sink_Right Drain_Two Bowl_Left Side Loop Vent	7/14/2015 4:48 PM	Revit Project	2,956 KB
1002010_Kitchen Sink_Left Drain_Two Bowl_Right Loop Vent	7/14/2015 11:33 AM	Revit Project	2,956 KB
1002011_Kitchen Sink_Right Drain_Two Bowl_Right Side DW_22 Horizontal Vent	7/14/2015 11:34 AM	Revit Project	3,420 KB
1002012_Kitchen Sink_Right Drain - Single Bowl - Dry	7/14/2015 11:35 AM	Revit Project	2,304 KB
1002013_Kitchen Sink_Right Drain_Single Bowl_Wet	7/14/2015 11:35 AM	Revit Project	2,300 KB
1002014_Kitchen Sink_Left Drain_Two Bowl_Left Side DW_22 Horizontal Vent	7/14/2015 11:36 AM	Revit Project	3,424 KB

Figure 9: A sample of our archived group assemblies on the server for future use, and utilized through our template file.

The intent of this article is to achieve an evolution of residential construction assembly creation and field placement. If something in this article may be done in a different or more efficient way, I would love to learn from other professionals in the industry. Through collaboration and coordination we can better our industry and become more efficient together.

### Special thanks:

To Marcello Sgambelluri for your resources for new Dynamo users like myself. Also for providing me with some feedback.

To BuildingData, Lewis Wolcott, for clearing up the unknowns about your content and providing us with data that actually works.

To SteamNodes for allowing us to place our groups with the Place-Group.ByPoint node.



Brian D. Nickel is a mechanical designer by trade and a senior in architecture school at Montana State University in Bozeman, Montana. He has been using Revit since 2006 (Revit 6.0) and has used it religiously since then. Currently Brian is continuing his learning through his architectural studies and through the workplace. He works for Harvey's Plumbing and Heating in Bozeman, helping to get Revit up and running in the office. In this environment, Brian challenges his Revit skill set by leveraging what he has learned through architectural firms toward learning more about a subject that was a bit out of his "comfort zone." Contact Brian at <http://therevitsaver.blogspot.com/>, 951.218.6673 or bd5cents@gmail.com.



# An Interview with Daniel McFarland



➔ In my Revit® and BIM, VDC travels, so to speak, I talk with a lot of folks about the transforming world of AECO and within these conversations I think it of benefit to give space here for a Q&A to colleagues whose considerations I find personally and professionally helpful. This year's interview is with Daniel McFarland. With that in mind, I hope you too find some gold that you can apply to your part of the spectrum we call BIM. – Jay Zallan

## EXAMPLES AND MISCONCEPTIONS

**JZ:** What makes great models great in the Construction phases?

**DM:** Great models are models that are coordinated with themselves and all other discipline models and continually progress in development, in response to and in concert with construction needs.

That said, one of the biggest misconceptions of modern construction is that there are still clearly defined, distinct phases to a project. I don't see this as valid any longer.

Fast tracking and compressed schedules have blurred the traditional divisions of SD, DD and CD, CA. This may sound strange to many, but consider it—we start building models using Revit during preliminary discussions with clients, even when initially studying feasibility and broad options.

To my knowledge there are a seeming few contractors using completely customized 3D estimating workflows, which helps set us and some others apart. Many of even the major construction firms begin with architecture and engineering models during SD phase; not us, we don't or can't always wait that long.

One of the reasons to use such a system is that we can, in turn, pass this information on to subcontractors who build their own model for permit, construction documentation, and fabrication from the original architectural and engineering models. Supplemental models will often be employed to keep track of and document changes to the original proposal.

Many RFIs from engineers and architects are handled with sketches, so those models will lag behind the actual construction design. Supplemental models help track changes and are often

the only means of coordinating the multiple subs and consultants on a job. At the same time we begin the process of integration into Navisworks®, building custom search sets for clash detection and coordination of Federated Models, including models built by subcontractors.

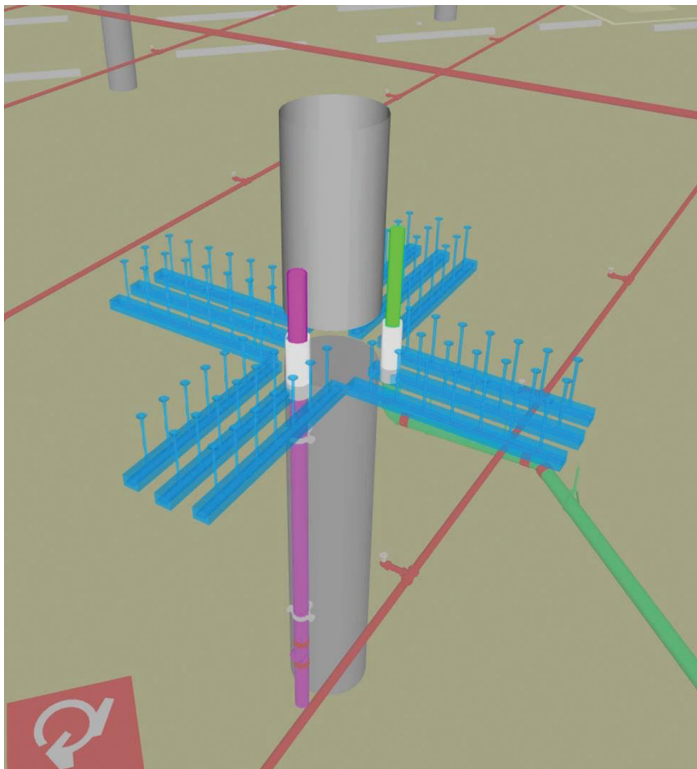
Information that is developed in the creation of details needs to be pushed back into the larger context of the model. Changes in a detail can drastically change building scale elements. For this reason I am a huge proponent of taking the details directly from the model, with some added notation and fine detail in a detail view.

Often it is found that even in a BIM project model, changes to a plan will not be tracked through different portions of the documentation. An example would be changes in plan don't get pushed to sections, elevations, and RCPs. As important as the 3D model is we still need 2D documentation for many reasons. Due to the diverse nature of communication and needs of different software, such 2D documentation is still hugely important, but must be dealt with at a higher level than traditionally has been found produced.

## FOCUS | WHEN?

**JZ:** Are there some suggested, valuable, yet often overlooked things that your teams model to great benefit?

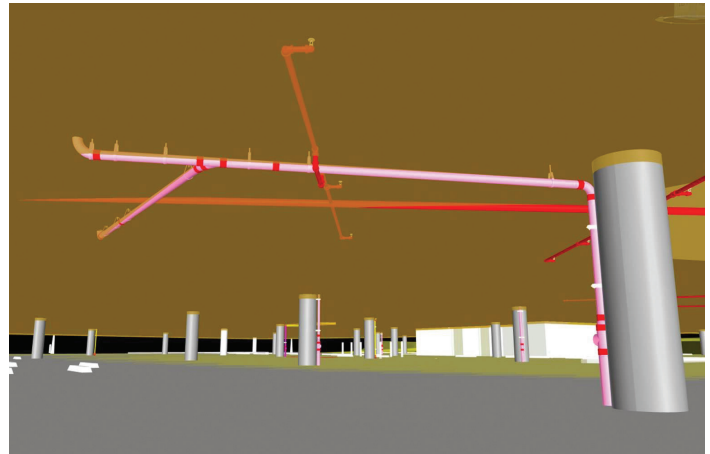
**DM:** Our team will model things that are not often seen—things like stud rails, footing surcharges, post tension tendons, no-fly zones for parking clearance, door clearances, king studs, structural reinforcement, and sleeves.



We will often model these things as soon as we have useful de-

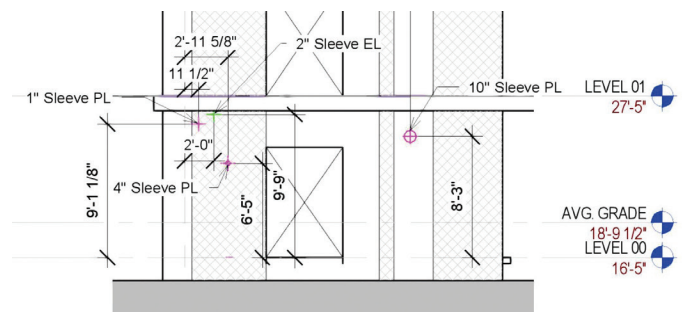
sign information. We prefer using 3D elements since it reduces the chances of error and they can be included in preliminary and ongoing clash tests.

These unseen elements have a huge effect on the design and the schedule. Giving designers of all types this information as early as possible is always a positive choice. Clearance zones, for instance, are useful when coordinating with Navisworks, since they can be included in a clash test and conflicts can be quickly identified and planned for resolution.

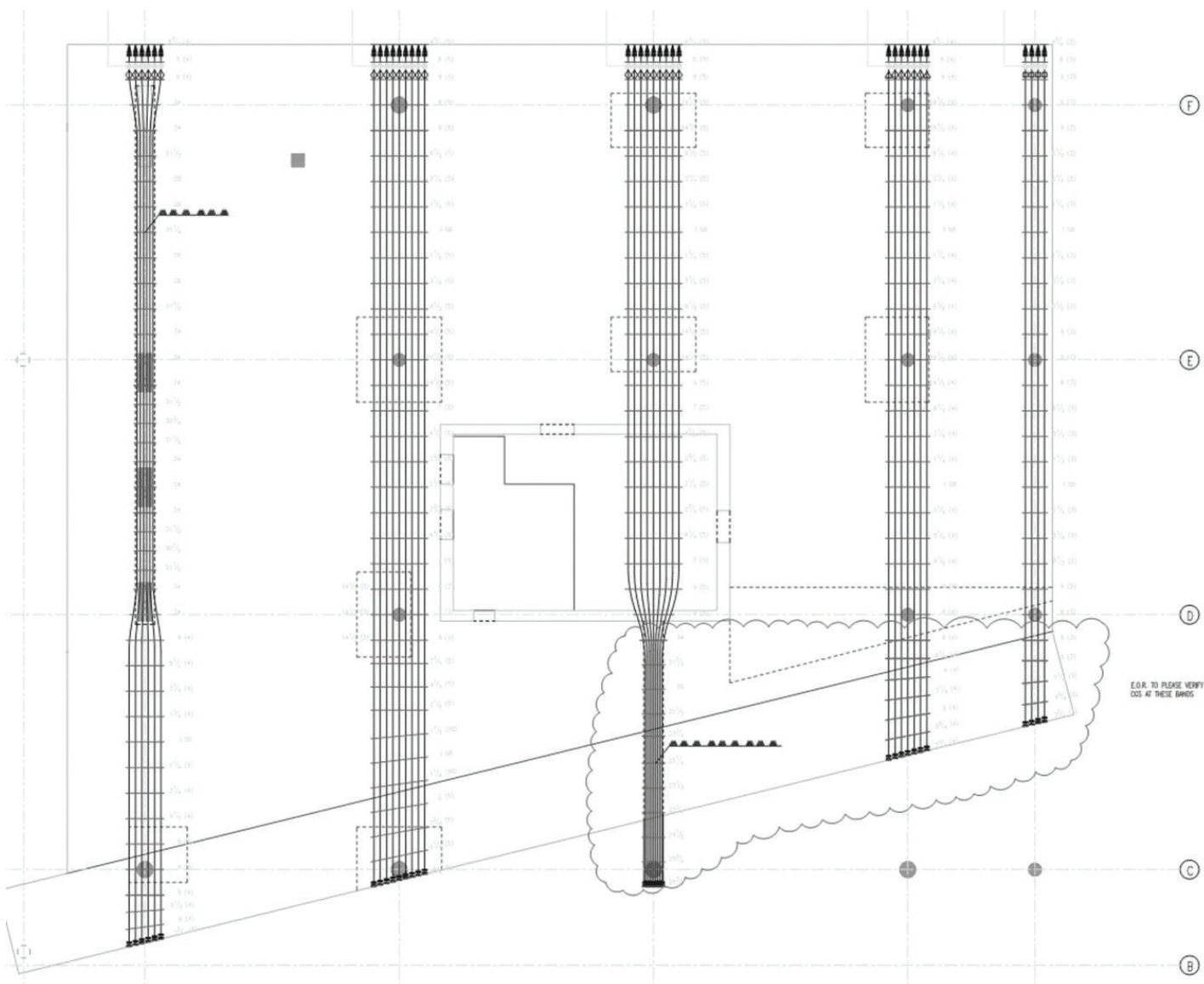


Here in Los Angeles, we are in a substantial seismic zone and as a result heavy concrete shear walls are often used to resolve seismic loads. The services of the building MEPF often need to penetrate these walls with pipes and sleeves to run services up through buildings; models need to reflect this.

