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# AUGIWorld

The Official Publication of the AUGI Design Community

October 2019

# Customizing Autodesk Products

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- Controlling Calculations in AutoCAD
- Developing a Strategic Plan, Part One
- Share/Load/Use Elevation Markers in Revit



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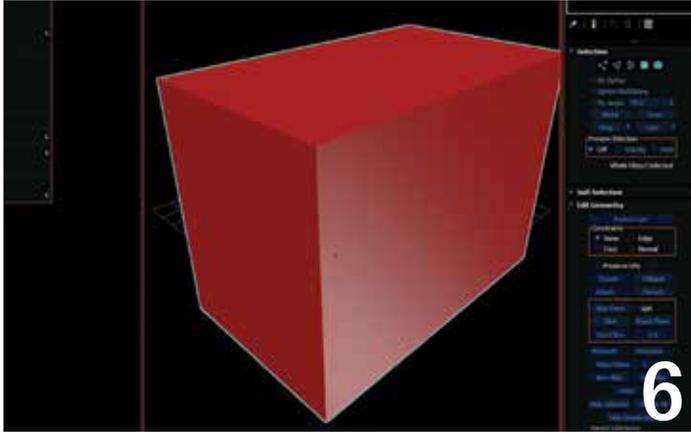
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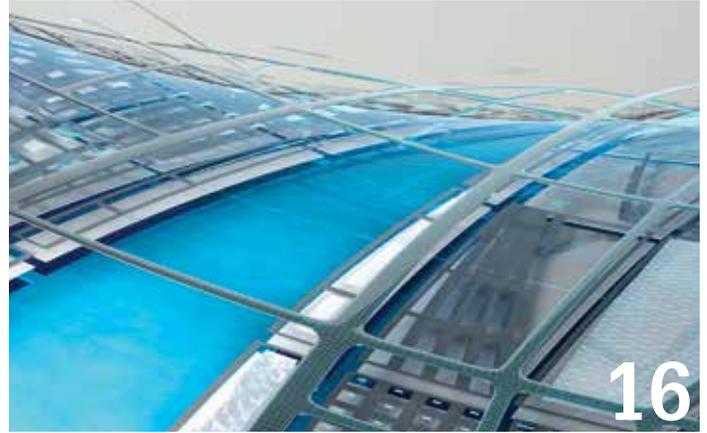
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# Letter from the President



# AUGI

## GREETINGS!



October is here! Can you smell the pumpkin spice everywhere? Fall brings about so many changes. Tree leaves display an array of color that could set the background for a Thomas Kinkadee painting. The chill in the air makes us bring out sweaters and jackets, and we know that winter is just around the corner.

For those of you in warmer climates, I am sorry you don't get to experience fall the way we do in the Northeast USA, although many of us here spend our cooler months wishing to be on a warm beach!

This year has been a year of many changes for AUGI, and this month is no different. So far, we have gone through a complete restructuring of our organization, and by the end of year will become reincorporated as "AUGI, Inc". Reincorporating has prompted the Board of Directors to review our bylaws, which were last revised in 2016. With this revision, the Board has decided to change the terms of the Directors. Similar to many organizations, Directors now elected to the board will remain on the board until they choose to step down, or are removed per the bylaws. Previously, Directors were elected to staggered three-year terms. The Board feels that this will provide stability to the organization rather than having a continuous revolving door of Directors. The executive officers (President, Vice-president, Secretary, Treasurer) terms will remain as previously stated in the bylaws. Once adopted, the revised bylaws will be available on AUGI.com on the "About" page. We will discuss more about this at the AUGI Annual General Meeting at Autodesk University (AU) 2019 next month.

Speaking of AU, can you say "more changes"? For the first time, AUGI will not have a formal booth in the exhibition hall (\*gasp\*!). Instead we are taking part in the new AU Community Hub, alongside other Autodesk Community groups. Obviously, we will have many opportunities to network with volunteers, partners, and attendees throughout the week, so please stop by and say hello! Also, we will be holding the Annual General Meeting on Wednesday afternoon before the evening social. Please check the AU2019 schedule for the time and place, and add the AGM event to your agenda. (Hint: we will be handing out our famous beer glasses during the meeting, so you will want to be in attendance!)

This month's issue of *AUGIWorld* focuses on Customization. Our authors have come up with some fascinating ways to customize software, content, and processes. I am sure you will find something that can help your daily workflow!

We sincerely hope that the changes the Board has made will be for the betterment of the organization as a whole and better prepare the organization as it goes forward into 2020 and beyond. Each of our Board members has a unique enthusiasm for the organization and our membership. We still have a long way to go, and we welcome your feedback. We look forward to meeting with those who are able to attend AU2019 in person, but we are always available by email as well. Please feel free to reach out to any of us!

Cheers!  
Kimberly

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## AUGIWorld

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# Customizing Interface Colors

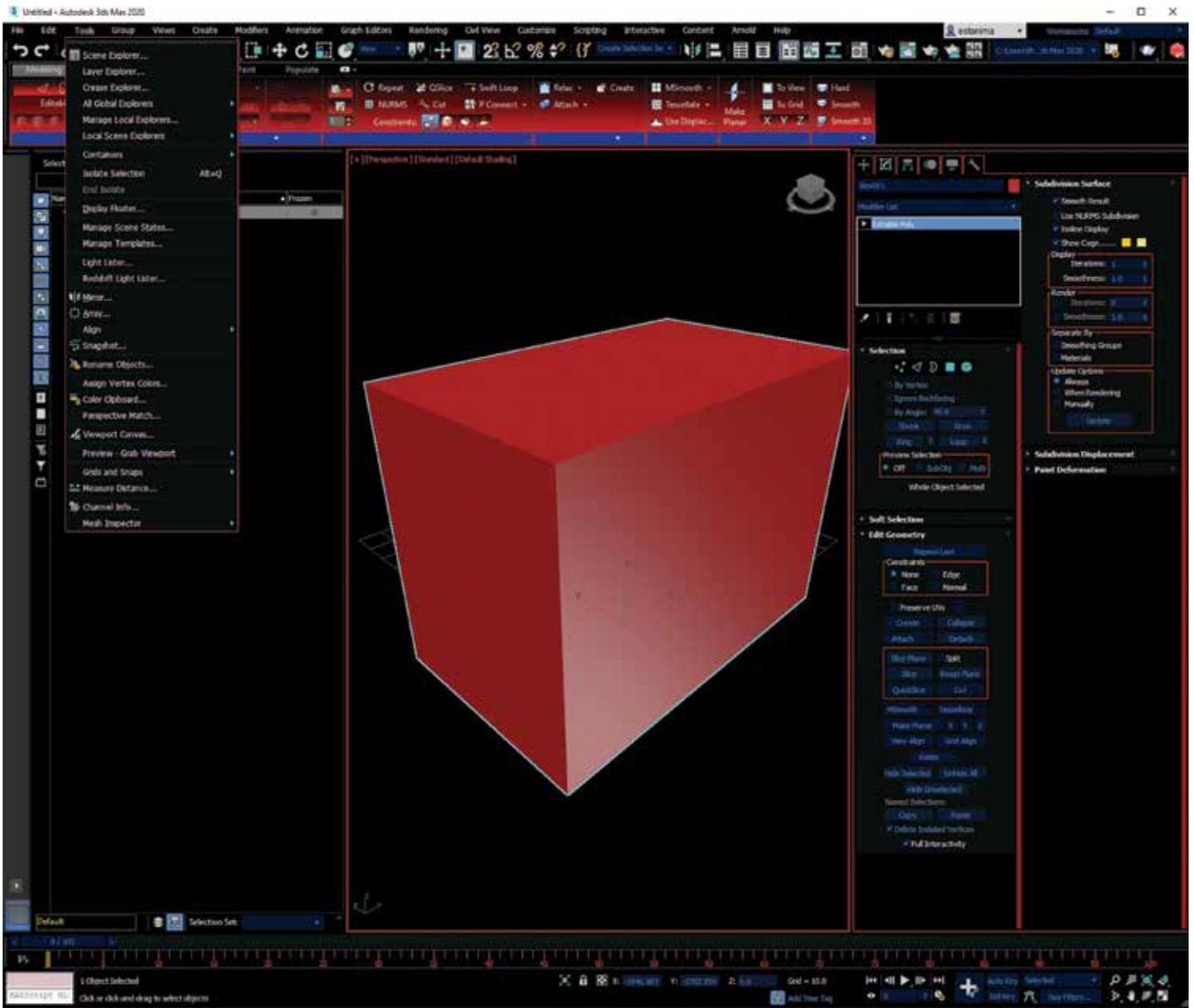


Figure 1: The Red Dragon interface



The 3ds Max® interface is virtually identical to the one from two decades ago, so let's spice it up a little. I'll be sharing the files for the configurations in this article as well as describe how to implement them and customize them.

