# Building Information Modeling on a Smaller Scale

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**CO5249** When looking at case studies and success stories that demonstrate how construction projects have implemented Building Information Modeling (BIM), the project values are at least $30 million, and they usually run into the hundreds of millions of dollars. This does not address the numerous projects that are much smaller and still require detailed coordination efforts. This class will look at using BIM and virtual design and construction (VDC) on smaller projects, as well as explore the tips and tricks that our firm has learned using BIM on smaller projects, including projects valued at less than $10 million.

## Learning Objectives

At the end of this class, you will be able to:

- Understand key factors that make BIM feasible on smaller projects
- Be able to find ways to integrate BIM into the project team
- Learn how to create and use model templates and standards specifically for small projects
- Learn tips and tricks designed specifically for smaller projects

## About the Speaker

*Tim's history in construction began 12 years ago, and spans a multitude of construction types including 9 years in commercial and industrial. His construction expertise and background stems from participating in the physical process of construction from both a field and supervisory perspective. Having served as a Project Engineer prior to heading up his company's Building Information Modeling implementation efforts, Tim understands the process of construction from concept to completion. Tim's strengths lie in translating the intricacies of complex mechanical, electrical and structural systems from theory to reality, as well as assisting his firm's clients and internal team members visualize their finished projects. Tim holds a Bachelor of Science in Construction Management form Colorado State University, and his educational background also includes intensive training in Revit, Navisworks, AutoCad and 3ds Max Design. He lives in northern Colorado with his lovely wife, and their three children.*

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## Introduction

This presentation is centered on my experiences, good and bad, with using BIM on small projects. There are differences and similarities with how BIM is used on small and big projects, and through this presentation my goal is to focus on the key factors that make BIM work on a smaller project. Some of these factors are things that we have picked up from larger projects, and may be something that you are already doing. The presentation will start with some of the general theories and information related to project set-up, and will move more toward the technical information that has made the software perform more clearly for our uses.

My background is rooted in the field operations of a construction company. The content and information in this class is structured from that point of view. There are lots of great classes and webinars on going to BIM from a design perspective on the AU website. These have been very useful for my work, and should work in conjunction with the material that is presented in this class.

The tips and tricks will be spread throughout the presentation, and then at the end there will be a handful of tricks that I could not incorporate in other sections.

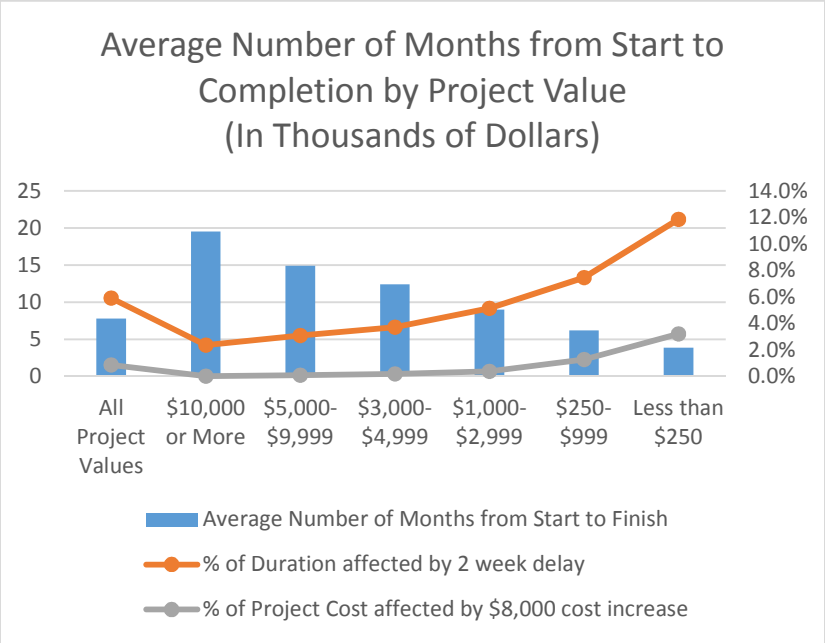
Throughout this presentation, all 3D models, the process of working with 3D models, and most of what I do will be referenced as BIM. I know this isn't the 100% correct usage, but for the sake of simplicity, we are going to roll with it. I do promise not to use the term BIM Modeling.

## Understand key factors that make BIM feasible on smaller projects

BIM and the process of designing in 3D has been around long enough, tested, researched, and the benefits have been reported in many research studies, news articles, and white papers. I do not feel that spending time to justify the basic value of what the process brings to a project is worthwhile.

### *How can BIM be a benefit to a small project?*

When considering if BIM can be a benefit to a small project, the same benefits of problem mitigation, increases in efficiency and waste, and the increased information from the design are all similar to what you see on a large project. The difference comes in the ways that you go about gaining these efficiencies. There will be more details to follow of what this looks like. When dealing with changes in design and problems on smaller projects, the effects can have larger impacts to the project's schedule and budget than on larger projects. Consider an issue where you were hit with a cost increase of $8,000, and a two week delay.