Such penetrations and sleeves can run as large as 10" or 12" or more in diameter, etc. An area of a shear wall containing #5 rebar (.625") @ 4" O.C. does not leave room for necessary services without penetrations and sleeves, so each penetration in a given area may have to be engineered and detailed. Providing the visual locations of sleeves, etc. allows the teams time for early adjustment to the placement or re-placement where and when possible. These construction-inspired design influences can see services routed to areas of sparse rebar, which can accelerate a project and save a great deal of time and money for all teams concerned.



Again, being a physical “no-fly zone,” these too can be included in simulations and clash tests for fast and easily understood results.



## BIM WILL SOLVE ALL YOUR PROBLEMS

### And Other Fallacies

Perhaps the biggest fallacy we find is that BIM will solve all your problems. It won't.

BIM is inherently a collaboration process. It is a highly sophisticated collaboration tool, but is only as good as its users. The best instruments in the world do not make a symphony transcendent alone—without great musicians, conductors, and the like, there would be no beautiful music; so too it is with BIM.

BIM won't solve all your problems, but what it can do is help improve communication so you can solve your problems—often before they are problems. BIM facilitates, if not forces, more communication, information sharing, and collaboration. In my opinion this collaborative communication and information sharing are its major contributions to the building processes.

Gone are the days when a consultant could work without collaborating, and without collaborating responsively. Within BIM, the information is at every moment right there on the screen and/or sheet, if we only take a moment to look.

If we miss information, then chances are we have not looked at the plethora of information available to us; it can be as simple as that.

If in fact we do take the time to look at the information—starting early and continuing often—we find that such projects stand out and serve to make our lives so much easier, even as buildings become more complex.

**JZ:** Do you have advice for improving modeling or efficiency?

**MD:** One of the things I have seen on successful projects is to have a simple QAQC regimen; for instance, have someone unfamiliar with your model review it once a week.

Yes, I did say unfamiliar!



Thirty minutes can do wonders toward finding sloppy mistakes that we all can make and overlook. Often we become so familiar with something that we don't see the errors.

Our brains project what we expect to see and not what is actually in front of us much of the time. I have heard of artists turning a canvas upside down to see their work in a new way. Not terribly functional with a computer screen, but by having someone unfamiliar with the project look at the model and sheets they can and often do quickly notice errors that we have become accustomed to seeing and overlooking. This ongoing process, carried out over just a few weeks even, has been proven to drastically improve model and team efficiencies.

**JZ:** Will you (and if so, when) repair architects' and/or engineers' models?

**MD:** We leave the architects' and engineers' models untouched. Full stop.

If there has been a major change to the project that has not been updated yet, we will remodel that element in a supplemental model. It's a simple exercise to hide the original incorrect portion of the original model in Navisworks. This way we don't disturb the intended and official nature of the author's work and yet we can achieve the desired effect of having a correct model, thus a correct set of models for coordination, estimating, etc.

Supplemental models will contain anything from a few elements to major portions of a building. If and when the original model gets corrected or further development takes place, then parts of the supplemental model(s) can be removed from the process.

## CONCLUSION

To wrap this up, I will paraphrase a few of my favourite quotes and send you off to create great(er) Revit models and more and more coordinated BIM projects!

Great models are models that are coordinated with themselves.

Information that is developed in the creation of details needs to be pushed back into the larger context of the model.

Our team will model things that are not often seen.

(Objects) being a physical "no-fly zone" too can be included in simulations and clash tests for fast and easily understood results.

The biggest fallacy we find (in BIM) is that BIM will solve all your (AEC) problems.

Our brains project what we expect to see and not what is actually in front of us much of the time.

We leave the architects, and engineers, models untouched. (Rather) we will remodel that element in a supplemental model.

## ABOUT DANIEL MCFARLAND:

Computer Graphics and Technology are driving forces to Daniel McFarland, who studied Architecture at Arizona State University as well as continued his education at the University of Texas' Computer Science Dept. and the Texas Advanced Computing Center (TACC), #3 in the top 500 Super Computer Sites at the time. Daniel has worked for several high-profile architects including Daniel Libeskind, Michele Sae, and Gensler and is currently a BIM Technologist at Hathaway Dinwiddie Construction Co. in Los Angeles. He has a deep interest in technology, visualization, and architecture and is proficient in several programming languages including CUDA, C++, Python and Open GL. Daniel has been involved in SIGGRAPH and served as the Austin, Texas SIGGRAPH Chair. He is highly proficient with several software packages including all varieties of Revit, Maya, 3ds Max, Inventor, InfraWorks, ReCap, Mari, Nuke, Visit, Paraview, GCC, and Matlab. He has also worked for RTT USA, several major movie studios, and served on several film projects including Dome and 3D films. Daniel is well known as a Rendering Technical Director and for his computational photography.



*Architecture | Technology | Creativity*

*These are Jay B. Zallan's professional passions: an intense and well experienced Virtual Design and Construction, BIM Leader, Designer, Artist and an AEC technologist*

*As an AECO BIM & VDC leader, Jay brings unique & qualified insights into the business & creative processes of Architecture, focusing on large projects and large teams through communication, collaboration and shared goals. Jay brings proven strategies, leveraging technology, both human and mechanical, building teamwork toward efficient project delivery*

*Mr. Zallan has more than 20 years of Architectural experience and enjoys a varied & diverse portfolio of Architecture and Art*

*Jay is an Autodesk Expert Elite member, President @ Los Angeles Revit Users Group, AUGIworld magazine Revit Architecture Editor and Graphic Standards' BIM Advisory Board*

*A speaker at Autodesk University, Revit Technology Conference(s) and lecturer on Creativity & Architecture at the University of Southern California, Cal Poly, LACMA, as well as various AIA & CSI events*

# The Rise of the Structural Modeler

It is like to believe the design and construction industry has become a brave new world in recent years. By this I mean that the advent, acceptance, and adoption of 3D as the new best practice has completely changed the landscape of opportunities within the industry. This is most true for the venerable occupants of the “smoky back room” of design firms—the drafters. New responsibilities are available, greater influence is possible, and, of course, higher compensation is likely. This will become our new normal. The structural *drafter* of the past has become the structural *modeler* of the future. Three drivers will influence this: supply, demand, and suitability.

## SUPPLY

Starting with supply, we begin with the common refrain of almost everyone in the entire construction sector. We don’t have adequate talent and skilled labor to fill the needed roles. As it relates to modelers, it is a much more complicated problem than most. This isn’t just about parents trying to convince their kids to go to college instead of being a bricklayer or ironworker. The modelers of the future may very well go to college, and if they are lucky may even find a place that teaches building modeling. Far more likely is that they will find an outdated two-year program with faculty still banging around in AutoCAD®, and who have little desire to update their curriculum to pick up Autodesk® Revit®, let alone some of the more discipline-specific modeling tools.

The fact remains that there are simply not enough students choosing the path in the first place to feed the current need. When students can choose between working in graphic rendering and modeling for the next version of *Halo*, *Call of Duty*, or whatever Apple sells us next, the idea of modeling apartment buildings, warehouses, and office buildings may have limited allure. Some of this has been helped by engineers and architects taking over modeling duties, but even that has its cost limits as they gain experience and their salaries go through the roof, not to mention the lack of continuity in production quality that came with experienced drafters. This leads us to the next, and frankly more significant problem—demand.



Figure 1: Today's college students acquire minimal 3D modeling skills (source: Pixabay)



## DEMAND

For years, demand for drafters was steady or declining as productivity gains through the use of AutoCAD and other drafting tools decreased the ratio of drafter to designer in most offices. Across the board, the labor pool contracted. All of a sudden, the idea of a 3D modeler pops up, and everyone needs one. And when I say everyone, I mean everyone. In the past, we competed with other design firms for people, maybe even a design builder now and then. That landscape has changed completely, and we now compete with every general contractor, major subcontractor, product supplier, and who knows what else. Heck, we even have to fight for talent with software companies, interior designers, and video production people.

The ability to visualize in 3D and translate that into an accurate model is suddenly the hottest commodity in construction, and given that adoption is not even yet across the board, I see no end in sight. This leads to my third point, and the most unexpected one for us and I imagine many early adopters: suitability for the job.

## SUITABILITY

In the past, a drafter could be a task type role. They get a design and they draw it. Sure, there was artistic skill involved back in the day, and experience counted (particularly when “guiding” young engineers and architects who needed a nudge in the right direction), but at the end of the day direction was given, and the responsibility stayed with the architect or engineer. The drafter also needed to be accurate, but not necessarily good at visualizing in 3D, because their job was creating drawings, not buildings.

Now we have entered an era where modelers have to be inherently capable of seeing things in 3D in their heads, and translating that to buildable models. They also end up making far more high-level decisions as they place objects within models and coordinate with other trades instead of just working on redlines. Particularly in the offices of builders, modelers take on ever greater responsibility.



Figure 2: Drafting tools, and those who are familiar with them, are becoming rare (source: Pixabay)

## WHAT DOES IT MEAN?

What does all this mean, you say? First and foremost, and relevant to all of us, is that there is suddenly significant upward pressure on salaries. Design firms are going to struggle to figure out how to fit this into their current pricing models, and it will have to work through a combination of improved efficiency, distribution of workload to other staff (like junior engineers and architects), and hopefully, better fees and margins. It will also fuel continued pressure to outsource, although I know of few people other than very large firms who have figured out a way to do this successfully.

Second, it has fueled an increase in the mobility of these types of roles. Firms will have to look further afield, and it will become cost effective to relocate talent to fill these positions as the markets continue to heat up. The talent war is just beginning and will not be local anymore. I certainly hope we see some relevant programs pop up (Pittsburg State University in Kansas is a particularly good example), but I hold out no hope in the short term as the demand is growing faster than we can react to it.

At the end of the day, I believe we are seeing the rise of a new type of employee in the industry...the rise of the modeler as a professional in his or her own right, and a key player in how we design and build in the foreseeable future.

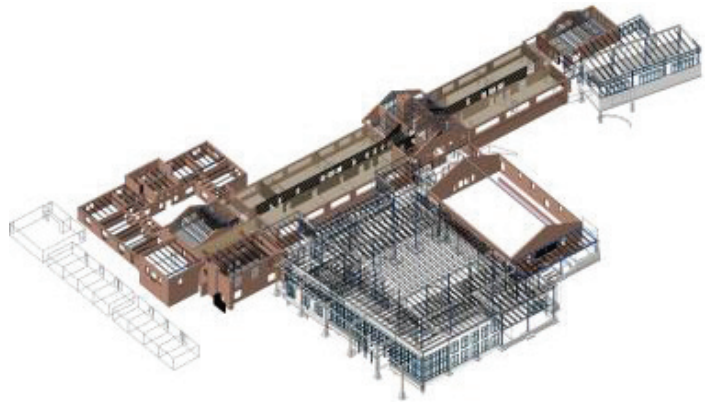


Figure 3: Revit Structure model courtesy of Carney Engineering Group, York, Pennsylvania



Josh Carney is a practicing structural engineer and president of Carney Engineering Group, Inc. in York, Pennsylvania, and Baltimore, Maryland. He was a very early Revit Structure convert, and believer in BIM as a game-changing technology.