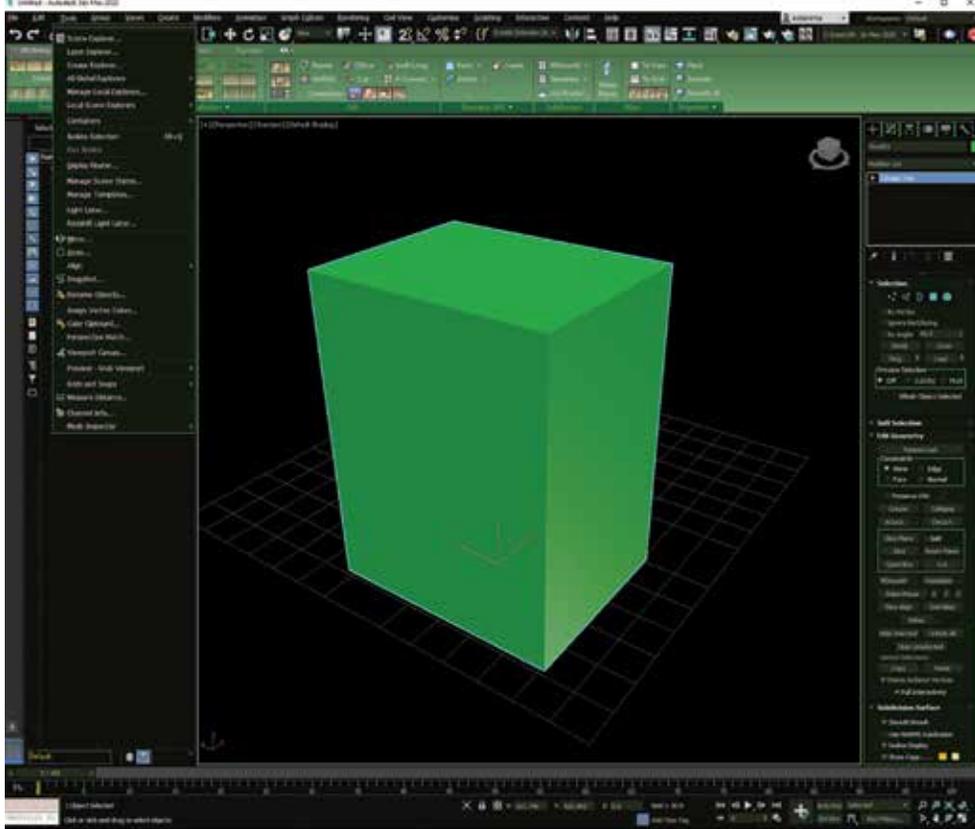


Figure 2: The Military interface

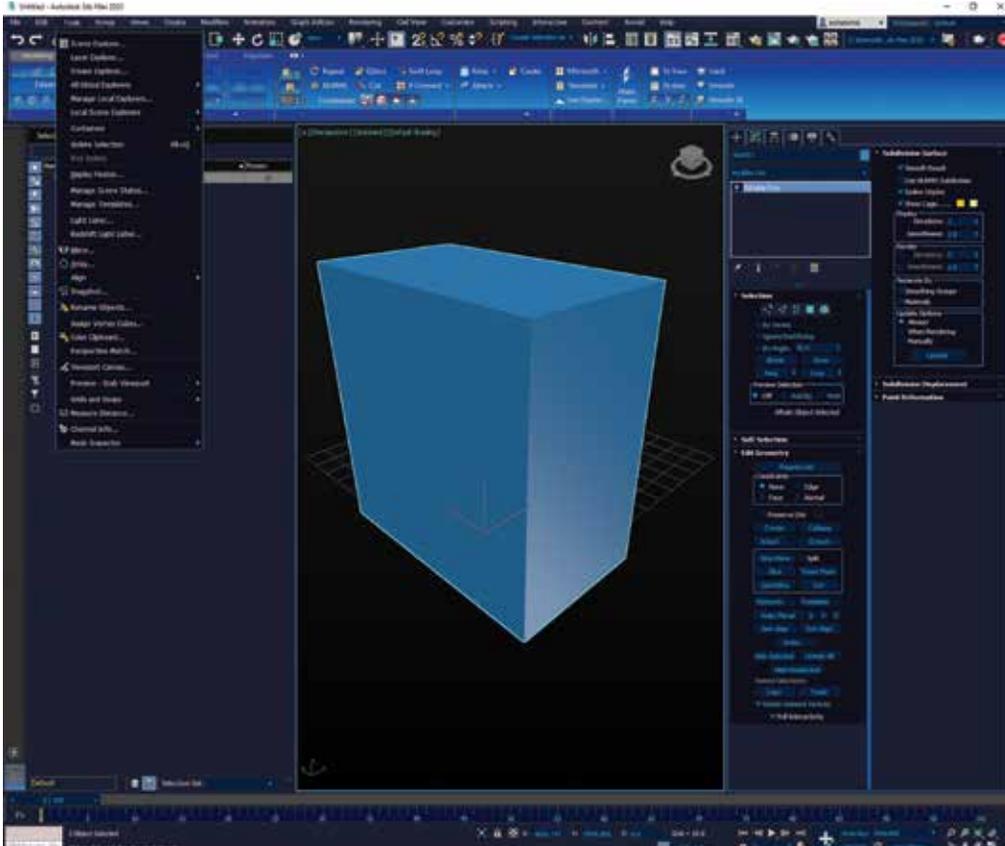


Figure 3: The SCIFI interface

# 3ds Max 2020

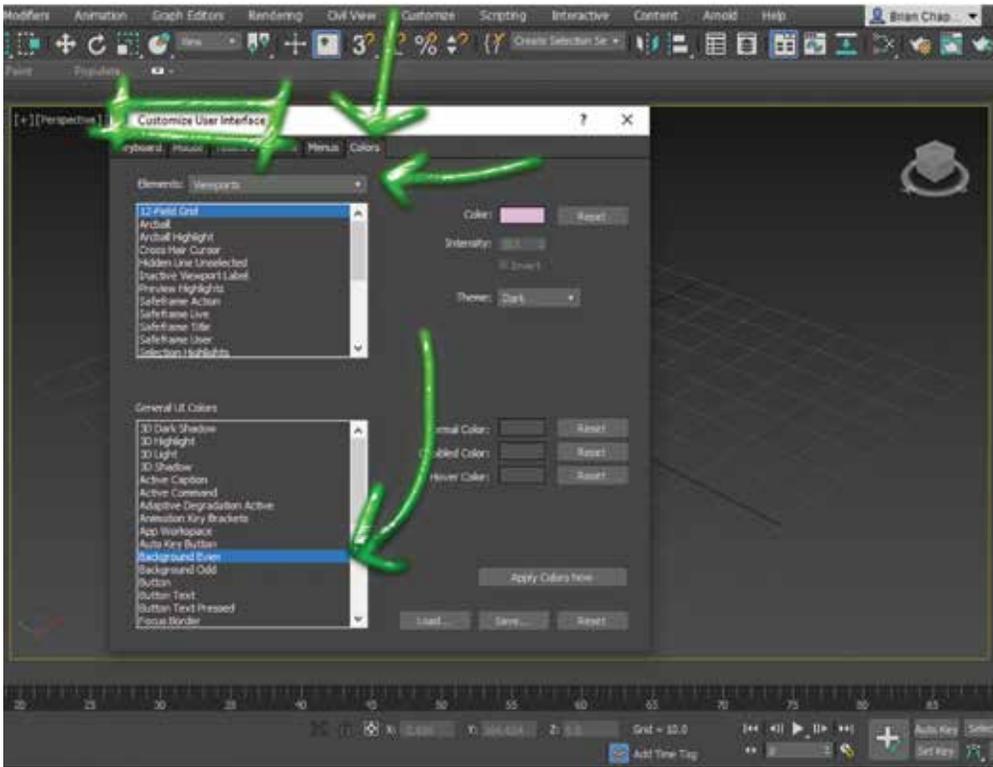


Figure 4: Customizing colors

Changing the majority of the colors of the interface is relatively simple using the Customize User Interface options found in the Customize menu and displayed in Figure 4.

The ribbon is more difficult. It requires manually editing the "CustomRibbonTheme.xaml" configuration file stored in the installation directory. For the 3ds Max 2020 English version, the default location is "C:\Program Files\Autodesk\3ds Max 2020\en-US\UI". Locating the proper values to reconfigure took some time, so I put together the graphic displayed in Figure 5 to identify the lines of text that impact each of the specific elements displayed in the ribbon.

**WARNING! CREATE A BACKUP OF THE FILE YOU WANT TO ALTER BEFORE MODIFYING IT.** These files are essential to 3ds Max and messing them up can cause 3ds Max to fail to start. Also, when modifying the color values in the text document, please be careful to notice and follow the format of the existing colors, where some are within quotation marks while others are not.

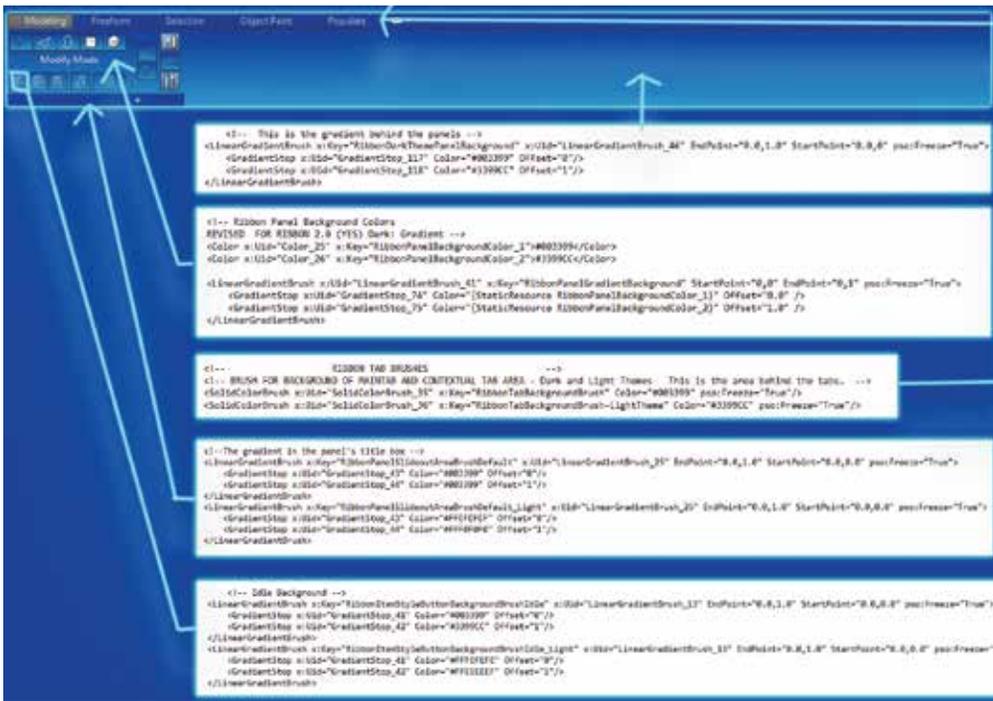


Figure 5: Ribbon elements for customization

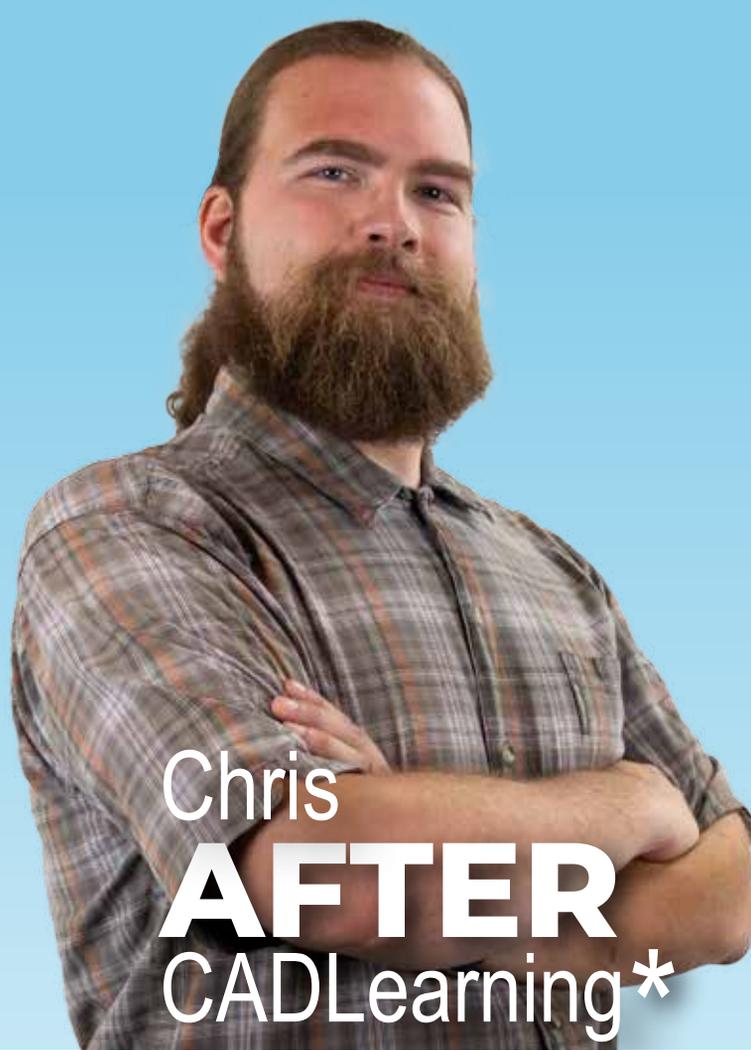
To download the themes mentioned in this article, visit my blog here: <https://wordpress.com/post/procad.blog/637>



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# Traditional(ish) Elevation Markers Share | Load | Use



**D**o you use standard OOTB (out of the box) Elevation Markers?

No = You can (possibly) go ;)

Yes = Read On! It's brief, but packs a punch beyond the thousand words I did not write, if your firm wants or needs something like these more (dare I say) traditional markers.

In response to a RevitForum.org<sup>1</sup> post—where I included the Elevation Markers<sup>2</sup> I had created a few years back (when we were finally allowed to modify them nearly as we require)—I am once again sharing them, for anyone interested to use...thus the “sharing” part of the title.

<sup>1</sup> <http://www.revitforum.org/forum.php>

<sup>2</sup> <https://bit.ly/2IHuDP8>

Figure 1

The reason the View Number is not in the circle above a line over the Sheet Number is because I have not gotten that line to stay horizontal, no matter the angle of Elevation (and I do not suggest using a bootlegged Section Marker to look like those old markers). Well, on to the goods...

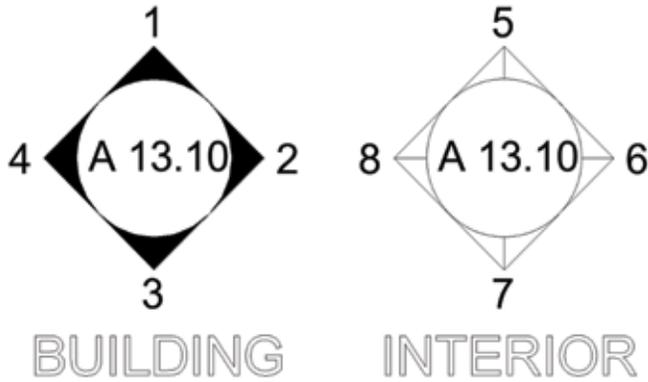


Figure 2

While these do not (since they still cannot) appear exactly like the old hand-drawn Elevation Markers, they are an obvious boon over the OOTB offerings. Well, as much as they can be ;-). The little lines in the Interior Elevation markers (Unfilled) are needed due to the construct of the “pointers.” If you find that an imperfection, I can’t help you but to say you can probably modify the nested families and perhaps use an Invisible Line for the bottom of the arrows... I never did, because I am not offended by those “lines.”

So without further ado... Download ‘em from below, embed ‘em into your template(s), set ‘em as your Elevation Tags (refer to the images, of course) and have at it! Then share with anyone you know who you think might also benefit.

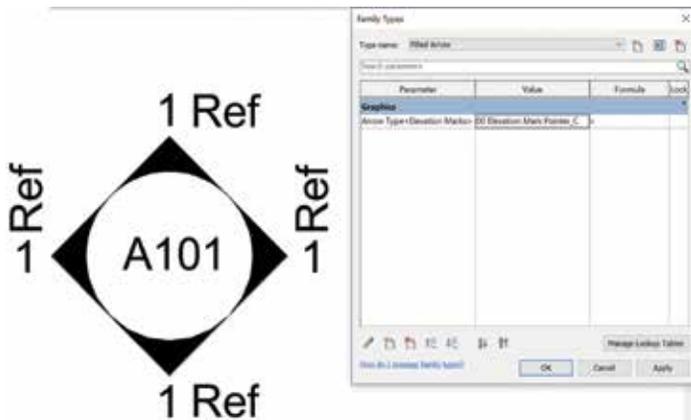


Figure 3: The “Circle” and Parameters

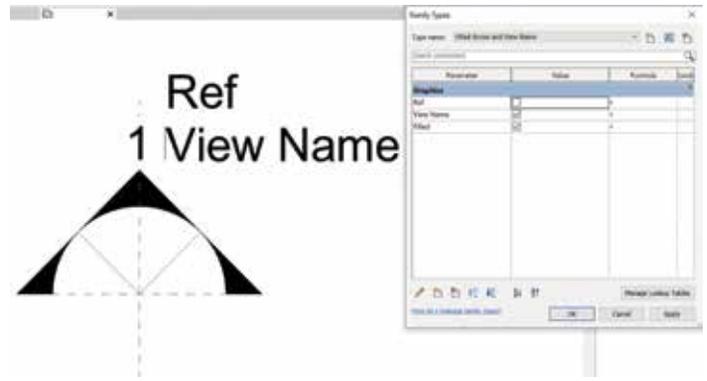


Figure 4: The “Pointer” and Parameters

The “Circle” and Parameters, followed by the embedded Types:

Download the “Circle” below<sup>3</sup>  
Download the “Pointer” Here<sup>4</sup>

Share, rinse, repeat. Cheers.



Jay B Zallan | Virtual Design & Construction Technology Conductor (& Fine Artist)

Mr. Zallan brings wide-ranging Design, Delivery, Management, Mentoring and Teaching experiences to the readily changing AECO industries, founded on an expansive 35 year career.

Jay has focused on VDC planning, production, process development and research & development; to help enable efficiency-generative creative project execution, delivery and success throughout the AECO landscape.

This JayZ is an educator, author and industry lecturer throughout the BIM world; Jz strives to inspire current and future generations to achieve and exceed beyond even their own expectations.

Being a Fine Artist (large format oil & mixed media canvases), J adds unique and collaborative insights and perspectives to every team he is part of.

<sup>3</sup> <https://bit.ly/2LZ4AmJ>

<sup>4</sup> <https://bit.ly/2kzyPQO>



# Developing a Strategic Plan, Part One



**I**n previous issues, I presented information on a Start/Stop/Continue process that gets you thinking of what might need to be addressed in your tech environment. That leads us to the next step, a more formal, written Strategic Plan. The need for a Plan may not seem obvious, but it is a needed effort. If your firm does one for the entire organization, see if you can participate or feed into it. You need to have your own for design technology even if you do not have one for the entire firm.