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An issue of this magnitude on a construction project is not uncommon, and you can see that as a project decreases in size, the issue has a greater impact. I acknowledge that as a project gets small the likelihood that an issue of this size will occur, but the impact of a smaller issue grows in this situation as well.

***Is it needed?***

There is as much of a need to provide the same benefits of BIM to small projects, but, it does not work on every project. When making the determination if BIM can be a useful addition to a project, a use case needs to be outlined from the beginning. The work that is being included into the scope of the BIM process may not be newly created work that is omitted when BIM is not a part of the project. Spatial coordination is still needed, quantity take-offs are still required, and the equipment and system sizing still will happen whether it is included or not. BIM is used in all of these situations to improve these tasks.

When you are defining whether BIM is or is not a good fit, some of the basic questions that need to be asked are: Can you get models to coordinate? What will you use the model to coordinate? Can it be coordinated effectively? It sounds simple enough, but surprisingly this is often skipped as the first step in determining if BIM is a good fit for a project or not.

***Don't underestimate the simple benefits/ low hanging fruit.***

The traditional benefits from BIM may not be as farfetched on a smaller project as you think. When you are determining if BIM is a good fit for your project, getting the full scope of the building into a 3D model can be a lot more easily achieved than you may think, especially if the design team is already working with BIM authoring software.

If obtaining all of the models needed for a full coordination effort is not a possibility, just using BIM as an advanced visualization tool can be very valuable. Using it to help all of the project's stakeholders to learn and understand projects better than traditional paper documentation is

often overlooked, but using BIM significantly helps the team understand the project faster and more clearly.

BIM has also gained a reputation as solely an MEP coordination tool to make the different systems within a building fit with proper operational clearances because it is very good tool for MEP Coordination. Architectural and Structural Elements can greatly benefit from using BIM as a coordination tool as well, and this limited coordination effort is often worth as much or more than the MEP Coordination.

The most basic uses of the software can be very valuable, and with a little creativity BIM can be very successful on a small project.

## Sourcing Models

Getting models is fundamental to making the entire process work, right? One of the unique challenges to making BIM work on smaller projects is getting models on a project without exorbitant effort or costs. This is something that can be accomplished, but part of determining whether BIM is feasible on a project is decided by the effort needed to get models and the effort involved. As a general contractor, our goal is to get 100% of our models from the companies who are either designing or building the project. The reason for this is twofold: First is because we do not want to model everything due to the financial and personnel investment required. Secondly, when the General Contractor draws everything the design intent from engineers, and installation details from our subcontractors can be lost. The investment to have an internal team drawing the entire project from scratch has a significant cost, and may not be as accurate to what an engineer or subcontractor may come up with. This is why I put as much emphasis as possible on getting models from external sources rather than creating internally.

### *Partner Selections*

By relying on sourcing models from our partners rather than creating them in-house creates a greater emphasis on selecting the right partners for a project to determine if BIM can be completed successfully. Being able to create and use 3D models effectively becomes a part of the selection criteria when selecting firms with which to work with. While considering the capabilities of a firm on the design and construction side is important, the means that they go about to get to the end result is something that we like to leave as open as possible. The reason for this is to make sure that everyone can use the software that is the most beneficial for their company and scope of work.

This ensures that the companies that put in the upfront work of planning and coordinating are not undercut by companies that may take short-cuts, or do not properly plan and coordinate their work. By structuring our BIM program like this, it makes using BIM is a pre-qualification tool rather than something that is tacked on to the existing project team.

When selecting subcontractors, many are already creating 3D models for detailing or prefabrication purposes. We make every effort to utilize these models because they are the

most-accurate models for the sub-contractor to provide, they require less work for the subcontractor to optimize for 3D spatial coordination, and it is the lowest cost way to include them in the process.

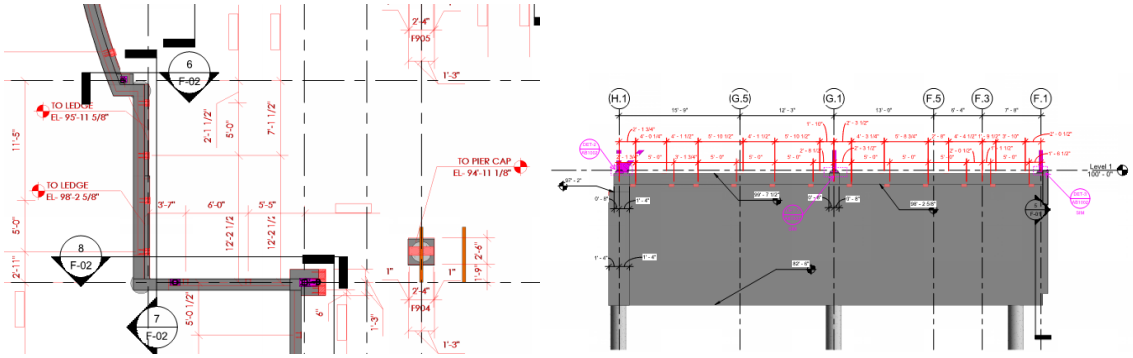
An example of this can be illustrated by two plumbing contractors: one who uses BIM and one who does not. The first company plans their work, looks for conflicts with other trades, structural, and architectural constraints, and finds the most efficient way to route their piping systems. The second contractor shows up with a semi-trailer full of pipe and fittings, looks at the drawings, and starts installing pipe. It is obvious that the first company in this example is the company that will be more prepared, and perform their work more efficiently with less delays because of the work they did before boots hit the ground.