# LiDar Scanning:

## Using a ReCap Workflow within Civil 3D

**L**iDar Scanning has been around much longer than most people think. But one of the biggest issues is the deliverable of billions of points. The other issue I see often is the time and cost associated with modeling the point cloud so you can get it out of your software as quickly as possible. That typically necessitates a non-Autodesk product and can get pretty expensive. However, with the addition of ReCap to the infrastructure tools from Autodesk, these billions of points seem to act like nothing more than a typical AutoCAD® entity, making it much easier on you and your computer to handle.



Figure 1: LiDar scan and BIM model

This article looks at the benefits of using the ReCap engine in order to take your scans from “Field to Finish” utilizing the power of Civil 3D and ReCap. We will also introduce and explore a couple of my favorite add-ons in case you need to take things a step further.

## OVERVIEW OF RECAP

Even if you just use ReCap to import data, save as an RCS or RCP file to be used inside Autodesk products, which will immensely help speed up the insertion and workflow associated with LiDar point clouds.

One of the biggest points of confusion pertains to the different “flavors” of ReCap. Yes, I am sure this will change by next year, but for right now there are three options as follows.

**ReCap** – Import and view point cloud data with the base version of ReCap. It is available in all Autodesk suites and this may be the only thing you need.

**ReCap 360** – Unlock the power of advanced measurement, organization, and collaboration tools. Also transform photos to 3D models with ReCap 360 Photo. The model below (Figure 2) was created from still shot photos from a DJI drone and imported into ReCap 360. No additional work needed, and this is a quick example of the power of ReCap 360.

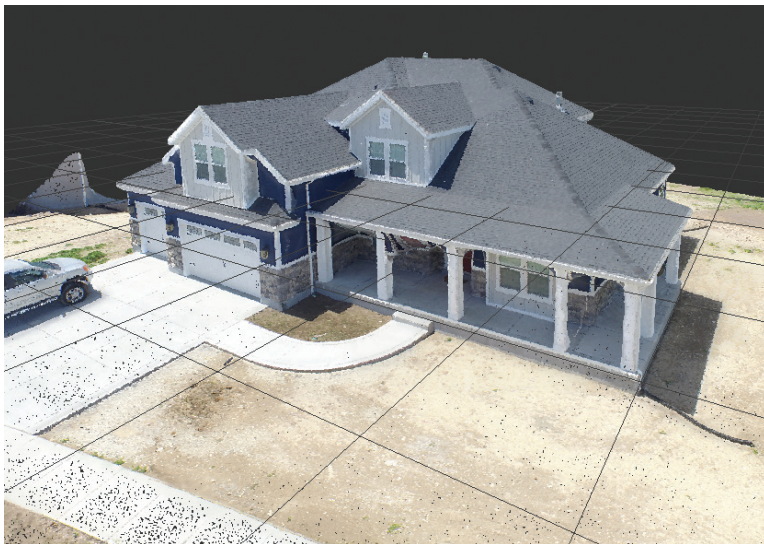


Figure 2: Drone data capture using ReCap photo

**ReCap 360 Ultimate** – Speed your workflow and get increased accuracy by utilizing auto-registration functionality and extensive reporting capabilities.

Really the biggest thing to remember is that if you need to register your scans, you need ReCap 360 Ultimate. If you just want to import already registered scans, or files such as LAS, PTS, etc., then just ReCap will suffice.

## TYPICAL SCANNING WORKFLOW

There are many types of scanners out there—many do the same thing and some have other features that set them apart. The good thing about ReCap is that no matter what scanner you use (for the most part) you will be able to bring that raw data into ReCap.

Regardless of the type of scanner you have, the typical workflow around data capture and point cloud modeling is about the same.

1. **Scan Planning.** Anyone can run a scanner, right? Although the scan portion itself is simple, it does take some time to plan out your field work. I typically start with some sort of scan plan, maybe by taking a floorplan and sketching out my proposed scan location. Maybe think about where you will place targets, if you choose to use them. And then bring that plan to the field so you can supplement and add locations as needed. Trust me, this plan makes life much easier during registration.
2. **Scanning.** Point data is first captured using 3D laser scans of existing structures. Set up your scanner as needed and remember that scanning is LINE OF SIGHT. If you can't see something from a certain angle, then the scanner probably can't see it. So make sure you capture as much data as possible to reduce trips back to the field.
3. **Importing.** Autodesk Recap converts the scan files to a proprietary Reality Capture Scan (RCS) format that can be read by other Autodesk programs.

This process, called indexing, involves importing raw scan files into Autodesk ReCap. At the start of this process, you can adjust the number of points imported by changing settings for noise, distance from the camera, intensity range, and decimation values. Save the indexed scan files in a Reality Capture Project (RCP) file that references, but does not contain, the files.

4. **Organization, Cleanup, and Analysis.** A number of methods are available to organize the indexed data to remove or hide portions of the point cloud. Create scan regions that you can turn on and off, specify temporary clip regions, turn off or remove scan files, or delete unwanted points permanently.
5. **Attaching.** Indexed scan files and projects can be opened, or attached, in another program to provide realistic context for 3D models.
6. **Model.** You can now choose to model around the point cloud, create points and surfaces from the point cloud or fully extract a CAD or Revit model from your point cloud. Many options out there—just depends on how far you need to take it.

Then the “fun” part begins. What do we do with those billions and billions of points? First, let's dive a bit deeper into some tools inside ReCap that will help once we bring it into AutoCAD® Civil 3D®.



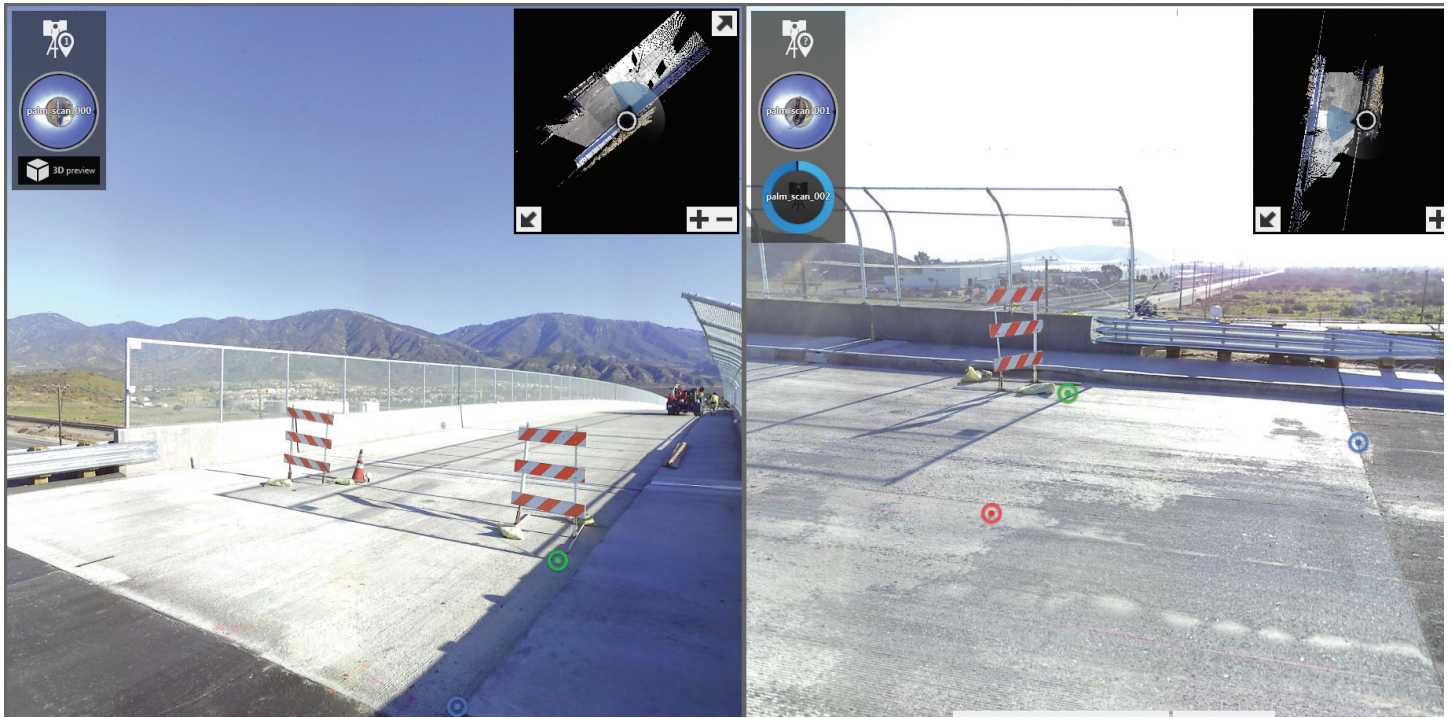


Figure 3: Scan registration in ReCap

## REGISTRATION IN RECAP

Stitching, or registering, your scans together in ReCap is very simple. In fact, ReCap 360 Ultimate has an auto-registration tool I mentioned earlier. This tool can really help streamline your data processing. But be careful, there is no EASY button and you want to verify. Sometimes when you get the greenlight in ReCap it will still be way out of line. So it is good to continue to check your work as you go.

If you choose to skip the auto-registration, ReCap is one of the simpler processes you can find. Once you enter “registration mode,” your screen will be split in two and you will be asked to pick three points on the left, and three points on the right.

Once you successfully choose three points, you move on. You can see a report of all scans registered at any time. The scan registration report gives you the following (Figure 4):

scan name	overlap	balance	points < 6mm	
techshop_003	15.2%	59.5%	99.9%	
techshop_002	19.6%	63.6%	99.9%	
techshop_001	28.7%	65.2%	99.9%	
techshop_000	20.0%	67.7%	99.9%	

✓ OK

Figure 4: Scan registration report in ReCap

## CLEANUP AND PREPARE IN RECAP

ReCap has many tools that can help make life easier once you bring files into AutoCAD, Civil 3D, or even Autodesk® Revit®. First, you can remove any unwanted points by simply selecting the area and deleting points. That is where I would start first. You don't want to add unnecessary points to a surface in Civil 3D.

Regions are very helpful when preparing your point cloud to be modeled. Think of Regions as a LAYER. You can select items within ReCap and then add them to a Region. Walls, pipes, and vegetation are all examples of something you may want to put on a separate Region. In Civil 3D you have a Scan Manager that will allow you to turn Regions on or off.

## BRING INTO CIVIL 3D

If you have a RCS or RCP file, there probably is nothing simpler than bringing that into Civil 3D. Before, we had to bring point clouds in from the Prospector, and go to lunch in hopes that it would be finished when we returned. Now that same file, imported into ReCap, can be brought into Civil 3D in a matter of seconds. Go to the Insert tab of the ribbon on the Point Cloud panel and choose Attach. That is all!





Figure 5: Adding "Regions"

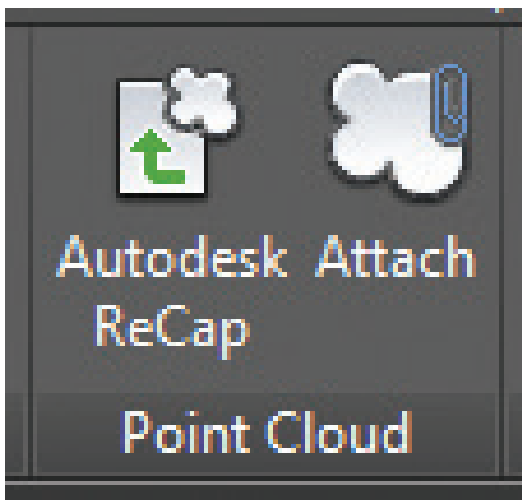


Figure 6: Attach Point Cloud in AutoCAD Civil 3D

## SETTING UP FIELD TO FINISH IN CIVIL 3D

The "Field to Finish" stuff has been around a long time now, although I still see most firms connecting dots and manually processing their survey data. But I will save that rant for another article.