NOTICE: This material was developed for and presented by me at Autodesk University 2010 and also posted on my [caddmanager.com](http://caddmanager.com) blog. It fits well in the progression of my articles and so I

present it here in abbreviated and updated form. If you have heard/read this before, you can read it as a refresher or just fast forward to another article in this magazine.

## WITHOUT A STRATEGIC PLAN...

What would you see as the impact of operating without a Strategic Plan? If there is not much impact, then why bother with the whole effort? Let's look at what your processes and progress will look like without a Plan in place.

- Your budgets will be difficult to get approved because each line item will not tie to another. They will just be scattered acquisitions that are seen by management as "going nowhere." The Plan focuses.

- There are teams of people who ignore your advice because they do not share your end goal. They think your perspective is just another in the mix of scattered opinions that the firm has. The Plan unifies.
- Random silos of technology are competing for attention and you have no way of shouting over the noise. The Plan give you a voice.
- Projects march to their own drummer and adopt technology that does not mesh well with other tools. The Plan helps production.
- Someone else will “sell” management on their vision because it appears you do not have one. The Plan presents the future.

### WITH A STRATEGIC PLAN...

If you have taken the time to develop a written Strategic Plan, then you will have begun the unification process of getting everyone on the same page. Here is what is more likely to happen if you have a Plan in place.

- You increase your credibility with the business leaders because they see you as a peer in their process of getting the firm going in the right direction.
- You gain closer alignment between technology and business objectives because you have included their goals as a target for yours.
- You improve teamwork between tech and internal business partners such as design and production.
- Your efforts are easily visible to others because they appear as firm-wide successes. You have outlined what you will be doing and how you are going to get there. When you succeed, everyone knows it.

### WHAT I WON'T TRY TO DO IS...

I am not trying to define the perfect planning method. There are so many out there that this would be tough to do anyway. What I am going to do is discuss what I have done in the past and keep it as simple as possible. I will not try to cover the grand scope of planning. I will not try to discuss every option and critique current wisdom. There is too much to cover. With the expansive concepts and ideas and methods for planning that exist, it would take too much to cover them all.

### WHAT I WILL TRY TO DO IS...

I will give you a starting place. I want to provide a spot to start or some additional thinking about getting started. Where to start is sometimes the hardest thing to define. People get caught up in the overwhelming scope of things and freeze up. Starting simple is key. I will seek to give you a framework for creating a Strategic Plan. It will be simple, but workable. I will try to set you in motion. I will talk about where to start and how to get moving. And finally I will let you define your processes. I will encourage you to make it your own.

Here is a basic process for Strategic Planning in a nutshell.

**Step One: Look to the Past** – where have we been – what got us here – what has worked – what has failed.

**Step Two: Look at Now** – what are we doing now – what are we



doing that works – what needs to be addressed (think Start, Stop, Continue).

**Step Three: Look Toward the Future** – what could we do – where might we go – time to dream.

**Step Four: Define your Goals** – what can we rationally expect to achieve.

**Step Five: Identify Initiatives/Actions** – in general, how are we going to do it.

This article, Part One, will get through Steps One, Two, and Three. We will cover Steps Four and Five next time and then wrap it up.

### LET'S DIVE IN

**Step One: Look to the Past.** A quick or long look back will help frame the whole process. By getting a proper perspective on what has previously happened, we may be able to either repeat the successes, build on them, or avoid the failures of those that came before. You need to be asking some questions about your firm and team and environment that will be used in framing steps four and five.

What is the CAD history at your firm?

Did your firm jump into the CAD or BIM arena quickly? Did it get dragged into the latest release begrudgingly? Did it have any major failure points in the past that might cause some to have concerns if you attempt something new? How quickly does your firm embrace new technology? What were the challenges faced and how did your firm handle those challenges? Are the circumstances that caused these challenges still the same? Are those challenges still around? What have you learned through past changes and progress efforts?

#### The Product of Step One:

You will know you have finished this step when you can write a good narrative or list of what has happened in the past, how you got there, what you learned, and what you would avoid in the future. If you think you are done and have not written it down,

# Tech Manager

then stop and create a document. Don't just think you are done because you have it in your head. Writing it down will force you to think through the issues and personalities that surround the issues. You may not share this with anyone or it may be a collaborative effort. The document is just a method of getting it all assembled in your head and then on paper to make sure it captures everything. Don't just think that if you spend a few hours thinking about the past that you have completed this step. Writing it up is part of the process of completing this step.

**Step Two: Look at Now.** What is happening at your firm right now?

You need to review the following areas at a minimum.

**What's Working; What's Not** – take a hard look at what people are embracing and what they are rejecting. What is improving and what is floundering? What made one project a success and another stumble?

**Team and Talent** – the makeup of the group you are working with will impact your ability to reach a goal. What is your team good at? Where do they need training?

**Resources and Budget** – the availability of tools, budget, and hardware will frame the scope of your planning. Do you have all the tech you need? Is money tight? Is hardware showing its age?

## The Product of Step Two:

You will create a short written list of possible and probable areas of opportunity. It will include constraints and resources, key people and tools, and other important items from your review. A list of strengths and weaknesses, opportunities and threats. Think "SWOT" analysis (search it on Google if needed).

**Step Three: Look Toward the Future.** Now you can start dreaming a little. Now you can think outside the box. By working through steps one and two, you have framed the reality of what you might dream about. Thinking about the future should be done by keeping in mind what the past has taught you and where you are now. Don't let it specifically limit your thinking—just allow it to define the issues related to the dreams you may have. Drawing on the data and knowledge you have obtained from steps one and two, create a picture of how you want your environment to be. Build a list of 20 or more "possibles."

Think now about the long term. What vision do you have for your environment in one year? Three years? Think about what your users might want or just ask them. Think about your firm and what they are trying to get done. Talk to others about what they are hearing, where they would like to go, and what buzz might be going on in their circles.

When you have your 20 or so, then go back and prioritize them. Put the most important at the top. Move the ones you think you can reach up near the top. Put the ones that have to be done near the top. Force yourself to have the 5-7 most important at the top of the list. Keep them all, just get them listed in priority.



## The Product of Step Three:

- A coalescing vision of what you want to do going forward.
- A list of 20+ "possible," then narrow it down to 5-7 "probables"—targets for review in Step Four and possible action.
- Others who in general agree with your targets since they help define them.

Next time we will look at Step Four and Five and then wrap up the Planning portion of your thinking. In the meantime, start thinking and working through Steps One, Two, and Three.

Ending with a side note: now I can add CIM Manager under my umbrella term of Tech Manager for those that oversee and manage technology. So there is CAD/BIM/CIM/CAM... the list keeps growing. Did I miss any? If you need to know what a CIM Manager is, go back and read the article by Todd Rogers in the August 2019 issue of *AUGIWorld*.



*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).*

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# Introduction to Dynamo for Customization

 **W**ith the last few releases of AutoCAD® Civil 3D®, Autodesk gave users the ability to manipulate the software in unconventional ways. Some options should directly impact the way we think about our work, while others can simply make the experience of using the software better. In this article I'd like to talk about one of those called Dynamo.

## DYNAMO

It's difficult to estimate the impact of Dynamo will have, but for me it's a ground shaker. I spent the last 20 years diving into the customization realm of Autodesk software to simplify my life. After years of tears I've finally built a decent foundation and can accomplish most of what I want. Dynamo came in and smashed that foundation to tiny little grains of sand. Let me try to explain.

Programming is all about optimization, scalability, reusability, and speed. Despite our best efforts to achieve this, there is almost always something certain to interrupt the effort and break the process. This causes a constant urge to rewrite while weighing the options if a bug is big enough to warrant such a task, or is something we can learn to live with and work around.

To clarify, in most cases, we write code for CAD in a way that can be used across multiple routines. This intertwines them. When a user, boss, or client asks for that specific portion of a program to be reconfigured, say for scalability or to be shared in different environments, this can require tearing out portions of the code and force rewrite (which involves an entirely new level of debugging, testing, QA/QC). Because these lines of code are embedded across multiple routines, the prospect of accomplishing this seems agonizing.

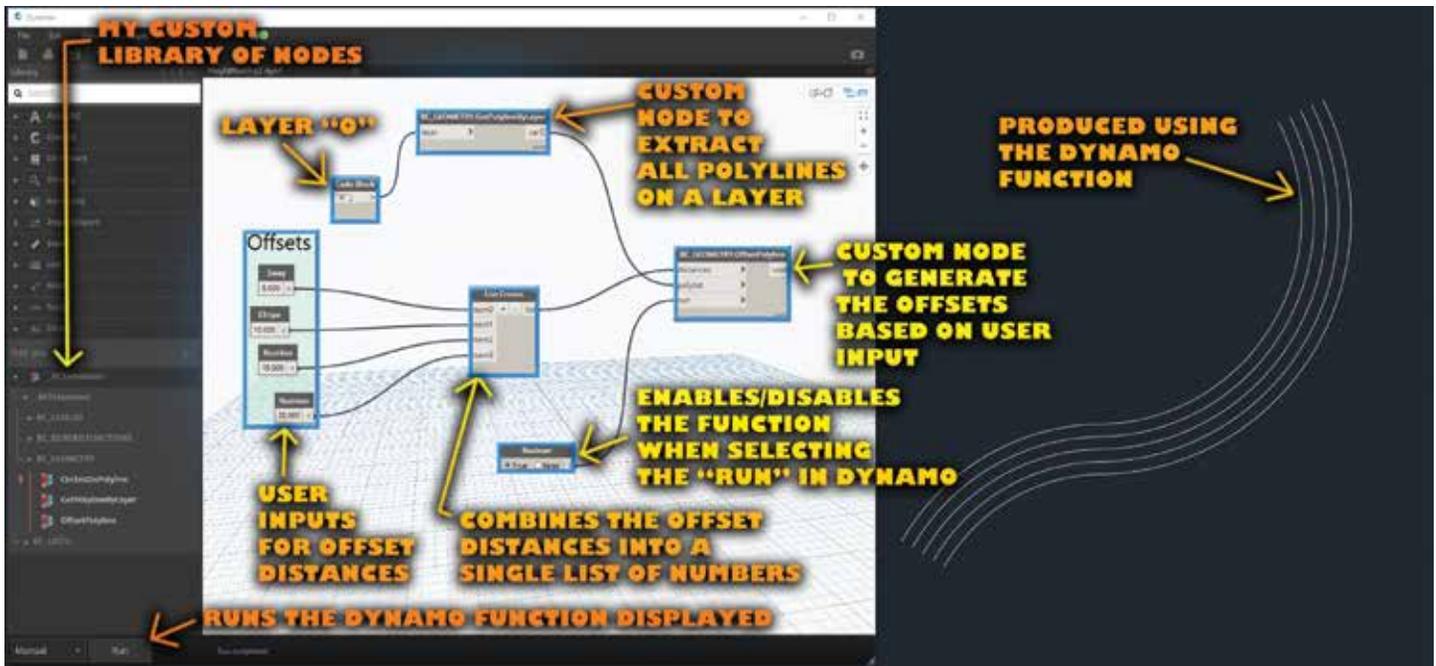


Figure 1: Dynamo example

Think of it as human DNA. The DNA is stranded together, but if we simply rip out chunks of it, the system is more likely going to break down completely than ever being repaired.

Additionally, without diving into the API, users have few options to customize their production. They rely on tools online or they outsource to individuals unfamiliar with their production environments and teams. This is enough, but subpar in my opinion. The users inside the company have far more experience facing issues in design and production than outside consultants ever will. Makes sense, right? Users are in the trenches every day of the year. They troubleshoot, design, train, and manage all at the same time.

To me, Dynamo proves to be a unique tool to provide solutions for both situations. First, the node-based solution with connectors allows users to attach and remove changes on the fly to test and troubleshoot as needed. This means users can plug and play with the various nodes until they eventually solve some of their more complex production problems. This might seem complex, but it is virtually no different than a child's game such as Minecraft. In the game, children connect blocks of materials (wires) and when they press the appropriate switch those connectors cause a reaction. If children can accomplish this, there is no reason users can't as well.

Second, as a programmer I can focus on building nodes that accomplish specific tasks, rather than entire pieces of code. Users can begin to think of their tasks differently, and instead of asking for code that will solve one unique problem, they can begin to consider the steps that might be in common with other situations and simply request a node be constructed to solve that step.

This way, users and programmers become a team, and Dynamo can be used to connect them in a new way. For example, a user

might want a node that would offset a selected line a designated number of spaces. The designer realizes the same concept could apply to columns, trees, or anything else. The designer knows the spaces will vary and wants to be able to input varying numbers and distance conditions at the same time. So, the designer asks the programmer to provide a node that will assist him. I won't lie, for me to program this could be a real pain. The varying inputs can provide a unique challenge with coding. Dynamo nodes provide simple and quick solutions to this. It will simply take all the users' input, regardless of how many there are, and implement them as the designer sees fit.

See Figure 1 for an example of custom nodes used in conjunction with the standard Dynamo nodes to offset polylines any number of distances desired.

One last note: Dynamo allows us to connect multiple applications to each other at the same time. For example, I've constructed a node system that will take Excel data and update a drawing simultaneously based on the input on the Excel sheet. I can't wrap my head around all this yet, but I know it's incredible.



Brian Chapman is an Autodesk Authorized Developer, Digital Artist, and a Senior Designer for an engineering firm located in Las Vegas, Nevada. Brian shares tips and tricks at [procad.blog](http://procad.blog) with a portfolio of digital artwork and renderings at [emptypawn.com](http://emptypawn.com). He can be reached at [procadman@pro-cad.net](mailto:procadman@pro-cad.net).

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## Kreo plug-in

<https://www.kreo.net>



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**Kreo Design plugin – Import:** Plug-in for importing BIM models to Revit from Kreo Design. Kreo Design is a cloud-based Common Data Environment for architectural design, structural and MEP engineering.

## Hilti BIM/CAD Library

[https://apps.autodesk.com/ACD/en/Detail/Index?id=4171643372823727407&appLang=en&os=Win32\\_64](https://apps.autodesk.com/ACD/en/Detail/Index?id=4171643372823727407&appLang=en&os=Win32_64)



A fast and convenient way to integrate models of Hilti objects in your project design. This AutoCAD® plug-in allows you to access the Hilti BIM/CAD library and download BIM/CAD objects.

Features in version 1.0.6:

- A library of downloadable 2D and 3D models of Hilti products
- All objects contain BIM information/attributes for your specification needs.

## SteelGen

[https://apps.autodesk.com/ACD/en/Detail/Index?id=336903807590709510&appLang=en&os=Win32\\_64](https://apps.autodesk.com/ACD/en/Detail/Index?id=336903807590709510&appLang=en&os=Win32_64)



SteelGen is an extension for AutoCAD® software that allows users to quickly create pipes.

It also allows users to create steel profiles from an archive with all the standard ISO sections.

## Scope Box Purge

<https://apps.autodesk.com/RVT/en/Detail/Index?id=4919173385045756509&appLang=en&os=Win64>



This application is used to purge unused Scope Boxes from an Autodesk® Revit® project.

It will quickly show you how many Scope Boxes there are, which ones are not used (and are thereby safe to delete), and which are in use by which views, levels, grids, or reference planes.

## Unhide Elements in View

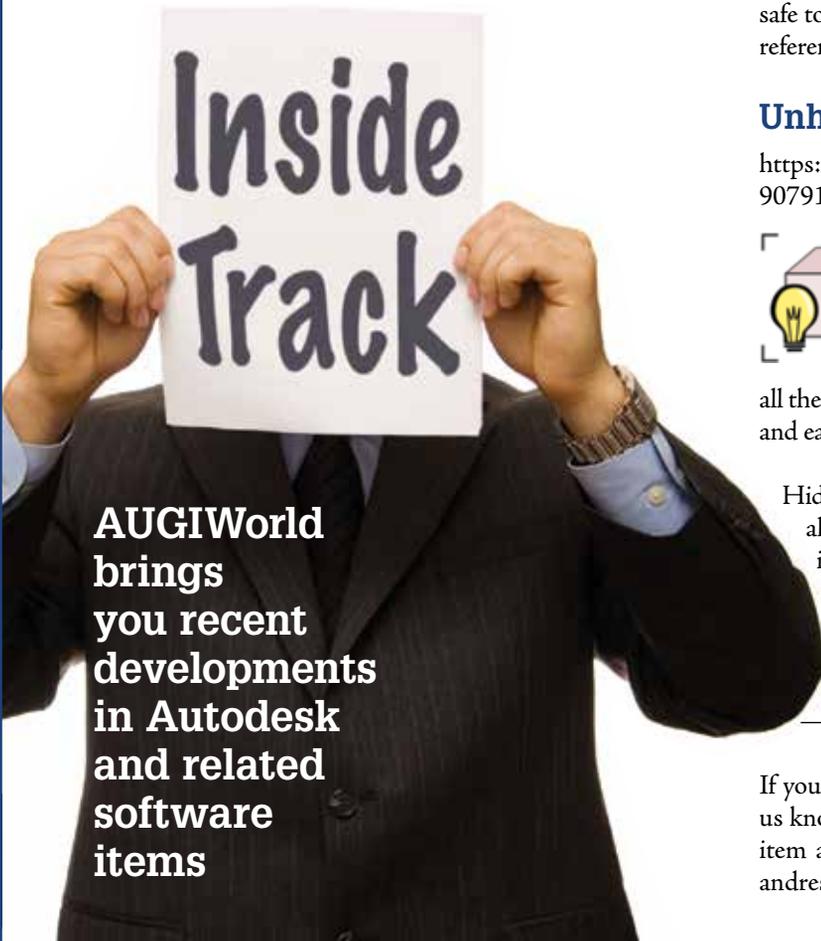
<https://apps.autodesk.com/RVT/en/Detail/Index?id=5479557907912375808&appLang=en&os=Win64>



Hiding an element in the view is quite a tricky move. It is an effortless way to mask single elements; however, hidden elements are hard to manage.

With this add-in, you will be able to quickly identify all the elements which are hidden in the active view. It is much faster and easier to use than the native “Reveal Hidden Elements” button.

Hidden elements will all be listed and sorted in a new window, allowing you to choose the ones you want to unhide in the view.



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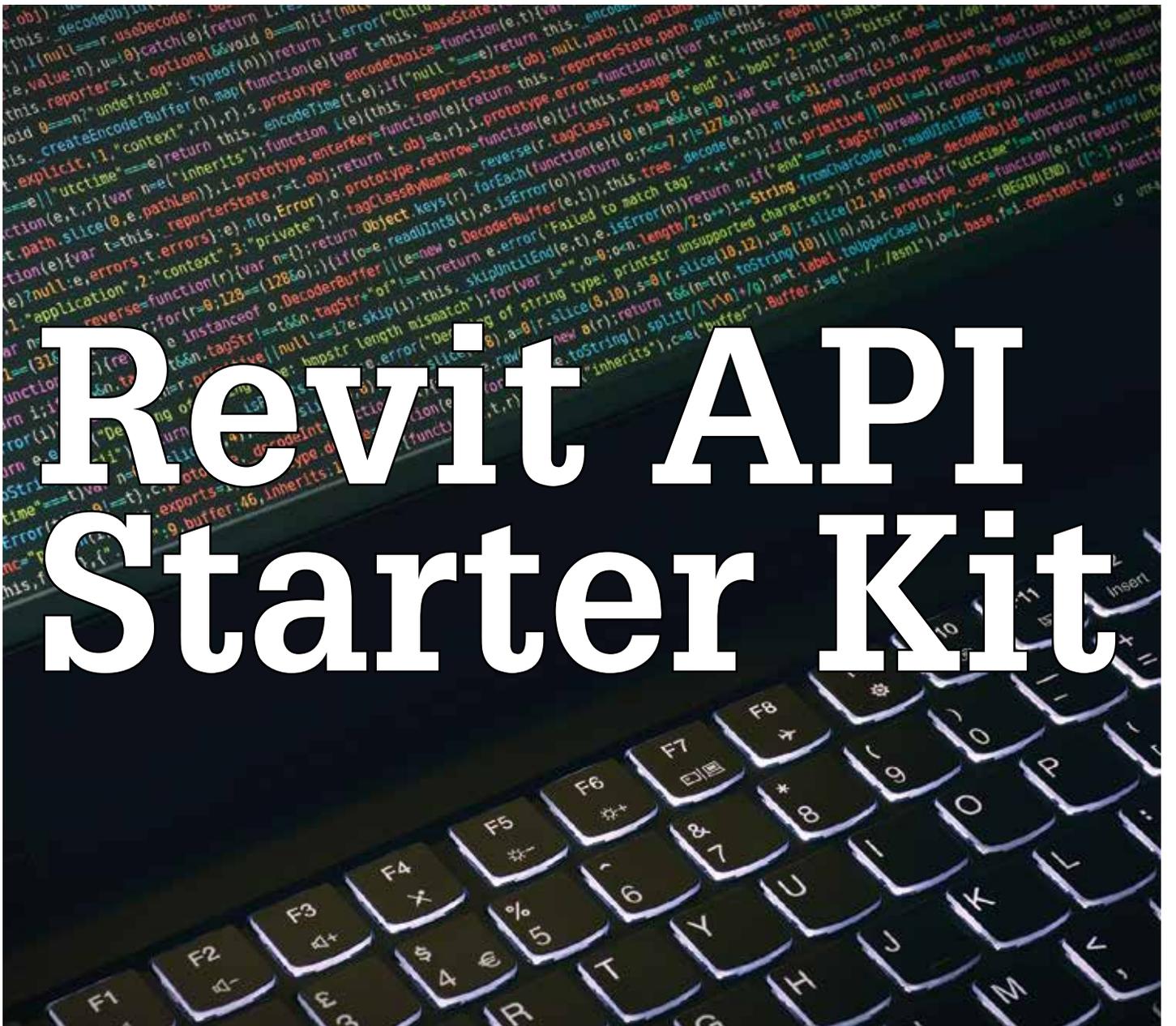


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# Revit API Starter Kit

**W**e all have some tedious, mundane tasks we would like to automate. Perhaps it is the dream button you have had on the wish list for years. Or it's a company standard that just isn't user friendly. Either way, you don't want to spend your precious time on tasks you can do while mentally checked out. As an employer, you don't want your employees unengaged in what they are doing when they could be performing valuable work. You also don't want them to feel unvalued, being asked to spend their time on menial tasks. Automation provides a win-win for the team. But where to start?

This article is intended to be a starter kit for programming. You'll find lots of links throughout to help you along your way. I know this may be coming to you in a printed format, I like it printed myself, but for what we are trying to do here, I'd recommend looking up this article on AUGI's website so the hyperlinks will work. I'm not

going to pretend to teach you everything in one article. Rather, I want to give you the tools that will help you along the way.

First let's discuss the various flavors of programming with Revit®. For many tasks you don't need a full blown programmed add-in. Dynamo is all the rage these days, but it is not without its own drawbacks. There are also macros, with pros and cons, and then there are full blown add-ins that take a bit more to get going, but with many advantages the others lack.

## DYNAMO

Dynamo (Figure 1) is one way to get the power of programming without having to code at all. It is called visual programming. It now comes free from Autodesk and is installed with Revit. It comes with a large supply of commands, known as nodes, that can get you going pretty well. Soon after you start playing with Dynamo you'll discover other people are generously donating their

efforts in creating packages of new nodes. You'll get hooked on these nodes and build some truly awesome graphs (collections of nodes and connecting wires to do a task).

Then just as different versions of Revit get released, different corresponding versions of the API get released, and so do different versions of these nodes. Keeping everyone in your organization current on the nodes and the graphs created for them can be challenging. I will often use Dynamo for tasks unique to a project—things I don't expect to need again on future projects. That's not at all to say you can't save your work and reuse it later. I do that all the time. If a graph is robust enough, you can send it to users and they can run it in Dynamo Player. It is a user interface that hides the nodes and wires of the graph by giving users a Run button. It even allows for user input for specific variables.

One awesome resource in the Dynamo realm is John Pierson, aka sixtysecondrevit. He offers tremendous support to the Dynamo community, maintains the Rhythm package of nodes, and a blog at: <https://www.sixtysecondrevit.com/>.

There are a lot of free tutorials on Dynamo. If you are looking for a video training package, BIM After Dark by the The Revit Kid offers a Dynamo class titled DIY Dynamo. It costs around \$250. <http://diydynamo.com/>

the application—you have to pick one. Macros saved within the project file can be used by any user who opens that file. Macros saved in the application are saved to the user's Revit configuration. These macros can be used on any model file, but only by the user who created the macro, which makes sharing them among many users cumbersome. All in one project is easy, and that project can be the company template—then everyone gets all the macros. However, they also get a pop-up every time they open Revit asking if they want to enable macros. This gets old fast. There is a setting under Revit options that will allow you to always enable macros, but you might want to run that by your firm's security team first.

I will often use application macros for repeatable tasks I perform, but not necessarily ones I expect others to need to use. For example, I maintain the project templates. If I need to make a change across all of them, I have a macro I edit each time to automate that change across all the various view templates. I rarely ever use the project-based macros due to the annoying pop-up everyone gets. But if I were to use it, it would be to solve a project-specific problem and I would be comfortable with its use by others on the project.

Macros are a good gateway into learning to program before diving into a class on programming and installing specialized software to learn. Harry Mattson at Boost Your BIM blog has a great online course. You'll pay about \$150 for the Udemy class, but it does a

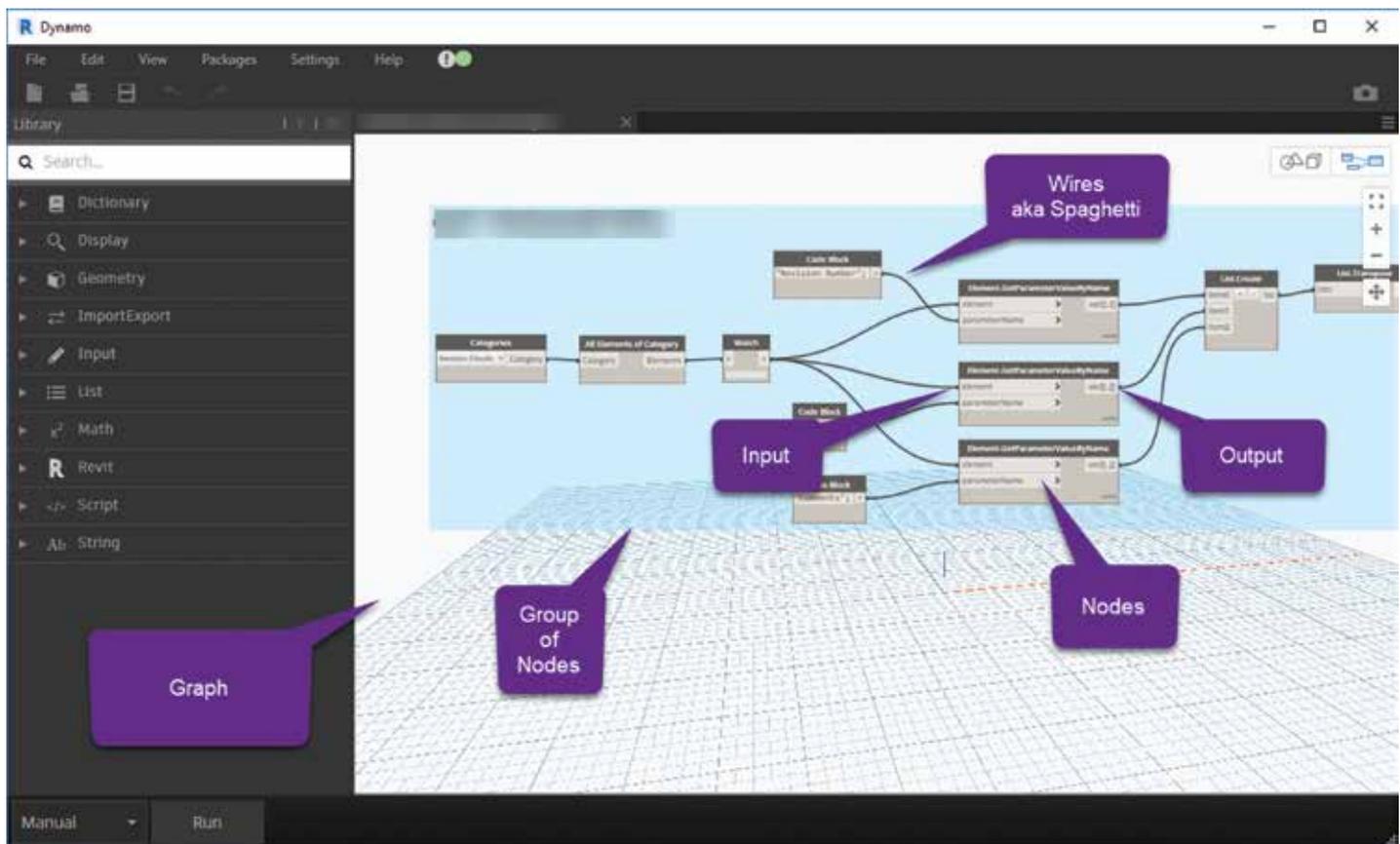


Figure 1

## MACROS

Macros are a powerful tool, but they have some hefty drawbacks, too. Macros can reside either in the active project file or within

great job of explaining the commands and how to use them from the macro environment. This environment is a lightweight programming editor and compiler known as Sharp Develop (Figure 2). It is very similar to Visual Studio, which we will discuss later.