The setup is fairly straightforward. On the Survey tab of the Toolspace, there are just two things you want to take a quick look at.

**Figure Prefix Databases** – Expands to display available figure prefix databases. Figure prefix databases enable you to determine the layer on which a figure is drawn by creating a prefix for a group of figure names. These are basically feature lines, but are controlled from the database and your survey codes.

**Linework Code Sets** – Expands to display available Linework Code Sets, which are used to interpret the syntax of the field codes that are entered into the data collector by the survey field crew. For example, as we pick points and want to begin a new line, we may choose to use BF (Begin Feature) or B. This entire setup takes just a few moments.

From there, we can begin to pick out points from the scan data.

## PICKING COGO POINTS

We first want to turn on some different OSNAP options. Go into your OSNAP settings and select 3D Object Snap tab. On the right side of the menu, turn on the items under Point Cloud.

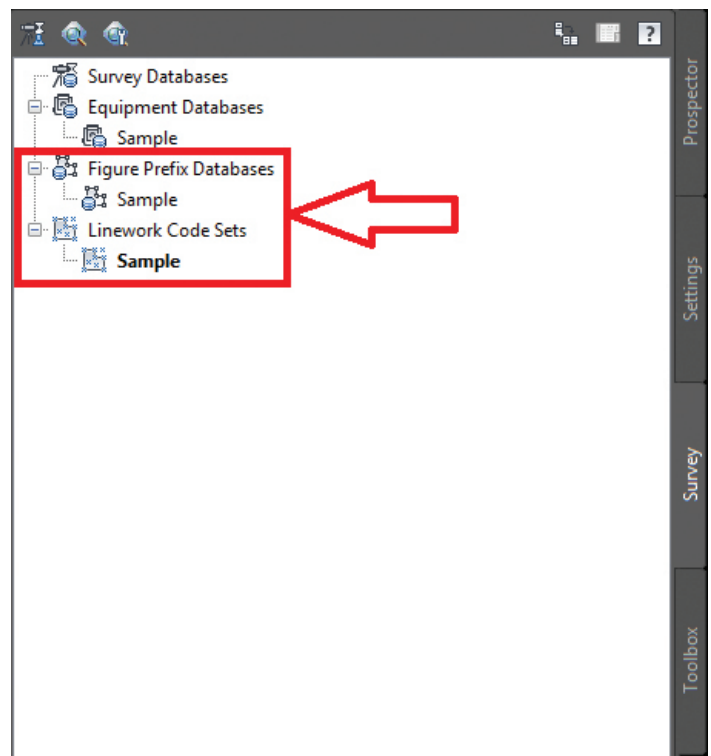


Figure 7: Survey database setup

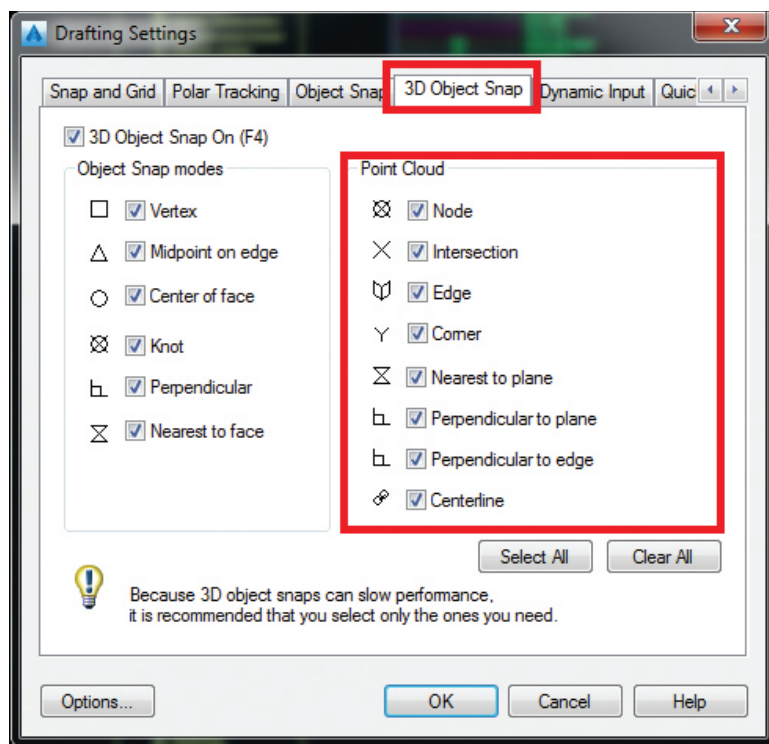


Figure 8: Point cloud OSNAP

We can now select individual points along our scan. You can use the same create point options that you are accustomed to. The only thing to remember is to code them properly. For example, we can begin by choosing the edge of pavement as a feature we want to define. Based on our codes out in the field and the linework code set we just set up, we just need to make sure they match. For our first point, we will use **B EOP1**, go to the next point and use **EOP1** and continue down the line. At the end we will use **E EOP1**. This is just a quick example, but you will see how easy it is to use a ReCap file and maneuver around to pick points.

## CREATING SURFACE IN CIVIL 3D

In 2015, the Autodesk Point Cloud Surface Extraction 2015 extension provided the ability to create a TIN surface from points within RCS format point cloud scan files and RCP format point cloud project files created with ReCap.

You can use the Create Surface from Point Cloud command that is provided in the extension to create a surface from several point clouds, selecting only the areas that you want to include and filtering out non-ground points so they are

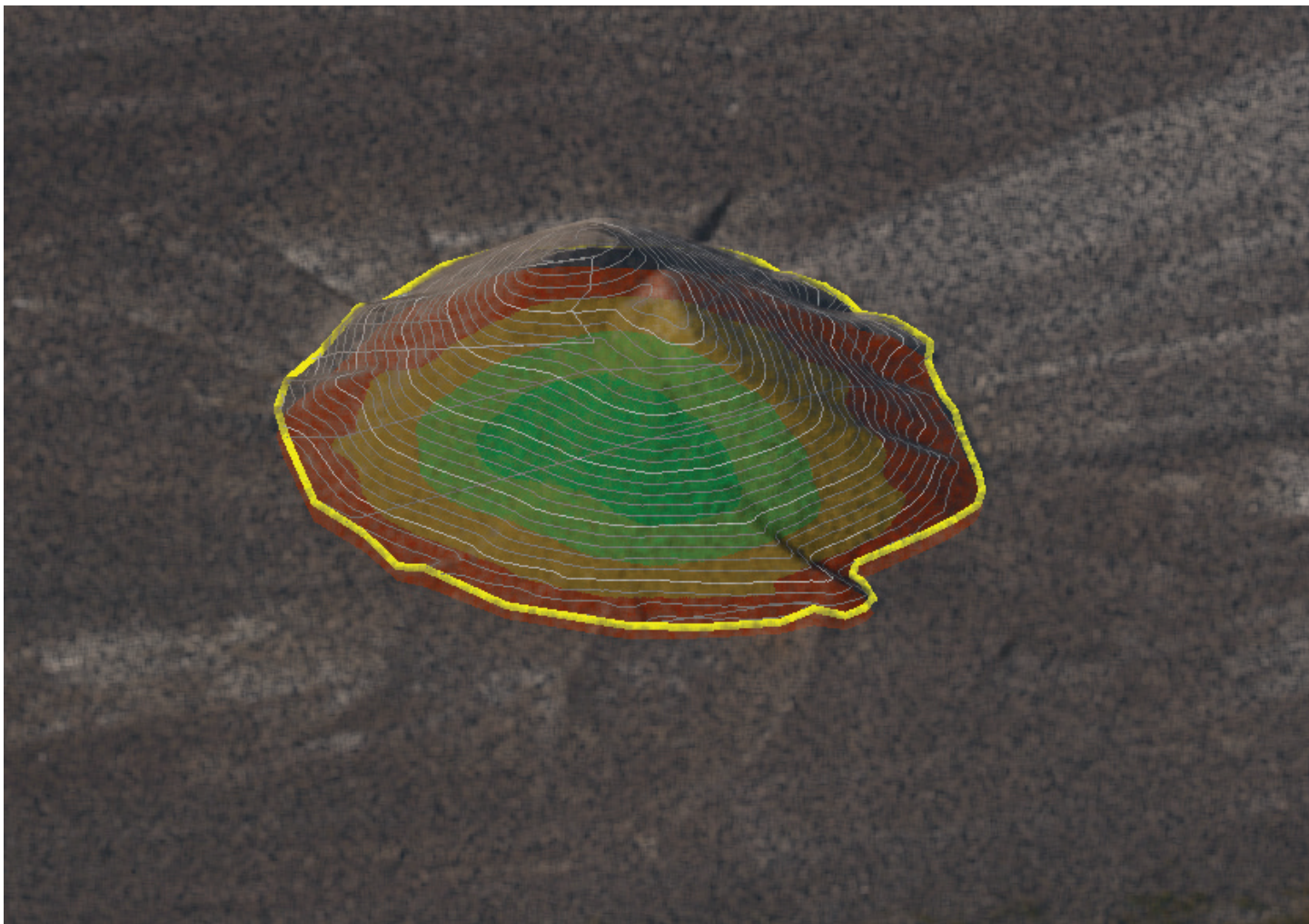


Figure 9: Surface from point cloud



not included in the resulting surface. You can select areas of point clouds by using window selections, by defining polygon areas, or by selecting existing closed polylines in the drawing.

1. In Toolspace, on the Toolbox tab, expand Subscription Extension Manager ► Autodesk Point Cloud Surface Extraction. Double-click Extract Point Cloud Surface.
2. Select a point cloud, or use one of the command line selection options to select an area of one or more point clouds. The Create TIN Surface from Point Cloud wizard is displayed.

In 2016, this extension was built into the software and now provides the same functionality.

1. Click Home tab ► Create Ground Data panel ► Surfaces drop-down ► Create Surface From Point Cloud Find.
1. Select a point cloud, or use one of the command line selection options to select an area of one or more point clouds. The Create TIN Surface from Point Cloud wizard is displayed.

## HELPFUL THIRD-PARTY MODELING ADD-ONS

As of right now, there is no Autodesk product that can really compete with any of the point cloud modeling software out there. In time you will want to extract features such as pipes, walls, floors, etc. Below are some examples of available software.

**Faro/Kubit** – Early in 2015 FARO purchased leading point cloud modeling software called kubit. kubit has been developing field-proven software products to enable and simplify the use of real world objects in CAD applications since 1999.

For users of the SCENE software from FARO, there is now a Surveyor add-on. The Rithm Survey App for SCENE offers CAD drawing and virtual survey functionality directly from the point cloud.

**Cyclone** – Enables professionals to use point clouds directly, to process them into objects for robust export into CAD (and other applications), and to allow robust import of data from CAD. Cyclone-MODEL has a large, complete, and automated set of tools

for accurately modeling 3D point clouds as CAD geometry or as meshes for engineering, surveying, construction, architectural, and related applications.

**Clearedge/Edgewise** – EdgeWise users report an average modeling time savings of 70 percent. And because models created in EdgeWise export to Autodesk Revit as properly specified wall, floor, pipe, duct, conduit, window, or door families, there is no more remodeling or tracing in Revit!

I am sure there are many more out there, but these are a few I am familiar with and have used.