# Revit 2020 – MEP

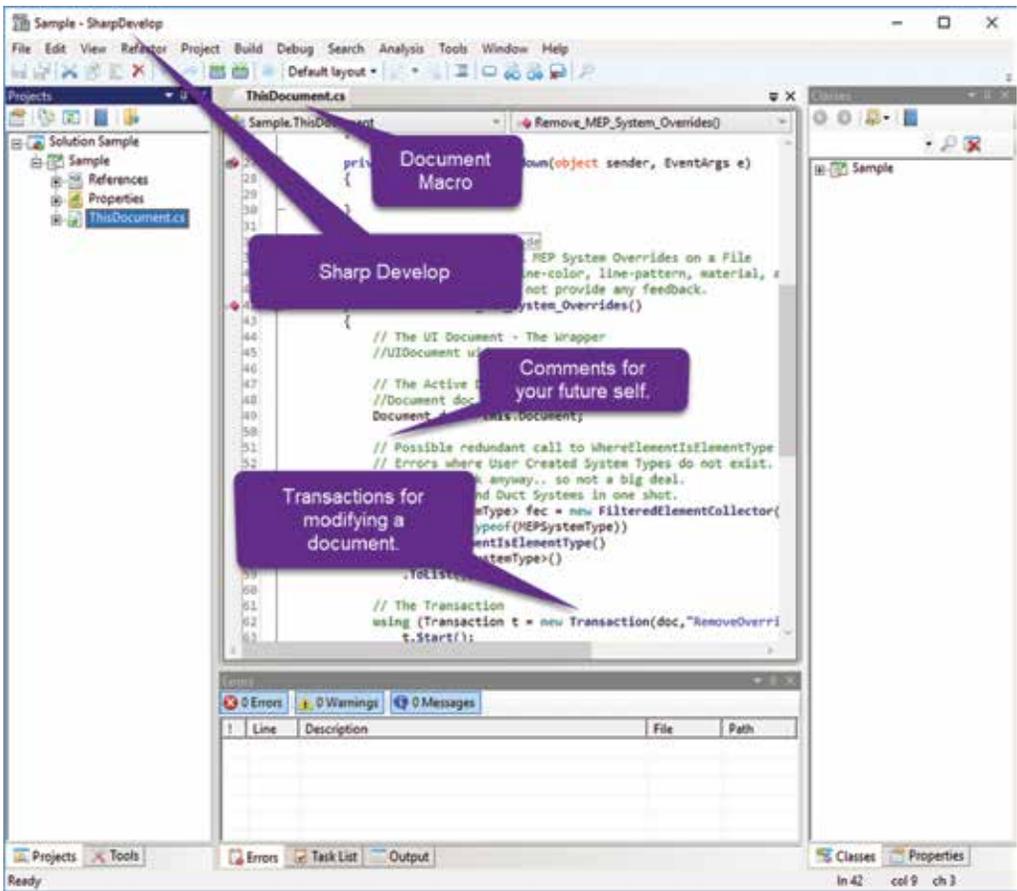


Figure 2

Another great resource is Michael Kilkelly at ArchSmarter. He has a great seven-step starter for writing macros.

<https://archsmarter.com/first-revit-macro/>

<https://www.udemy.com/>

<https://boostyourbim.wordpress.com/>

## ADD-INS

Add-ins are a bit more work upfront. They are just as powerful as Dynamo and Macros, but more rigid. Users are not able to open up the hood and edit what is happening. Add-ins offer the ability to add your own buttons to the ribbon, though this is not required. Because of the environment they are created in, they have better tools for debugging and figuring out why things are going awry. They are also much easier to share and maintain across a large company.

### Minimum Requirements

There are just two elements required for Revit to acknowledge and implement an add-in. First, it needs to read a “add-in” manifest file. This file must be stored in one of two places.

C:\ProgramData\Autodesk\Revit\Addins\2019

or

C:\Users\userName\AppData\Roaming\Autodesk\Revit\Addins\2019

This file tells Revit that an add-in exists and where to find the second requirement, a “.dll” file. This .dll file is the output of compiling your code in Visual Studio. When you run your code via Visual Studio, it is compiling it and creating this .dll file in the “bin” folder of your project. Compiling is the process of converting the written code from C# into machine language the computer understands.

### Programming

If someone remembers their programming classes from college, that’s great, but not required. There are free resources available to learn programming. Here you’ll need to decide which language to learn. My recommendation would first be C sharp, aka C#. The reason is all of the supporting documentation, including sample code, is provided in C#. That makes using copy and paste much easier if it’s the same language you understand. That’s not the only one though. Visual Basic and Python are excellent choices, but may require more translation, which could be

troublesome for a beginner.

You don’t need to enroll in the local community college, though that would be a great start. On the frugal side of things, Microsoft offers a free online Fundamentals for Beginners C# Programming course. All it requires is a free Microsoft account.

This course gave me a good understanding of the functions and grammar of C#. It also talked me through downloading and installing Microsoft’s Integrated Development Environment (IDE), called Visual Studio, called Visual Studio (Figure 3).

Visual Studio comes in various flavors ranging from free to several hundred dollars. I recommend the use of the Visual Studio Community Edition, free for individuals for both free or paid apps. If your company has more than 250 PCs or generates over \$1 million in revenue, then you’ll need to be honest and pay the \$500 for the Professional version or the Enterprise Edition.

<https://docs.microsoft.com/en-us/visualstudio/get-started/csharp/?view=vs-2019>

<https://visualstudio.microsoft.com/vs/community/>

If you are creating your own add-in using Visual Studio I’d highly advise you to download and install the Revit Add-in Project template for Visual Studio. Just like Revit has project templates for new projects, Visual Studio has templates for programming new projects.

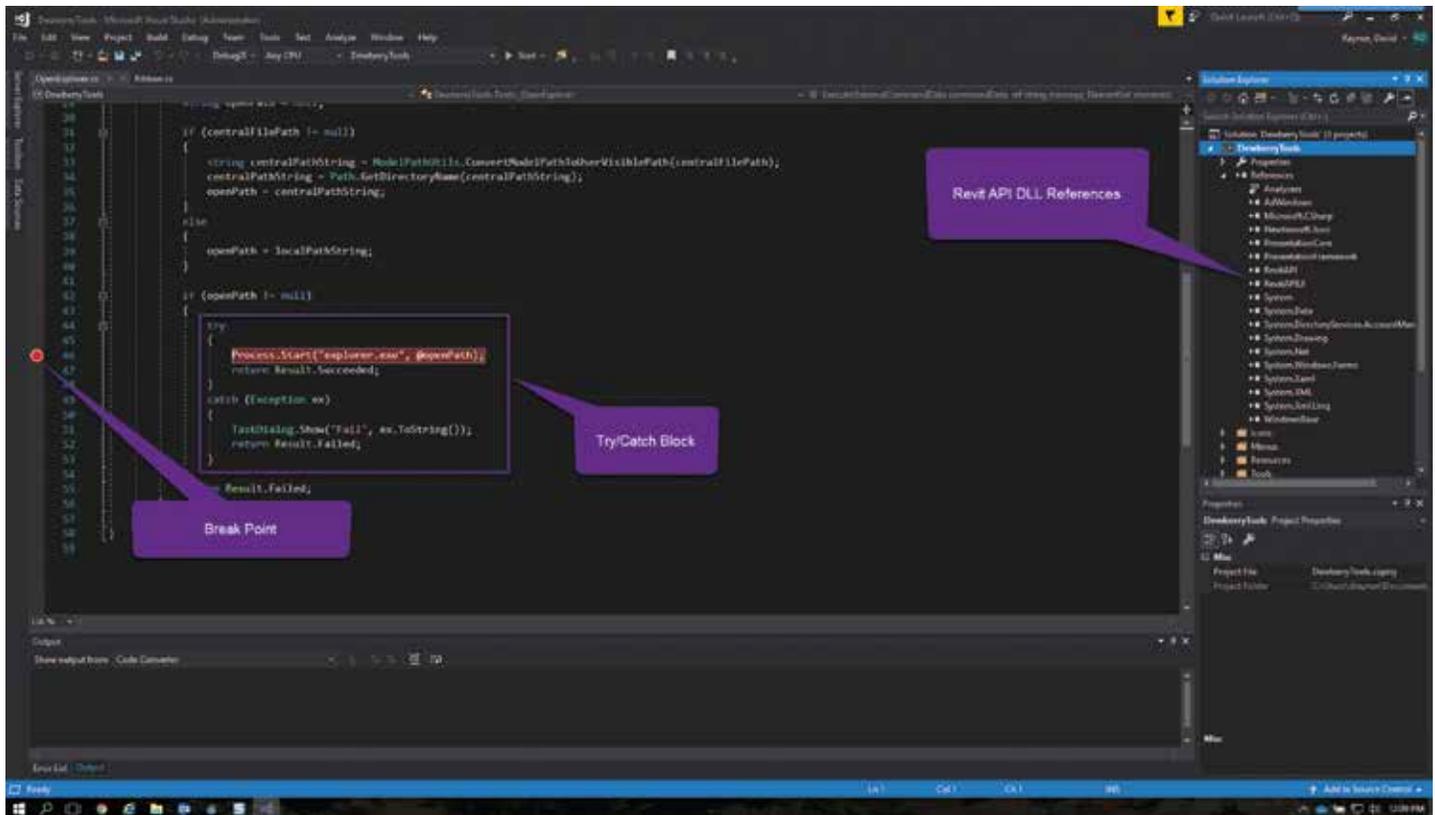


Figure 3

This template is stored on Github. Let me explain what Github is. When multiple programmers are working on a single project, they will use Version Control, which is a way to track what changes have been made to the files in a project, and by who, as well as being a convenient centralized storage location. It is really very similar to a Revit workshare-enabled project. There is a master repository you can think of as a central file. Individuals download a local copy, called a branch, which is a copy of the master. They will edit the code in their branch, adding or editing features until they have a fully functional tool. Then they will merge their branch back to the master, or sync their local copy with the central file. This way the master is always a functioning version of the software, with the latest features being added to it in a functional state.

Github is one of many similar services that use a form of version control called Git, thus the name Github. Many users will make their work public on these sites, giving you access to their master branches. This is called an open source project. You can choose to contribute to these projects with your own branches, or download versions for yourself. Be sure to read and honor the terms of use.

<https://github.com/jeremytammik/VisualStudioRevitAddinWizard>

While you are hanging out on Github, be sure to download Revit Lookup, a must have add-in for peeking under the hood at the database that is driving Revit. It allows you to select an item in Revit and explore the properties of that element, hidden from the users' view, but exposed in the API. You can view items such as the x,y,z coordinate, or to find out if a parameter is an integer value or a string acting like an integer. If you want to see what the compiler sees, this is the tool you need.

<https://github.com/jeremytammik/RevitLookup>

There is a huge programming community outside of Revit API work and many are very active on a blog called *Stack Overflow*. You can find answers to all kinds of programming questions there.

<https://stackoverflow.com/>

That covers the basic tools you'll need in your programming toolkit. Now we get started focusing on the tools for working with Revit. You'll need to download the Revit Software Developers Kit, aka the Revit SDK. This kit contains many shiny gems, including the documentation for the Automated Programmable Interface, or API. Don't be intimidated by all the acronyms. Just as the buttons and icons on the screen are the Graphical User Interface or GUI, the computer can send the same commands to Revit without going through the GUI. For almost any command you have access to with the GUI, there is a counterpart for the API. The Documentation just tells you how to use it and what information it's expecting.

Another great resource for the documentation is the website Revit API Docs. One advantage to this website is it searches all versions of the API, whereas the documentation only covers one specific version. Just as a new version of Revit is released every year, so a version of the API is also released. Some years they change how the tools in the API work to be more concise, optimize performance, or enable new features. This means one year's command may not work, or at least not the same way as in previous years. The older commands will have been deprecated over a year, allowing you to transition to the new command, and then finally unsupported the next year. Just like Microsoft offers free training on learning

# Revit 2020 – MEP

a programming language, Autodesk offers a few free training examples, also accessed via the Revit SDK website. Then there is the community that supports users just like you, learning to use and write code. Jeremy Tammik, aka The Building Coder, maintains an incredible blog with tons of sample code.

<https://thebuildingcoder.typepad.com/>

<https://www.revitapidocs.com/>

## PROGRAMMING SPECIAL TOPICS

### Visual Studio Settings

This topic alone could drive you mad. Visual Studio supports and works with countless programs and not all have the same requirements. Therefore, there are some specific settings you have to get right for everything to work.