## CONCLUSION

LiDar Scanning, data capture, reality capture, or whatever you want to call it, is here to stay! I could take up 100 pages with survey and scanning workflows, there is just so much to it. But as the hardware and software have drastically dropped in price, I am seeing this become a service that is talked about in even the smallest of firms.

I suggest that if you are debating whether or not to get a scanner, hire it out on the first one, or rent a scanner. That way you can really see what you are able to do before dropping 100 grand. Take the leap on this one—I think you may be surprised.

Good luck and happy scanning!



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

# Bringing Characters to Life



Figure 1: Rigged Bot in Alley Scene by Pro-Cad.Net

When we reach the point of rigging a character it can be exciting. We've completed our character mesh and have imagined our character posed or animated. Now we want to build a control rig structured to deform and animate our character in believable ways. This article is an introduction to constructing a rig to ensure we get fluid control and proper deformations needed to bring our characters and scenes to life.

## PREPARATION

When constructing our character we'll want to build it in a manner that's easy to rig. For most characters, this typically involves the Vitruvian Man pose, with arms and fingers spread out. If we're confident our mesh is easy to rig and clean, then we'll want to familiarize ourselves with the following tools to begin the rigging process.

1. Bone Tools – The Bone Tools consist of the various tools needed to construct a skeleton (aka control rig).

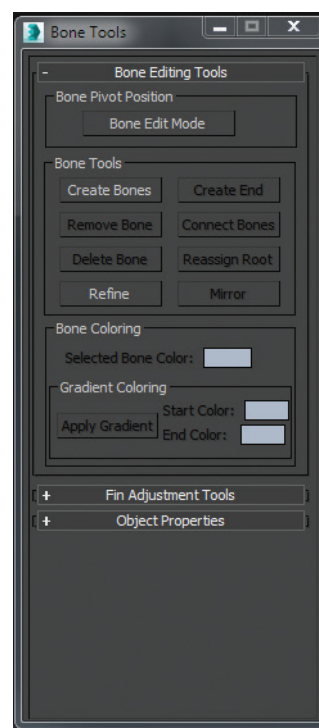


Figure 2 – Bone Tools



2. History-Independent IK (HI IK) Solver – We'll use this tool to determine how the bones will connect and react to each other.

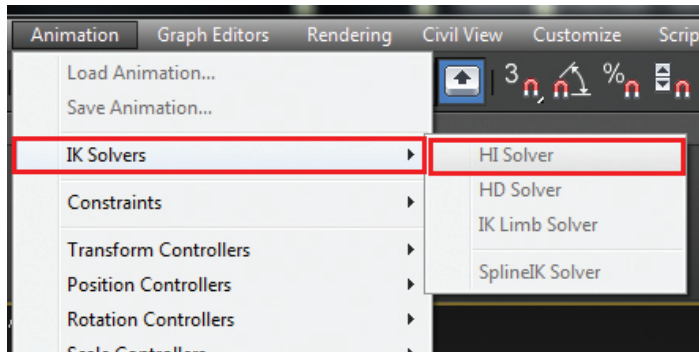


Figure 3: HI IK Solver

3. Position Constraints – This constraint causes an object to follow the position of a target object.
4. Lookat Constraints – The Lookat Constraint controls an object's orientation, so that it's always "looking" at another object.
5. Orientation Constraints – The Orientation Constraint causes an object's orientation to follow the orientation of another object.

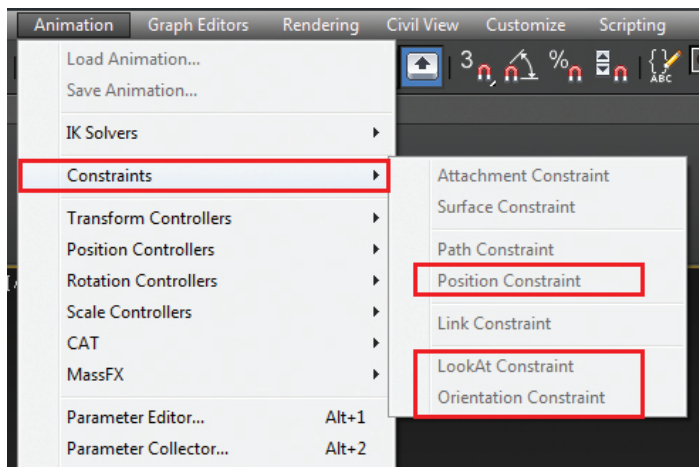


Figure 4: Constraints

6. 6) Xray Objects – Setting an object to appear transparent.

I'd recommend placing these tools in a custom quad menu or toolbar. Items 1 through 5 can be accessed in the Action List box located in the Customize User Interface -> Quads tab. For item 6, either construct a macro or simply select the object->right click and choose Properties->check "See Through."

Next we'll need to establish some layers to help with the rigging process. We'll need a layer for the character's mesh, a layer for control objects, one for envelope objects (or bones), and finally one for hidden objects used to assist in the rig's development and structure, but which cannot be removed from the scene.

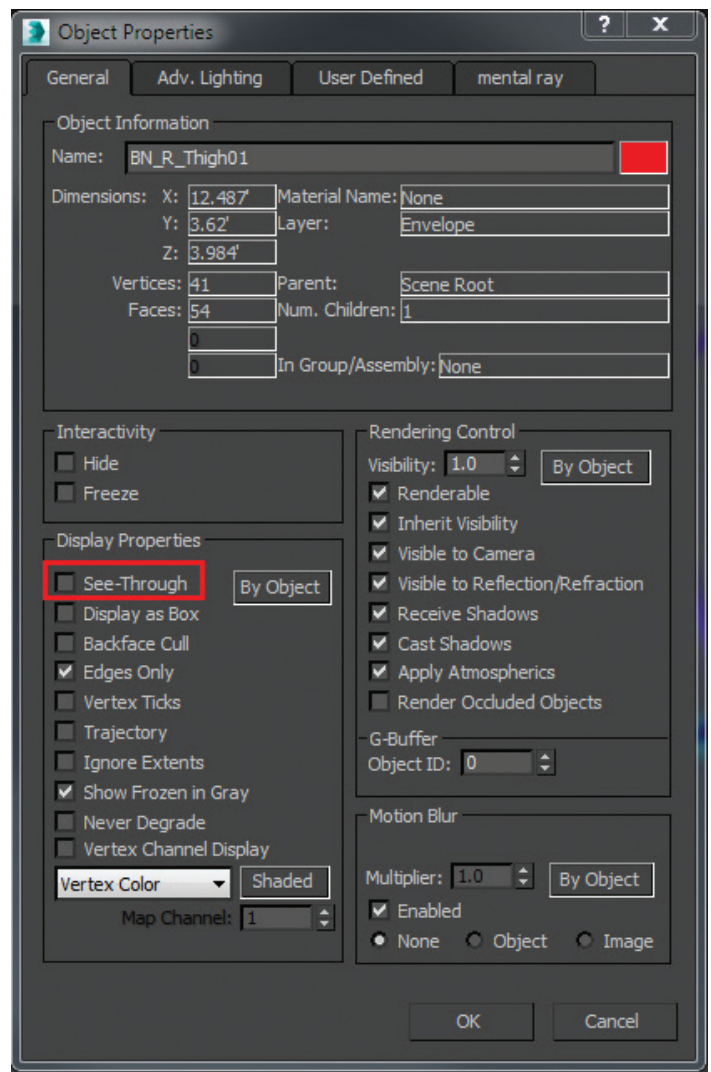


Figure 5: Making objects "see through" (Xray)

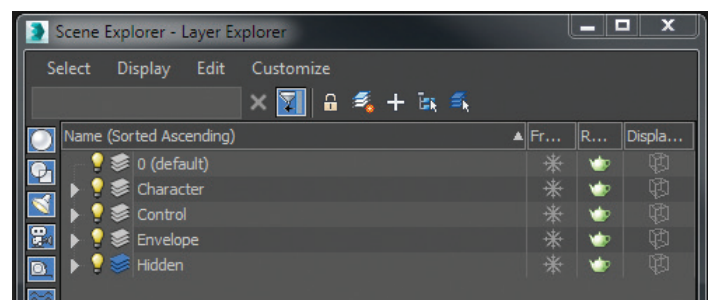


Figure 6: Layers

Next, we'll "xray" our character and freeze it to ensure it remains safe while constructing the rig. We can freeze simply by selecting our mesh, right-clicking, then choose freeze or use the layer control. To ensure we construct our rig with consideration for proper deformation, we'll want to work with wireframe on, placing our bone ends in locations where deformations may occur in natural locations along the mesh.

## STEP 1 – WORKING WITH BONES

Let's start with the leg. We'll begin constructing our "chain" or bone structure by working from the side leg view. Open the Bone Tools and select "Create Bones."

We'll begin the bones at the hip, and then select the knee, the ankle, the ball of the foot, then finally the toe. Right-click to finish. Regardless of the orientation of the leg of our character, ensure when selecting the knee that the joint is slightly bent toward the direction the knee will actually bend. If we make an error in the location, we can select "Bone Edit Mode" in the Bone Tools and edit the bones and joints as needed. Finally, we switch to front view and ensure the bones are centered in our leg. Be sure to name your bones appropriately (e.g., Bone\_Left\_Thigh, Bone\_Left\_Shin, etc). To complete the other leg, we simply select the bone tools and choose "mirror." Be sure to rename the new bones to something appropriate.

To complete the leg we'll add the History-Independent IK Solver by selecting thigh, and then tying it to the ankle. We can now select the IK solver cross hairs at the ankle; move it and begin to see how our leg will move in relationship to the ankle. Be sure to name the IK Solver objects to something more appropriate than the default.

## BONE FINS

Offering side, front, and back "fins" with taper options, 3ds Max® bones allows us to manipulate our bones to better fit the character's structure. This allows us to better visualize our character when our mesh is frozen and it assists in painting weights. We'll eventually discuss painting weights, a process where we tie the