<https://forums.autodesk.com/t5/revit-api-forum/advice-on-debugging-c-in-visual-studio/td-p/6496811>

### Breakpoints

As you start your program it is invaluable to peek at what is happening and step through the program, watching how variables are read and manipulated. Setting specific points at which to stop is done using a Breakpoint.

<https://docs.microsoft.com/en-us/visualstudio/debugger/using-breakpoints?view=vs-2019>

### Transactions

Through the API you can query and gather all the information you need, display it, or export it any way you like. If you plan to make a change to the Revit file in any way it must be done within a transaction block. A block is just code contained within a set of brackets. Transaction blocks not only enable the document to be modified, but also show up as an undo-able action from the user interface. Transactions can be grouped together while others can happen in quick succession. Sometimes it's necessary to perform a transaction to determine some piece of information, save that information to a variable in your code, and then undo the transaction. Whatever the task may be, you'll need to be familiar with transactions.

<https://knowledge.autodesk.com/search-result/caas/CloudHelp/cloudhelp/2016/ENU/Revit-API/files/GUID-BECA30DB-23B4-4E71-BE24-DC4DD176E52D-htm.html>

### Try/Catch Blocks

Think of this as a safety net. You are trying to do something, but if it fails, catch it, and tell me why it failed. This is just good practice and will save you time troubleshooting. Also, if one part of a program fails, it can swallow the error and proceed, allowing you to skip over some problematic situations.

<https://docs.microsoft.com/en-us/dotnet/csharp/language-reference/keywords/try-catch>

### Multi-Version Support

Every version of Revit has a corresponding API.dll file that must be included in the Visual Studio References. Also, every tool you create will compile to create a ".dll" file. To keep from going mad with all the different versions, you'll want to follow Konrad Sobon's guide on setting up Multi-Version Targeting. This will likely be a topic to investigate after you have developed your first add-in. With next year's release of Revit, you realize you may need to copy all that work into a new Visual Studio project for the next year's Revit version. This technique allows you to keep all your source code in one project, and build to multiple versions.

<https://archi-lab.net/how-to-maintain-revit-plugins-for-multiple-versions/>

### Keep With It

These are the tools and resources I use regularly. When I started on this journey I had never written a program. It had been years since I had any programming training in college and that knowledge was long gone. I was determined to automate a task that wasted hours of time per week and had no end in sight. I was very motivated, to say the least.

I didn't succeed initially. The first successful run was months after I started. I also recruited a friend to help me over a few humps. Don't be afraid to ask for help when you hit a roadblock. It was worth it many times over. Not just the value of the tool I had created, but the skill I had developed. I have found programming to be one of the most addictive activities I have ever started. Maybe I need to get out more! Then again, I get to use my words to write programs that create models that then get built in real life. Simply put, I use my words to build buildings. You can't get much closer to magic than that.

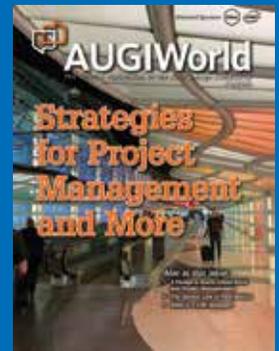
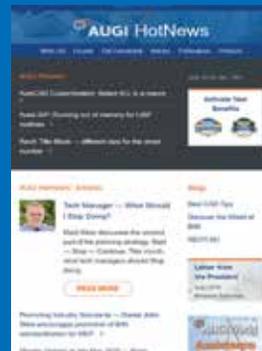


Currently, David Raynor works at Dewberry as an Application Specialist (BIM Manager) for Revit MEPS. He develops content for all trades and frequently travels to various offices teaching staff the Dewberry way of working in Revit. To help with consistency and efficiency, he maintains and supports all Revit API coding efforts. When not working, he can be found wandering the mountains, camping, kayaking, or skiing. He lives just south of Raleigh, North Carolina, with his family of three amazing kids and a supportive, understanding, wonderful wife.

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# Creating Customized 3D Views for Project Coordination

➔ **3**D modeling within Autodesk® Revit® Structure allows us to view the extent of our designs quickly and comprehensively. With the click of a single button, a 3D view of the entire model is created. Along with all project model elements, this 3D view also shows all modeled elements from linked Revit files, IFC models, CAD models/drawings, and point clouds. Everything from foundations to structural steel, floors and roofs, windows, mechanical equipment, piping, and topography, etc. is shown. It is incredible that this amount of information can be viewed in one place so quickly. However, is access to all this information truly necessary? How are meaningful 3D views created from all these modeled elements? This article attempts to cut through model clutter and provide tips for creating 3D views for internal and external coordination.



Figure 1: Greek Temple of Apollo at Didyma

## HOW DID ANCIENT ARCHITECTS CREATE BLUEPRINTS?

Buildings have been constructed long before the use of Building Information Modeling (BIM) software and 3D modeling. Ancient designers did not need today's high-powered design tools to construct their masterpieces. So, how did they document their designs? What was used to depict the design of the Great Pyramid of Giza, the Great Wall of China, or the Roman Colosseum? How were the overall project requirements communicated to a massive workforce?

In 1979, Lothar Haselberger, an archaeologist from the Technical University of Munich, was wandering through the ruins of the Greek Temple of Apollo at Didyma (circa 334 BC) and saw dozens of very thin, very shallow lines that were scratched into the marble of some of the lower walls. He found straight lines, circles, and even more complicated shapes. He realized that the blueprint, from which the temple was built, was drawn into the very stone of the temple. Since the plans were scratched into the marble, they would survive generations. Similar plans were found to be used by Egyptian architects. Kruszelnicki, K. (n.d.). *The Secret Plans of Ancient Architects*. Retrieved from www.abc.net.au

Today, even with the use of 3D modeling tools such as Revit, our blueprints really are not that much different than what was used at the Greek Temple of Apollo at Didyma. We still draw full scale building components but, obviously, our plans are scaled down and created digitally. The only purpose of any plan, blueprint, or drawing document is to answer the question, “What are we building?” The adage “a picture is worth a thousand words” applies just as directly to the construction industry today as it did thousands of years ago.

## A PICTURE WORTH A THOUSAND WORDS

Despite the numerous advantages Revit gives us in being able to view scaled, virtual models, there are a few drawbacks associated with having access to so much information so effortlessly. Information overload can easily cause confusion and complications when working with large project files and/or on complex projects. When Revit projects incorporate phases, design options, worksets, and multiple linked files, sorting through the model to create effective 3D views is a difficult task. For these complicated or more simple projects, the Default 3D View is the starting point in creating effective coordination views.

Utilizing the shortcuts within the ViewCube on the Default 3D View is the first way to simplify the model. It’s an easy trick to forget, but should be kept towards the top of your Revit toolbox. Right-click on the ViewCube to access the pop-up menu. From here, there are many convenient options to scale down the 3D view. The Orient to View option is a great way to match the extents of the 3D view to a view already created within the project. Floor plans, elevations, sections, and other 3D views can all be used as references to create a new 3D view. This is extremely helpful when you want to view a specific portion of the building. However, Orient to View only controls the section box limits and view rotation/orientation; it does not apply the view template from the referenced view.

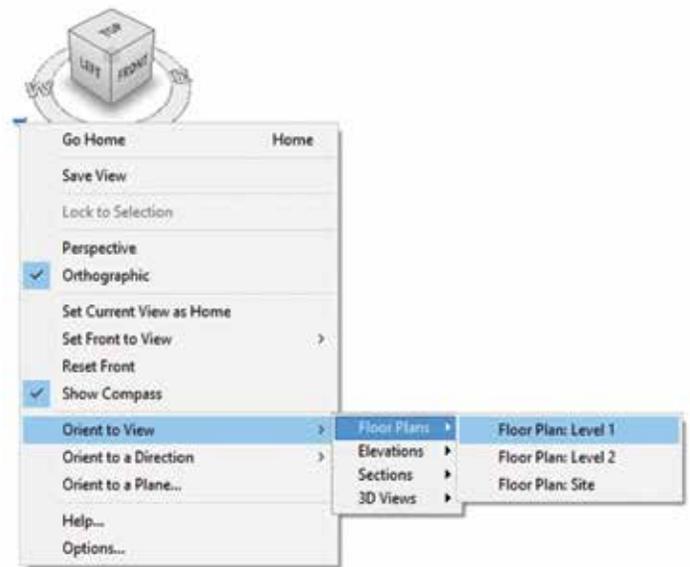


Figure 3: ViewCube

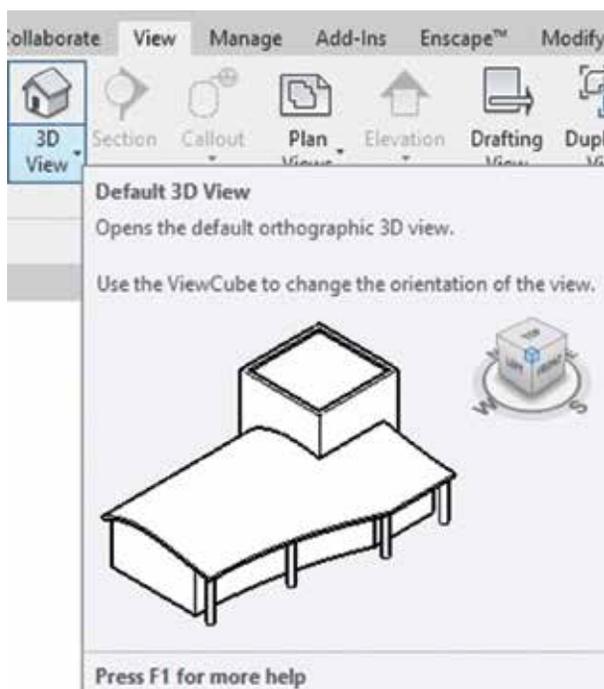


Figure 2: Default 3D view

Creating and using effective view templates is critical to generating organized and clear 3D model views. Large projects will likely contain numerous view template categories: sheet views, working views, coordination views, analytical views, etc. Well thought out and refined sheet view templates are essential to ensuring 2D paper drawing documents are clear and consistent throughout the project. Similarly, view templates for 3D coordination views should be given thoughtful consideration during project setup. Having a few 3D view templates is helpful for coordination amongst project team members, project managers, laypersons, owners, and your client.

3D views and view templates must be created with internal coordination efforts and client communication in mind. What items need to be coordinated within the model or between trades? What questions does your client typically ask and what do they need to see within the model? What are typical issues that arise from the specific project type? Once answers to these types of questions are determined, effective 3D views can be created and used for project coordination. The following case study of a new hospital project will showcase these points.

# Revit 2020 – Structure

## CASE STUDY: NEW HOSPITAL

Let's look at an example project for a new four-story, 300,000 sq-ft. hospital with a total project budget of approximately \$200 million. For this case study, the Revit model under examination is a Level of Development 400 model for prefabricated light gauge metal panels. The prefabricated metal panels act as exterior cladding and are supported by a structural steel building frame. The general contractor requires that the model be used for BIM coordination.

The model must also be used to develop a 2D delegated design submittal showing metal panel erection drawings and shop fabrication details that will be reviewed by the design team. The model and drawing documents must be prepared such that the panel manufacturer has all the information needed to properly construct the panels in their fabrication shop and then install the panels around the building. Links within the metal panel model include interior and exterior architectural models, structural steel fabrication model, mechanical, electrical, plumbing, and the structural design model.



Figure 4: Hospital default 3D view

What are the most important coordination items for this type of project? What items are most important to communicate to the fabricator, general contractor, design team, and others? Who is the end user of the information contained within the model? Various answers to these questions are discussed below along with a specific “a picture is worth a thousand words” 3D coordination view associated to each.

1. General panel geometry, alignment, and interferences with adjacent trades is the most essential coordination item for prefabricated metal panels. The model must be constructed such that panel top and bottom elevations, lengths, and widths match architectural design intent and that panels fit within constraints of masonry or concrete walls, structural steel supports, curtain walls, etc. For prefabricated building components, all dimensional details must be worked out prior to the finished product arriving on site, because repairs can be time consuming and costly. Issues with panel geometry need to be communicated to the metal panel manufacturer and general contractor so they can adjust panels prior to fabrication or make changes to other trades as needed.
  - ✦ 3D view used: Metal panels and structural steel only, with the section box reduced to only show a specific section of

the building. The user can quickly understand the scope and scale of the metal panel portions of the project and verify that the panels are not in conflict with each other or structural steel.

Once the interaction with a specific model element category has been verified, sequentially add model element categories, such as curtain walls, to the view until all pertinent items have been shown. Orient the view



Figure 5: Panel geometry

- to a specific elevation if needed to reduce the amount of building area shown. Refer to Figure 5.
2. Openings such as doors and windows must be located to align with the architectural design.
  - ✦ 3D view used: Metal panels and architectural walls, windows, doors, and curtain wall only. User can quickly compare opening locations and look for interferences. Orient the view to a floor plan to more easily focus in on a specific area. In this case, as shown in Figure 6, the architectural model requires adjustment.

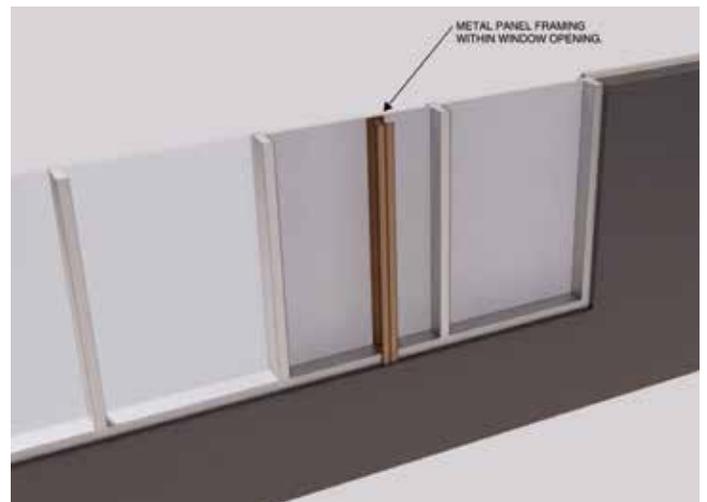


Figure 6: Window coordination

3. Mechanical, electrical, and plumbing (MEP) penetrations must be located on the metal panel drawings to ensure MEP equipment and piping do not impact the structural integrity of the metal panels and openings are provided as needed.