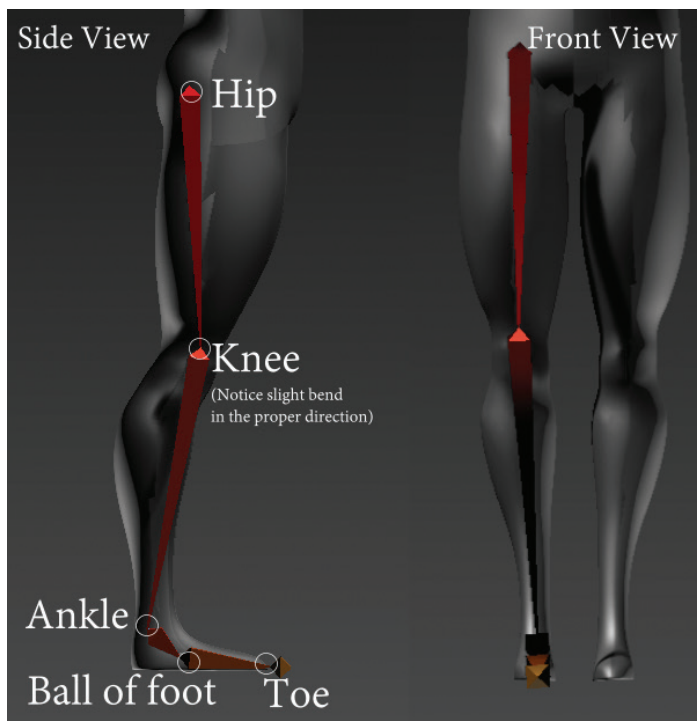


Figure 7: Bone placement

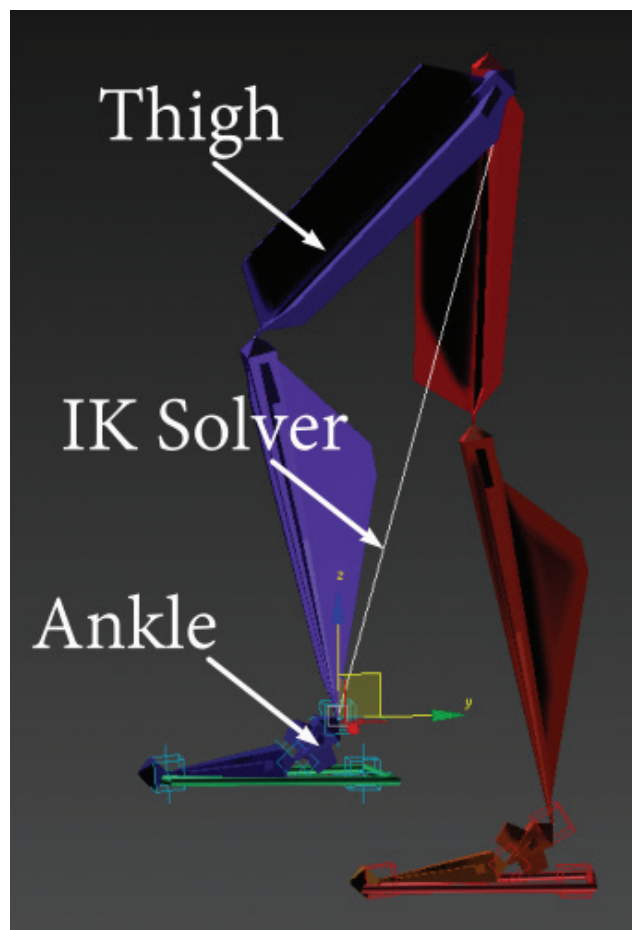


Figure 8: IK Solver

character mesh to the bone structure itself, ensuring it deforms in believable ways. We first focus on one leg, then use the Bone Tools to copy those to the opposite leg. Unfortunately the Bone Tools doesn't flip the values for the mirrored bones so we'll need to manually switch the front, back, and side distances as needed.

## SECONDARY CONTROLS

The IK solver gave us basic control of the leg, but we'll want to have more control over the foot. Any object can be used to act as additional control, but I've found most enjoy using Point Helpers located under the Helpers icon on the Create tab in the Command panel. For each foot, we'll need four Point Helpers. We'll need the helpers aligned with the proper bones and placed in the proper locations.

The image in Figure 10 and the information below helps outline the orientations and positions for each helper. To orient the helper, select the helper then use Alt + A, select align X,Y,Z and then choose the appropriate bone to align it to. Finally, use Shift + A to quick snap objects to the appropriate bone locations. Following that, we simply link the ankle helper to the ball helper, the ball helper to the toe helper, then finally the toe helper to the heel helper. Remember to rename the helpers to something more appropriate.



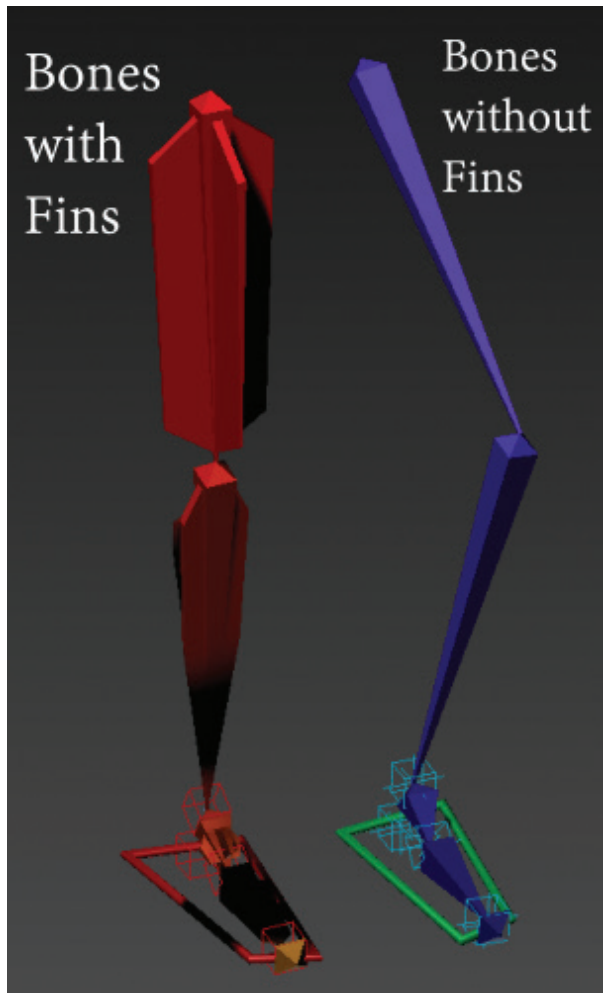


Figure 9A: Fins | Figure 9B: Fin copy

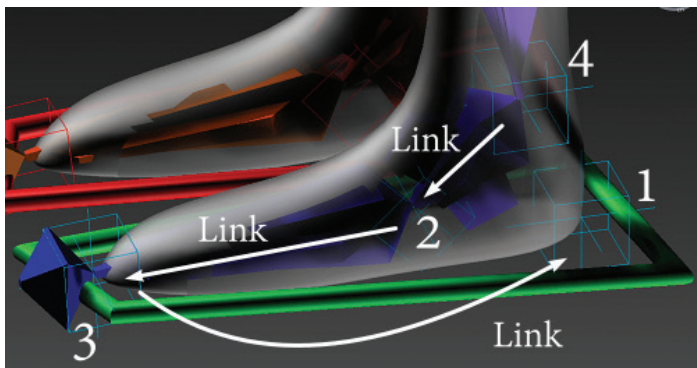


Figure 10: Helpers position and links

Point Helper #1 – Centered on the back of the heel. Eyeballing it is okay.

Point Helper #2 – Oriented to the ankle bone, but positioned at ball bone/ankle bone joint.

Point Helper #3 – Oriented to the ball bone and positioned at the tip of the nub.

Point Helper #4 – Positioned at the IK Solver.

Finally, we position-constrain our IK solver to our ankle helper so when we move the ankle helper, we move the leg. We select the ankle and orientation-constrain it to the ball helper so that the foot pivots properly, and finally we orientation-constrain the ball bone to the toe helper. Now by rotating and moving the various helpers we're able to control the leg and foot to pivot, jump, slide, or do just about anything we desire.

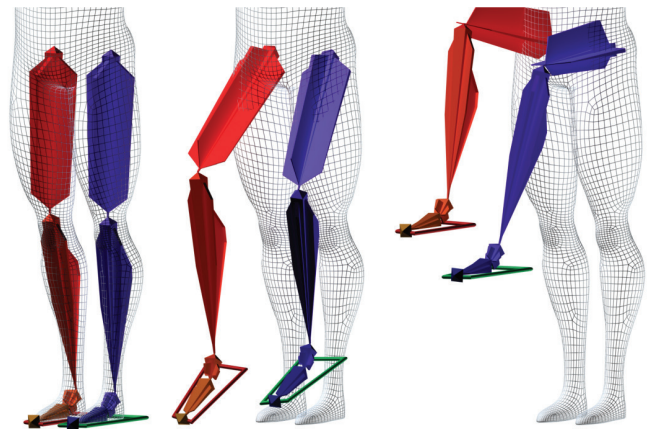


Figure 11: Foot and leg control



Brian Chapman is a veteran Autodesk zealot, creator of [pro-cad.net](http://pro-cad.net), and Senior Designer for Slater Hanifan Group, a civil engineering and planning firm dedicated to superior client service. Brian can be reached at [procadman@pro-cad.net](mailto:procadman@pro-cad.net).





# My Top Five Tips for Inventor Tube & Pipe



Autodesk Inventor® Tube & Pipe module is my bread and butter. This is the system I use on my job nearly every day. My employer, Powell Fabrication & Manufacturing, Inc., designs and builds skid-mounted chemical processing and mixing equipment for various applications around the globe. In designing this equipment, Tube & Pipe has become our tool of choice. After six years of using this tool nearly every day, I've learned a few tips & tricks to getting around in the system. I'd like to share with you what I consider to be my top 5. So, hang on tight and let's jump right in with Number 5.

## #5. CREATING A MIXED UNITS TUBE & PIPE STYLE

Occasionally in using Autodesk Inventor's Tube & Pipe you may find yourself in a situation where you need to create a design that has more than one system of units in the same pipe run. For example, you may need to design a pipe run that has ANSI Schedule 40 carbon steel piping and instruments, but terminates in a DIN standard flange for customer tie points. Well, there is a way to create these pipe runs using only one Tube & Pipe style. It's called a Mixed Units style, and here's what you need to do.



Inventor's Content Center already contains several examples of DIN flanges that you can use for the example above, though this will work with any combination of specs. Simply locate the flange in your Content Center that is closest to the spec you need, and save a copy of that family to your own Read/Write Content Center library.

This family has a column named ND which contains the sizes of the flanges, in millimeters, expressed as M10, M15, etc. In order to make this family table a Mixed Unit table, edit the Family Table and add two new columns: ND1 and ND2. In the ND1 column simply repeat the contents of the ND column so it has the metric sizes listed as Nominal Diameter 1. In ND2, put the Imperial unit equivalent sizes. Then, saving and applying the changes, right-click the family in the Content Center Editor window and select Family Properties. On the Parameter Mapping tab, set the NominalSize[1] and [2] so they are mapped to ND1 and ND2, respectively.

Once you apply the changes, this flange is now ready to be used in a Mixed Units style. A Mixed Unit Tube & Pipe Style will require a Mixed Unit Flange and Gasket, so repeat this

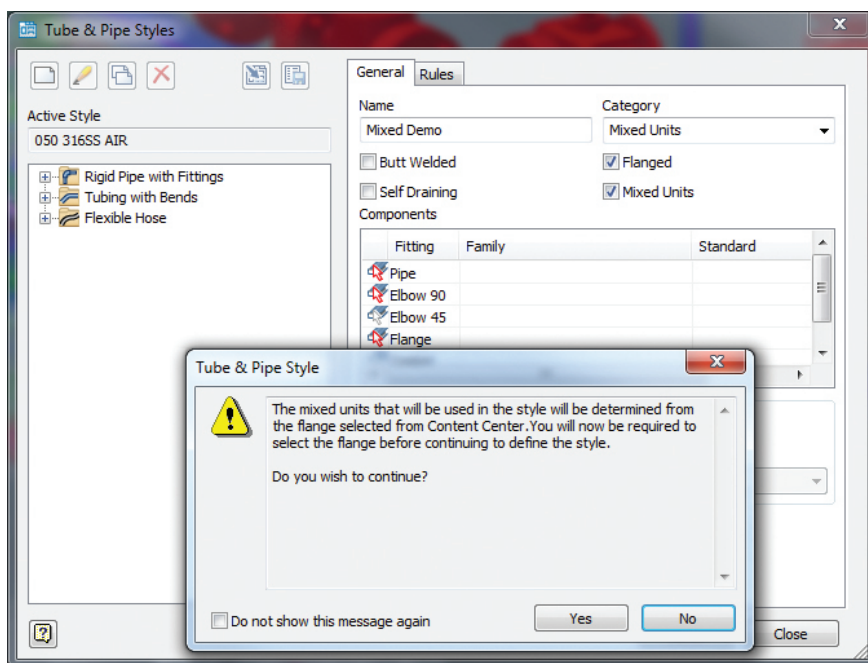


Figure 2: Selecting Yes moves you to the fitting selection window

with as many fittings as needed to create your T&P Styles. Next, create a new Tube & Pipe style. You must be in a Tube & Pipe assembly to be able to do this, or be editing the Tube & Pipe template file named Piping Runs.iam. This file is usually found in your Design Data path in a folder named Tube & Pipe. This file is where you would place any styles that you want to be able to use all of the time. If the style is a one-time-only thing, you can create the style in the assembly where it will be used.

To set this to a Mixed Unit style, first you need to designate that it is a Flanged style. When you select Mixed Units, a warning opens to let you know that in order to make a Mixed Unit style you will first need to select a flange fitting that is set up for Mixed Units. Select Yes on this warning box and you will be taken to the fitting selection window.

Using the filtering tools as needed, locate the Flange fitting that you set to have the dual units. Once that fitting is applied to the style, the style will become a Mixed Unit style, and you can continue to select fittings to finish it out. Remember that this style will also require a gasket that has been set up as Mixed Units. Save your style, and you are ready to start routing pipe in mixed units.

## #4. FILLING GAPS IN PIPE ROUTES

From time to time, in Tube & Pipe, you may run into a situation that cannot be resolved with a simple route change. This is generally (but not always) when dealing with a lot of "fitting to fitting" connec-

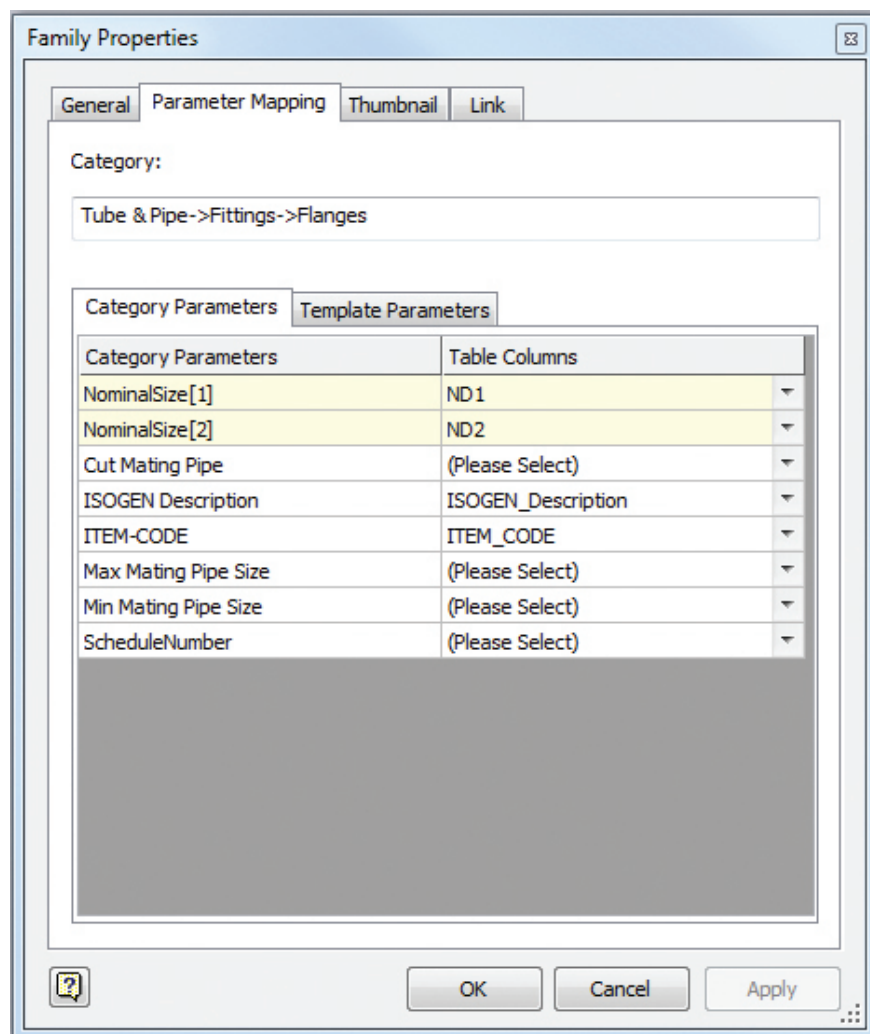


Figure 1: Parameter mapping

# Inventor

tions. That is, connections where there is no pipe spool between groups of fittings. Sometimes when a change becomes necessary and you need to move some of these fittings around, the only way to do it is to break all of the connections on the grouping, and then re-connect them as the situation calls for. The problem with this is that when a route is connected to this grouping of fittings, the route ends up hanging out in the breeze once the fittings have been reassembled. In this example, the valve and flange were moved up to the elbow causing a gap in the route.

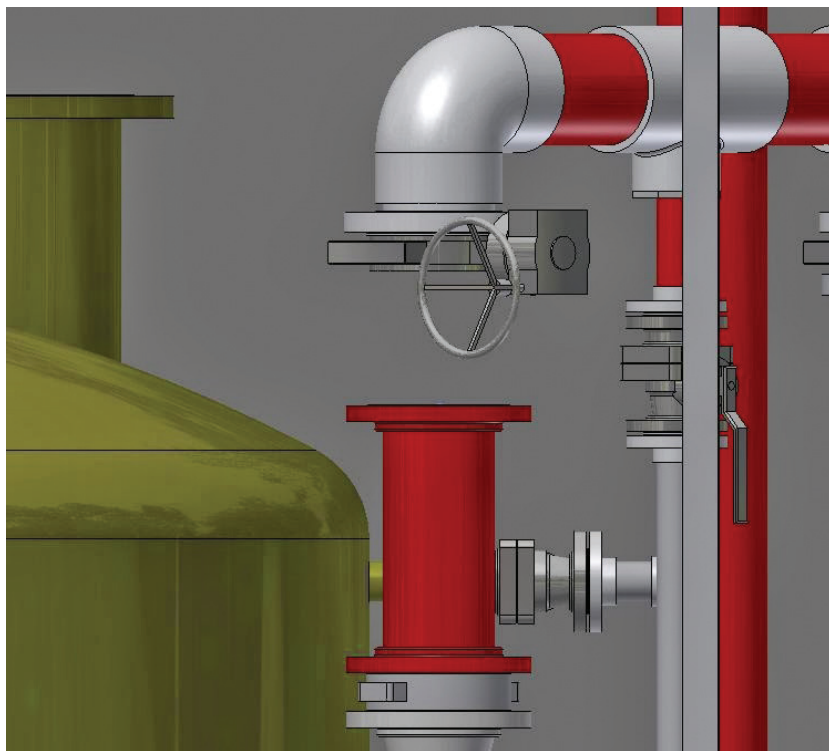


Figure 3: Gap in the route

Correcting this would be so easy, if only Tube & Pipe had an “Extend” feature... but alas, it does not. So here is what you need to do: edit the route. Select the “Route” command from the toolbar and pick the bottom of the valve as a starting point; route a short section ending in space above the endpoint of the lower route segment. Do not connect this new route segment to the existing one, as this would cause an “Auto-Route” to be created.

Delete the dimensions from both the new short segment and the existing segment, so neither one is dimensioned or fully constrained. Add a coincident constraint between the two endpoints, joining them. Then window around the joined intersection point of the two segments and delete the point. The two segments will become one, and a driven dimension will appear on the line segment.

When you finish the route, the new segment should populate (assuming the route you are working on has already been populated).

## #3. COPY AN EXISTING PIPE RUN AND MAKE IT ADAPTIVE

So, you’re working in Inventor Tube & Pipe, and you find that you have several pipe runs that are exactly the same. Do you create each one individually and spend a lot of time repeating yourself? You certainly can do that, but there is another choice. As each pipe run is saved as an Inventor assembly, they can easily be inserted into your assembly and placed using standard assembly constraints. In this way you can duplicate a pipe run many times while only having to model it once. But what happens when someone comes along and wants to make a change to just one of these runs? Well, the rest of them will follow the same change, of course. If this is not what you wanted, there is an alternative.

If you place the copied assembly beneath the Master Pipe Run (Tube & Pipe Runs.iam), you can select the copy and choose to make it adaptive. When you select this option, a dialog will open, allowing you to rename each part (not including library parts). Once you have renamed these parts, the pipeline becomes an independent, adaptive, and editable pipe run. In this way you can quickly copy pipe runs that are nearly identical, without having to fully model each one, and still be able to make each one a unique run.

## #2. QUICK PLACE PIPE FITTINGS

When working within a pipe route, it is sometimes necessary to have multiple copies of the same fitting available on the screen. Or sometimes you just want to quickly place one copy of an existing fitting. The temptation here is to use copy and paste functions in order to avoid having to keep going back to the Content Center. Content Center is a great tool, but it can take some time to open and navigate through large libraries to locate a single fitting.

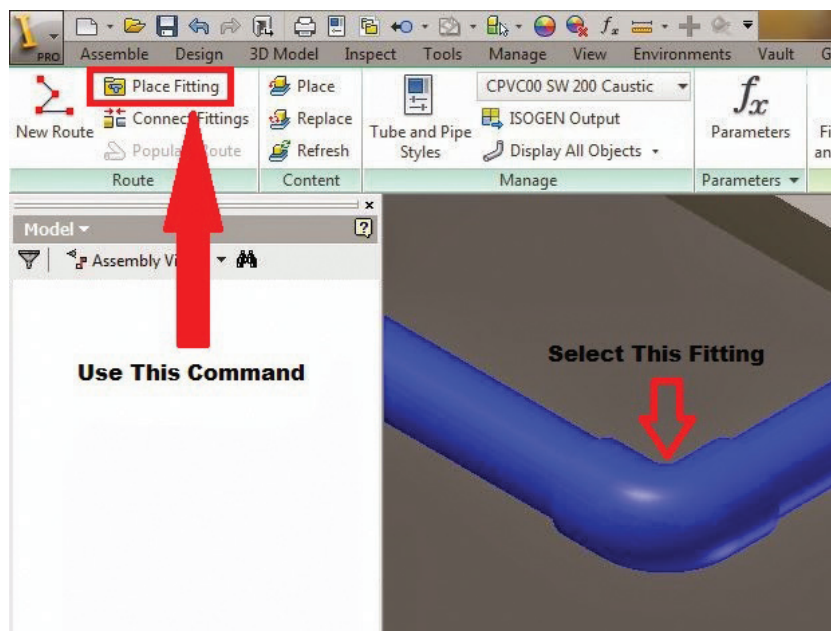


Figure 4: Place Fitting feature



Inside of Tube & Pipe, however, never use copy and paste. Copy and paste can make it difficult, if not impossible, to delete this fitting later if necessary. Best practice is to always use the Tube & Pipe tools to place all of your fittings.

A quick tip to use is the “Place Fitting” command. Normally this command takes you to a file window to navigate to a file outside of the Content Center. But with this little tip, it can be used for placing a Content Center part without the Content Center being opened. The secret is that the fitting has to be somewhere in your assembly already, even in a different sub-assembly. Simply locate the fitting in question, either in your currently active sub-assembly or in the assembly browser. Pick the fitting to preselect it, then pick the Place Fitting command.

A copy of the selected fitting will be brought in, with all of the normal piping options available (Place, Connect, Insert). If you use this, and place the new fitting over the top of an existing one, it will replace the existing fitting as long as it is possible for the fitting to work in that location. For example, placing a tee over an elbow will replace the elbow. You may have to toggle the orientation, but

again this is quicker than using the Replace Fitting and scrolling through the Content Center.

## #1. GROUNDING YOUR TUBE & PIPE RUNS

This is my Number 1 Tube & Pipe Tip, and one of the first things I always share with new users. It can save a lot of time and heartache as your designs grow in size and complexity.

Have you ever spent any amount of time working on a Tube & Pipe assembly with multiple sub-assemblies, getting everything just perfect, only to return to the top level assembly and accidentally clicking and dragging your tube & pipe runs? They move! Freely! They move, and all of your careful, hard work explodes before your very eyes. After thanking your deity of choice for the existence of an Undo button, try this:

When you create your first T&P run in an assembly, Inventor creates a top level sub-assembly called Tube & Pipe Runs, beneath which all of your pipe runs will reside.