- 3D view used: Metal panels and MEP equipment, ducts, piping, and conduit only. Orient the view to elevations established for the metal panel erection drawings.
4. Constructability is a main concern for the metal panel manufacturer and general contractor. The model should be used to look for areas where a specific construction sequence is required, or interferences occur.
- 3D view used: Metal panels, structural steel, and floor slabs. Orient the view to elevations or wall sections. Refer to Figure 7.

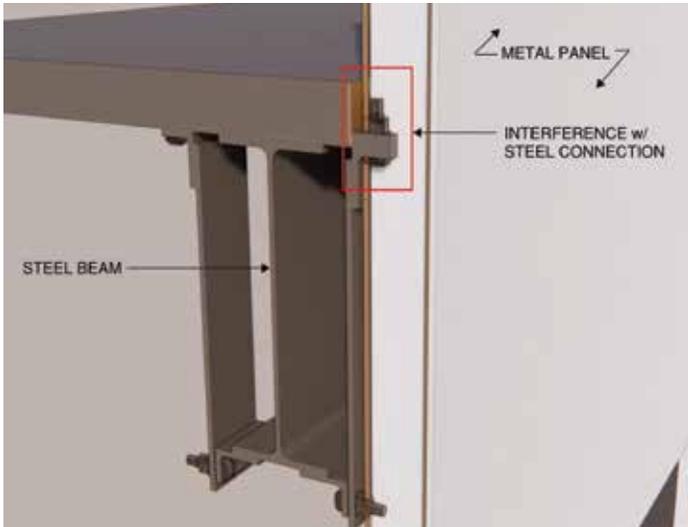


Figure 7: Steel interference

5. Consistency among the project's construction details both in the model and on the drawing documents will reduce questions and the potential for errors.
- 3D view used: Metal panels only to ensure that the model has been created in a consistent manner and that the details shown on the fabrication drawings match the model. Note that infill framing is not modeled for this project. Orient the view to project elevations or floor plans. Refer to Figure 8.



Figure 8: Metal panels only

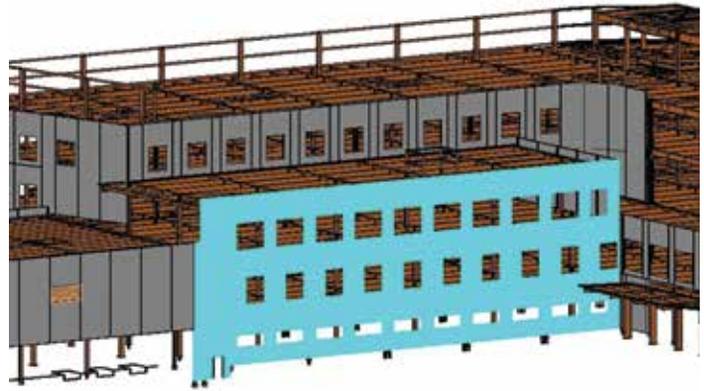


Figure 9: Production status

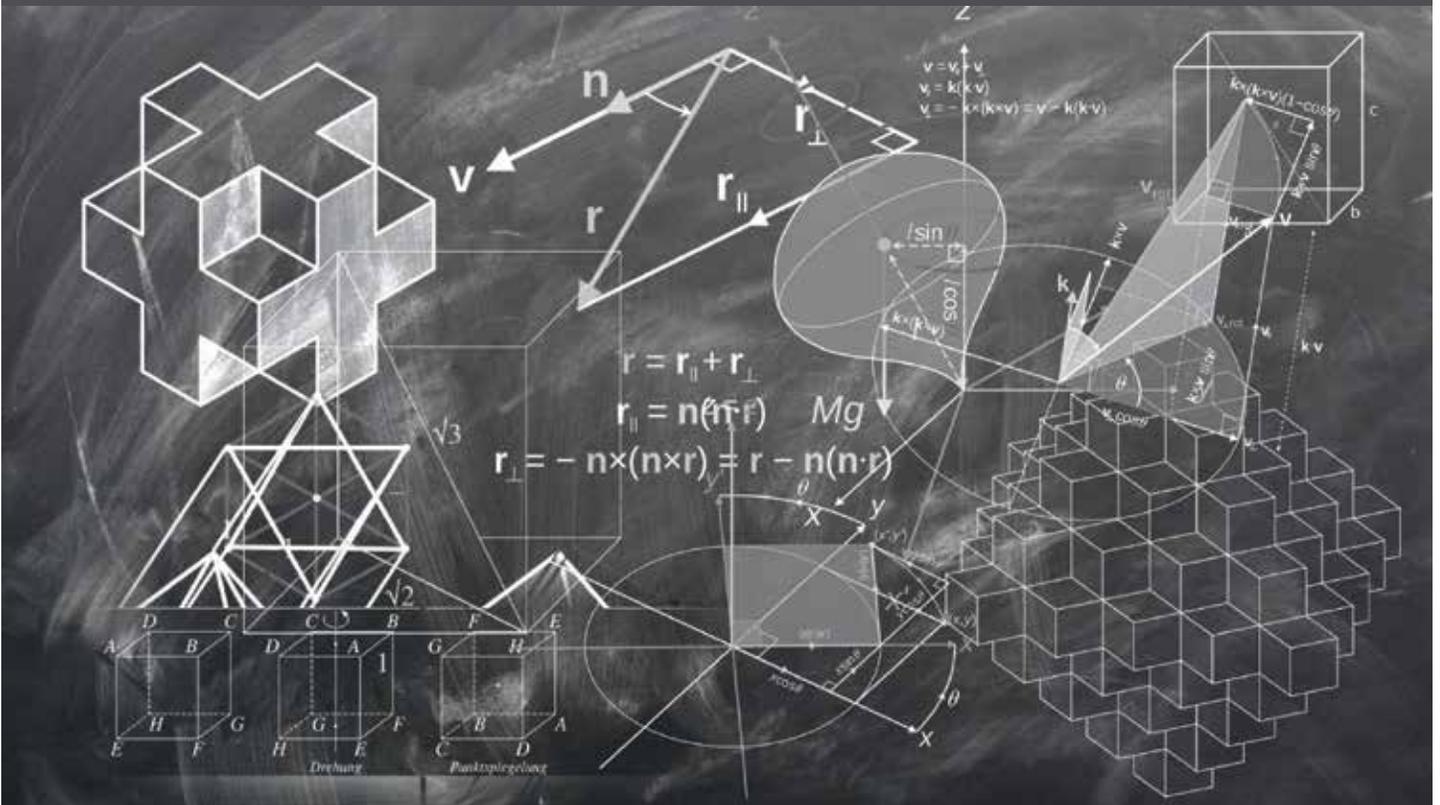
6. Knowing the fabrication shop drawing status is very important to the overall project schedule. The panel manufacturer must be kept up to date with what panels have been approved for production.
- 3D view used: Metal panels and structural steel only with a filter applied to change the metal panel color to blue once the fabrication shop drawing has been sent for approval. The filter reads a parameter on the panel family that is also linked to the production schedule. Refer to Figure 9.

Once one of the above 3D coordination views is created, duplicate and rename the view so that it will be stored within the project. Additional parameters can be added to the views for browser organization if needed. View templates should also be created from these initial views so the visibility/graphic settings can be easily applied for future 3D view creation. Exporting the model or the customized specific 3D views to a 3D rendering software allows the user to easily navigate the model and prepare images for communication with internal and external project partners.



Michael Hopple, P.E. directs the Virtual Design Solutions (VDS) department at Providence Engineering Corporation in Lancaster, Pennsylvania, which is a consulting structural engineering firm. The VDS group provides Building Information Modeling services across the Architectural, Engineering, and Construction industry. Michael can be reached for comments and questions at [mikeh@proveng.com](mailto:mikeh@proveng.com).

# Controlling Your Calculations in AutoCAD



**A**utoCAD® and AutoCAD® Civil 3D® have a calculator built right into the programs, yet many people I talk to do not use the full functionality of these tools. The CAL and QuickCalc calculators use geometric functions, unit conversions, and variables in addition to the basic features found in scientific calculators. You can use both calculators transparently from commands and from the Properties palette to obtain geometric information.

QuickCalc (Figure 1) can be used as an expression builder as well. You can compose an expression that can be easily edited and when you are finished, click the equal sign (=) or press Enter. Later, you can retrieve the expression from the History area, modify it, and recalculate the results.

Let’s explore the CAL and QuickCalc commands and what they can do for you not just as calculators, but also as tools to keep your drawings’ calculations accurate.

## THE CAL COMMAND

At the Command prompt, enter CAL. Then, enter a CAL expression as shown and the result can be displayed as shown in Figure 2.

You can also use the CAL command transparently by preceding the input with an apostrophe (') after the command. The example (Figure 3) shows the circle command started then the transparent cal command with an expression, which will result in a circle with a radius of 7.

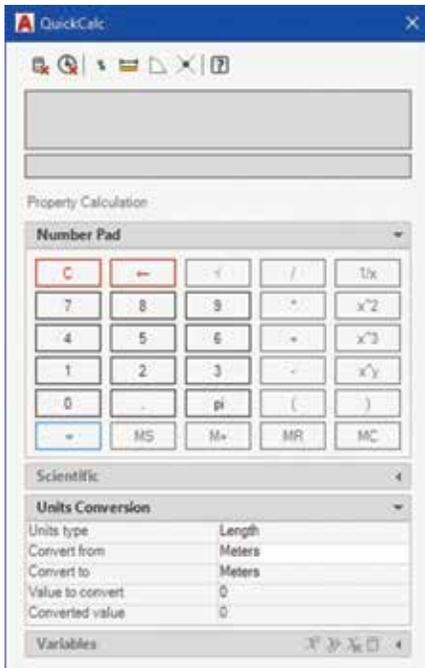


Figure 1

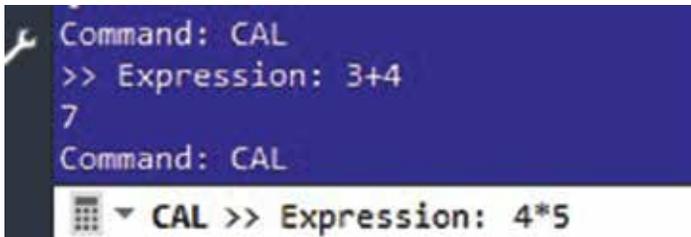


Figure 2

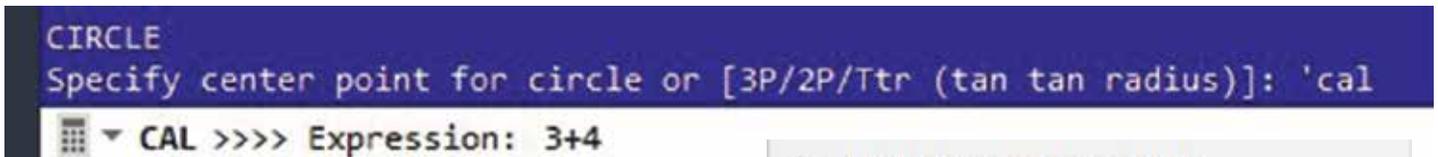


Figure 3

## CONVERTING BETWEEN UNITS WITH CAL

For general conversions, use CAL's cvunit function. This will convert amounts in one unit to the equivalent amount in the second unit. The formula of this function is as follows:  
 Cvunit(amount,firstUnit,secondUnit)

Figure 4 shows how this would look on the command line converting feet to meters from the Cal command.

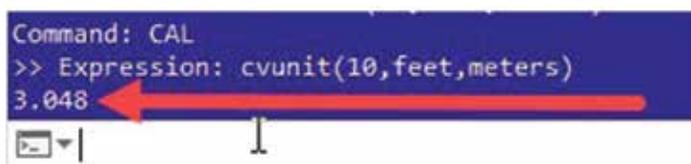


Figure 4

## THE QUICK CALCULATOR

You can access QuickCalc directly in the following ways:

1. On the ribbon, Home tab, Utilities panel, QuickCalc button (Figure 5).

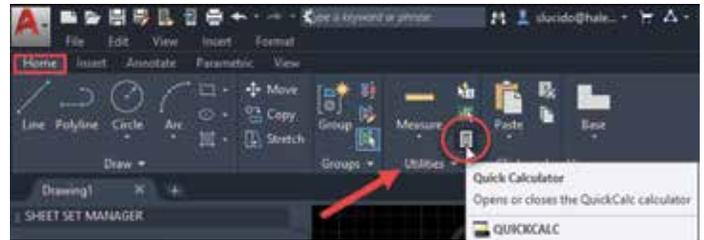


Figure 5

2. On the menu bar, Tools, Palettes, choose QuickCalc (if you do not show the menu set the menubar system variable to 1 to display the menu). See Figure 6.

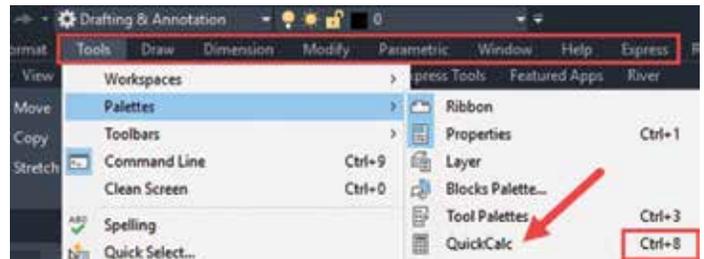


Figure 6

3. On the Standard toolbar, click the QuickCalc button.
4. In the drawing area with no command active, right-click and choose QuickCalc (Figure 7).

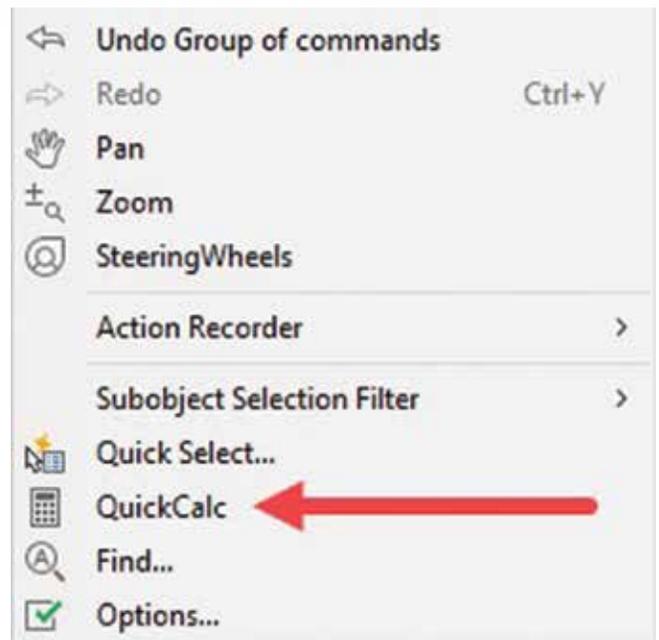


Figure 7

# AutoCAD 2020

5. At the Command prompt, enter quickcalc or qc.
6. Enter CTRL+8 at the command prompt.
7. Use QuickCalc Transparently Within a Command.

## QUICKCALC TOOLBAR

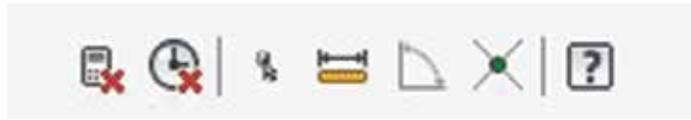


Figure 8

From left to right the commands are as follows:

1. Clear: Clears the Input box.
2. Clear History: Clears the history area.
3. Get Coordinates: This will take you back out to the AutoCAD window where you can capture the coordinates from your drawing. Those coordinates will be pasted into the calculator window.
4. Distance Between Two Points: Calculates the distance between two points. The calculated distance always displays as a unitless decimal value.
5. Angle of Line Defined by Two Points: Calculates the angle of two points.
6. Two Lines Defined by Four Points: Calculates the intersection of four points.

## CONVERTING UNITS OF GEOMETRY WITH QUICKCALC

To convert units using QuickCalc, simply expand Units Conversion tab on the Calculator palette. Select the type of unit you want to convert from the Units type field, then select the unit you want to convert, and in next field enter the unit in which you want it to be converted.

1. Draw a circle and give it a diameter of 6 units (ft.) We will be using 1 unit to represent 1 foot. Type CTRL+1 and open the Properties palette and pull down the Geometry section as shown in Figure 9.
2. The diameter of the circle is shown as 6. You can change the value of this directly and the change will be reflected on your drawing.
3. Select the Calculator at the right of the diameter to bring up the QuickCalc.

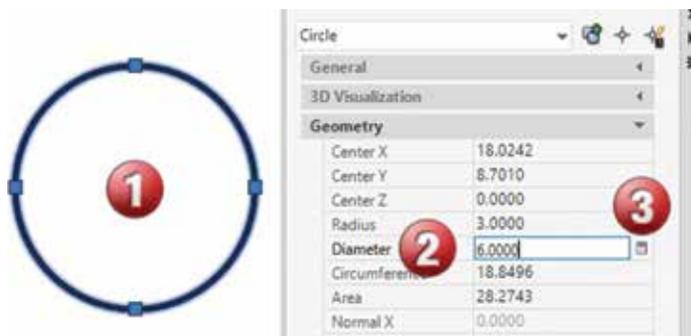


Figure 9

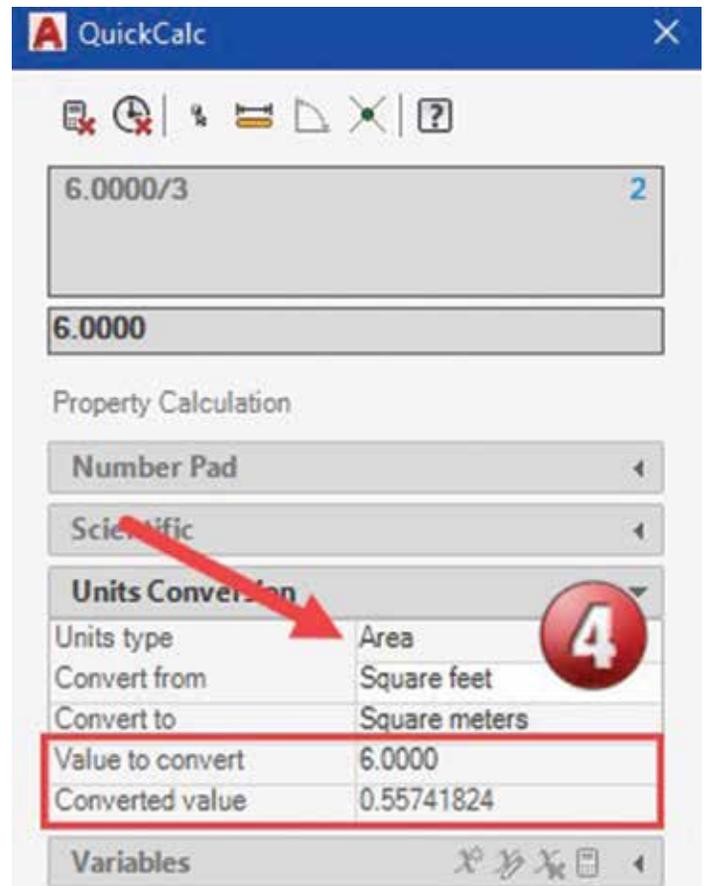


Figure 10

4. Under the Units Conversion section, change the Units type to Area. Change the “Convert from” and “Convert to” sections to your desired outcome and the converted value will be shown for you to use in your calculations (Figure 10).

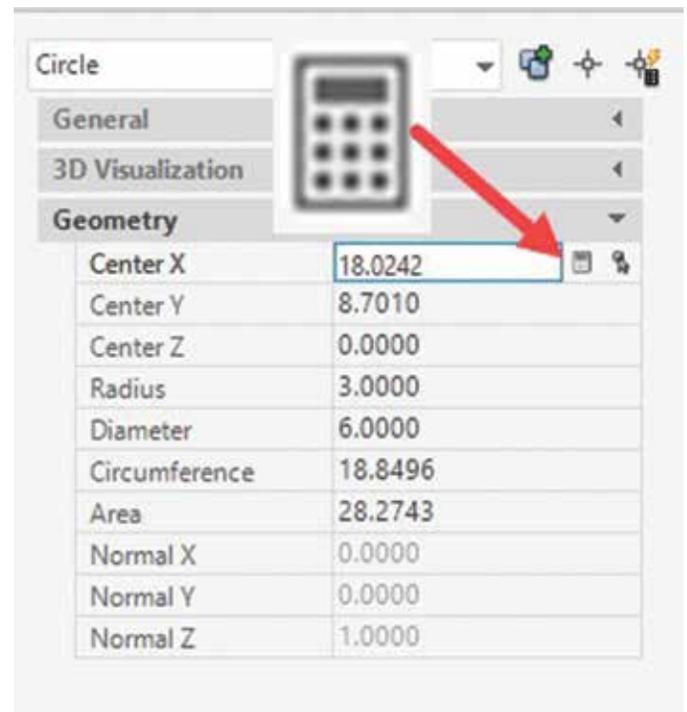


Figure 11

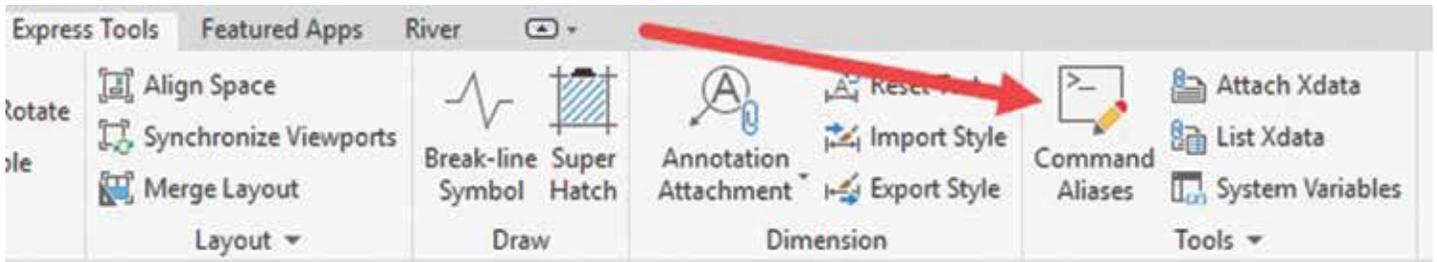


Figure 12

This is a good way to use the QuickCalc Transparently from the Properties palette. Click any box in the Properties palette that contains a numeric value, then click the QuickCalc button that appears in the box. In this section we clicked on the diameter of the circle. We can select any of the items that are not greyed out to use the calculator (Figure 11).

After calculating a value, transfer the result to the Properties palette by clicking the Apply button.

If the Apply button is grayed out, it means that the specified property cannot be changed directly.

## LAUNCHING THE WINDOWS CALCULATOR FROM AUTOCAD

Do you still prefer to use the windows calculator? You can do that by editing the ACAD.PGP file. On the Express Tools tab under the Tools panel, select Command Aliases as shown in Figure 12.

1. Move over to the Shell commands tab.
2. Select Add.
3. Add the information as shown in Figure 13.
4. Type WC at the command prompt in AutoCAD.
5. The Windows Calculator will be displayed.

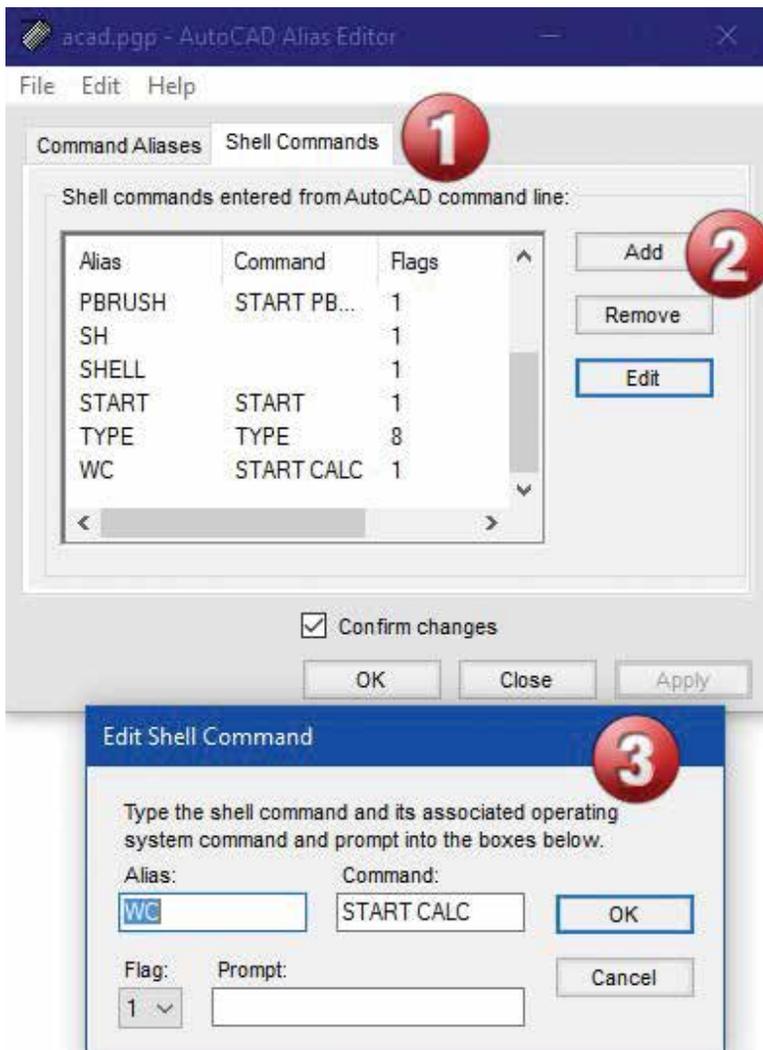


Figure 13



# AutoCAD 2020

## USE QUICKCALC TRANSPARENTLY WITHIN A COMMAND

During a command, you can access QuickCalc transparently in the following ways:

- Right-click to display the shortcut menu and choose QuickCalc (Figure 14).



Figure 14

- At a prompt for a value or coordinates, enter 'quickcalc or 'qc.

For example, while creating a circle, enter an expression in QuickCalc to the next point prompt and click the Apply button. The next point of the circle uses the results, which might be a diameter or radius. Test out by applying simple functions like  $2*3$ .

## RPN CALCULATOR IN CIVIL 3D

Have you ever wanted to use that older reverse polish notation calculator you had many years ago? Well you can in Civil 3D (but

not AutoCAD). Type RPNCALC at the command prompt and your calculator will be displayed as shown in Figure 15.

## CONCLUSION

The CAL and QuickCalc functions are examples of how you can make AutoCAD work for you. You can use both to perform calculations on geometry to provide accurate results. The QuickCalc is always a right-click away to help you calculate an accurate result for your project and the CAL command can be accessed from the command line.

Registration for Autodesk University 2019 has begun. You can find me in the lab this year teaching the following two classes:

**CES317051-L - Exploring Advanced Topics in the Lab with the Sheet Set Manager**

**CES322643-L - Investigate How to Use and Implement the CAD Standards Manager in the Lab**

Stop by the AUGI booth in the Community Hub or any of my classes to introduce yourself or ask a question. I look forward to meeting new friends at AU2019.



Sam Lucido is a CAD Services Manager with Haley and Aldrich, Inc. He has more than 25 years of experience involving design, user support, and customization. Sam is an Autodesk Expert Elite Member and on the Board of Directors for AUGI, Inc. He uses his knowledge about AutoCAD and Civil 3D to help provide support to engineering and design teams with monthly tip sheets and online training. You can find him at CADProTips.com and he can also be reached at lucido1373@gmail.com



Figure 15



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