As soon as this is created (along with your first run), return to the top level of your assembly. Use mate and align constraints to constrain Tube & Pipe Runs.iam to the top level—origin plane to origin plane using all three origin planes. Then for each individual pipe run sub-assembly you create, constrain that to Tube & Pipe Runs.iam—origin plane to origin plane, just like you did to the top level. Do this before you place any fittings or sketch any routes. Now your runs will stay put where you modeled them, as if they were grounded.

Occasionally your design parameters may not allow for this, as you may need more specific constraints on certain pipe runs, but for general piping design this is a good practice to prevent unwanted movement of your pipe runs.

Well, there you have it. My top 5 Inventor Tube & Pipe tips in a nutshell. Hopefully one or two of these will be helpful to you in your piping pursuits. Until next time... enjoy!

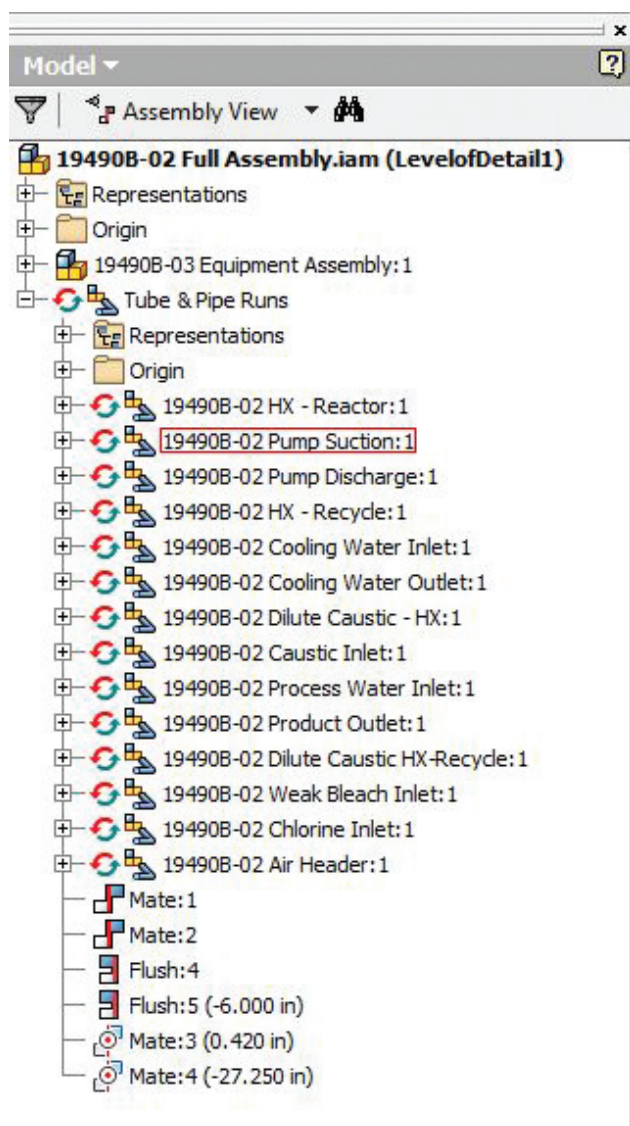


Figure 5: Avoid unwanted movement of pipe runs



Chris Benner is the CAD Department Supervisor at Powell Fabrication & Manufacturing, Inc. in St. Louis Michigan. He has been working as a mechanical designer and drafter for the last 20+ years, using Autodesk products for the majority of that time. Two years ago Chris was recognized as an Autodesk Expert Elite for his activity on the Autodesk Discussion Forums, social media, and for his tips and tricks blog. His work has also been published by Design & Motion and CADNotes.

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

<http://revitcoaster.blogspot.com/2014/02/bim-consortium-addin-updated-with-new.html>



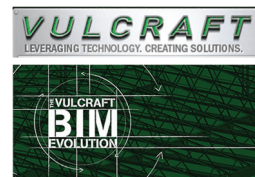
Troy Gates has been working with the Los Angeles Revit Users Group leadership group (known as the BIM Consortium) to start creating a set of Autodesk® Revit® add-ins based on meeting discussions. He announced the first release of the add-in in January 2014, but since then has released multiple updates with additional tools, making it one of the top add-ins available for Revit users! The tools he's created include the following:

- 3D Grid Generator – Be able to automatically place a 3D Grid family on every grid line in the model.
- Create Dependent Views – This tool will simply duplicate as dependent the active view five (5) times, saving you 5 right-clicks.
- Delete Views – The original reason he got into macros in Revit. Gates, in an MEP firm, worked with a lot of models from other companies. In order to keep the numerous linked models manageable, he would clean the models by deleting views, legends, schedules, and sheets. This takes a long time by hand, but now this tool gets it done quickly.
- Dependent Views from Scope Boxes – Allows you to create dependent views for any number of floor or ceiling plans and apply

a Scope Box to them. This tool was created for setting up projects that have multiple work areas divided up using scope boxes.

- 3D Room Tags – Places a generic family with 3D text into the center of every room at the specified height above the room's level.
- Room to 3D Views – This tool will create four (4) 3D Camera Views for every room in the model. The views are placed at lower-left and upper-right at floor and above ceiling. The heights are adjustable.
- Merge Text – Either take two (2) pieces of text and merge them together with several options available, or merge several text elements into the first one selected. Notice that you need to hit ESC to end the selection of elements.

<http://www.vulcraft.com/engineers/bim/revit.php>



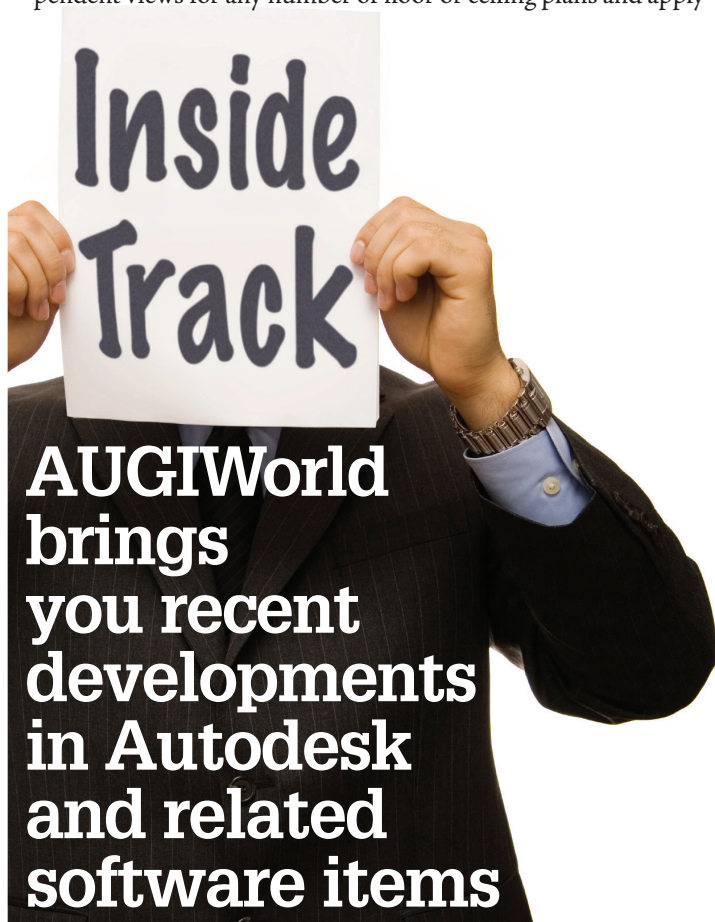
For more than half a century, Vulcraft has been a leading producer of steel joists and deck, providing high-quality steel joists to North America.

Vulcraft is pairing its proven track record of quality and service with the future of 3D modeling to give fabricators, erectors, general contractors, engineers, and architects an edge over competitors in the market.

Providing customers with a detailed model that can display a replica of their building, BIM leads to confidence and peace of mind for the lifecycle of the project. NuBIM® Vulcraft Add-in for Revit® 2014 and 2015 includes the following:

- Single-page user interface.
- Pre-Configured Ecospan Joists, Composite Joists, and Joist Girders.
- Bowstring, Single Pitched, and Double Pitched Special Profile Joists for increased design flexibility.
- Joist Loading Schedules with Load Diagrams for simpler specification of unique joist loading.
- Updated Joist Marking that groups like joists and simplifies your scheduling.
- Economical Joist Converter to quickly convert standard Revit joists into an economical Vulcraft alternative.
- Updated Deck Specification, which makes applying Vulcraft and Verco deck profiles to new and existing roof and floor systems easy.

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



**AUGIWorld  
brings  
you recent  
developments  
in Autodesk  
and related  
software items**



# Automating BIM for Revit users enhance your productivity today!



**Simple & Effective Solutions to automate Revit & BIM**

Discount offer valid until 30/09/15  
Terms and conditions apply

## **RTV Xporter**

**The easiest way  
to Export, Print,  
Track and Issue  
deliverables from  
Autodesk® Revit®**

**from just  
US\$9.99**

**loved by thousands**

- ✓ **Create PDF, NWC\*, IFC\*, DWG, DGN\*, DXF, DWF, FBX\*, RVZ\*, RVT\* files simultaneously**
- ✓ **Auto select Paper Size detection and combine into a single PDF or DWF**
- ✓ **Parametric Directory\* and File naming, use your own Revit parameters in file names**
- ✓ **Automatic upload and publish to FTP and Citrix Sharefile\***
- ✓ **Bulk upload to Aconex supported\***
- ✓ **Innovative Revit Revisioning engine, bulk up-rev 1000's of drawings in seconds**
- ✓ **Powerful Task Scheduler for Revit\*, Export and Print deliverables overnight**
- ✓ **Intuitive user interface, easy to learn, set up and deploy**

**[www.rtvtools.com/30-day-free-trial](http://www.rtvtools.com/30-day-free-trial)**

\* listed feature requires RTV Xporter PRO version



# ORDER TODAY. CREATE TOMORROW.

Thanks to Quick Ship, it's easier than ever to get your hands on legendary BOXX performance. Whether you're in the market for an overclocked APEXX 2 workstation, best-selling GoBOXX 15 SLM mobile, desktop-replacement GoBOXX 17 MXL, or desk side rendering and simulation side-kick renderPRO, Quick Ship lets you take delivery of your new system as soon as the following day.\*



APEXX 2



renderPRO



GoBOXX SLM



GoBOXX MXL



Image Courtesy of Daniel Simon

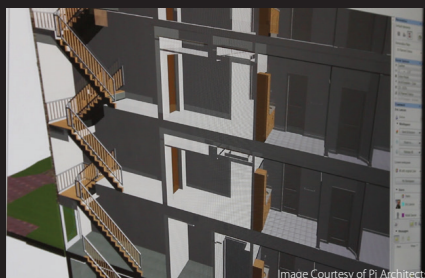


Image Courtesy of Pi Architects



Image Courtesy of James Cro



Image Courtesy of PBK VIZLab

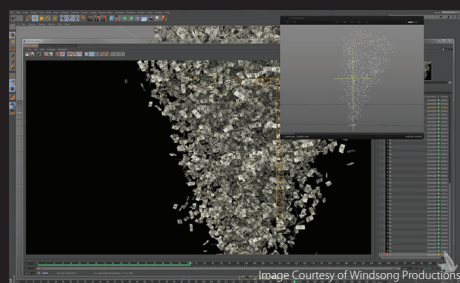


Image Courtesy of Windsong Productions



Image Courtesy of George Ma

\* Some restrictions apply.

For more information on BOXX Quick Ship, visit:

[www.boxxtech.com/products/quick-ship](http://www.boxxtech.com/products/quick-ship) OR call 888-984-7589



# BOXX

"Intel, the Intel logo and Iris are trademarks of Intel Corporation in the U.S. and/or other countries."