Similar to subcontractors, Design Consultants that are using BIM software are bringing more to the table, and it helps the entire team prepare more thoroughly for construction. In addition to using BIM software as a design tool (hopefully) the spatial components of the model can be used to test the constructability of the project as the design is being completed.

### Scope of 3D Modeling

Through the planning and selection process it may become evident that not all of the pieces needed to create a model can be obtained. This is unfortunate, but it may not mean that the entire BIM process for the project needs to be shelved; however you may need to re-evaluate how BIM can and should be used for the project. Some things worth considering:

- If only a small portion of the model cannot be obtained for the project, can the model creation be self-performed? This is not preferred, but is something that we can do to make the process move along.
- Can 2D Cad Files be used in combination with 3D elements to get the information needed for the model? Below is an example of how this could look. In this project we had 2D Cad files for our pre-cast floor structure, and a 3D model from our steel supplier. The foundation package was very complicated, so we decided that modeling the foundation would be beneficial to the project in both understanding the complexities of the foundation, and coordinating the foundation with the precast floor structure.




Images Courtesy of FCI Constructors, Inc

- Can the scope of the model be limited to coordinate what is absolutely necessary? A renovation/addition project is a perfect situation where the building can be partially included in the BIM process. Getting model data for the renovation may not be possible, or even worth the effort depending on the scope of work.

### Early Involvement

The earlier you can be involved with BIM in the design and construction phase of a project the better. This is true of any project where BIM is involved. In both design and construction phases, the earlier a change is found, the more options you have to remedy the issue, and the changes are made with the least impact. Also when you are involved in a project early you get a head-start on learning the project, and are able to be more prepared for the construction phase.

During design, making large changes earlier in the design process equates to less re-design at the later phases when the design teams should be focusing more on refining their documents during the closing of the CD phase, rather than cleaning up issues from numerous last second changes. Any change that is made in design is also a huge benefit to the construction phase of a project because it is much simpler to incorporate before the different trade partners are a part of the project.

During construction, coordinating earlier allows for more time to make adjustments with the structure, (coordinating roof and wall openings) the most flexibility in determining routing options, and it also allows you to more carefully consider options in ordering materials (i.e. mechanical equipment can be ordered based on the coordinated model, so that the handing, locations of coil connections and controls sections can all properly be accounted for.) The earlier the process occurs, it usually goes faster, and with less headache. This is because it is easier to know that none of the field work is completed, rather than having to continually check to see where things have progressed in the field or in a shop.

### Cost…

Cost, unfortunately, can be one of the reasons why BIM is not included in a project, and small projects are more susceptible to this than larger projects. The primary means to deal with issues surrounding cost is to make sure the BIM process is as efficient and appropriate as possible. As you can tell, that is the main theme of making BIM work on small projects. While there are some ways to increase efficiency in the methods of creating and managing models, there are other factors that can have a greater impact on making the process successful on small projects.

Making sure the scope of the BIM process is appropriate for the needs of the project is a simple way to make sure the effort exerted is as cost effective as it can be. The reality is what we are using BIM for is not all that new or different; it is a more efficient and accurate way to perform the same work with different tools and newer technology. So when the scope of the BIM process matches the needs of the project, there are not any new services being provided, and

the costs that you may see related to BIM are costs that should be offset by other parts of the project.

Limiting the amount of project specific websites and services is also very important to limiting the cost. I think that these can be great tools that provide value to large projects, but on smaller projects the investment of time and training does not offset the benefits received. There is also the issue of dealing with the cost of the software. That means that BIM 360 Glue is not a good fit for us. During construction, many of our smaller projects have 5 or less coordination meetings, and spending one meeting (around 20% of our time together) for training on the software just is not worth it.

## Be able to find ways to integrate BIM into the project team

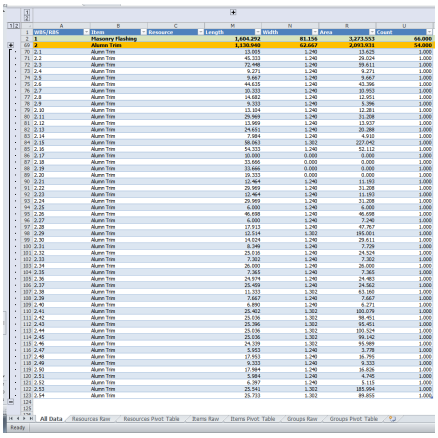
For BIM to be successful on a small project, the applications of your work in the project needs to be more than just a BIM coordinator tacked onto the project team. What this looks like is very different from organization to organization, but the opportunities are there, they just need to be found.

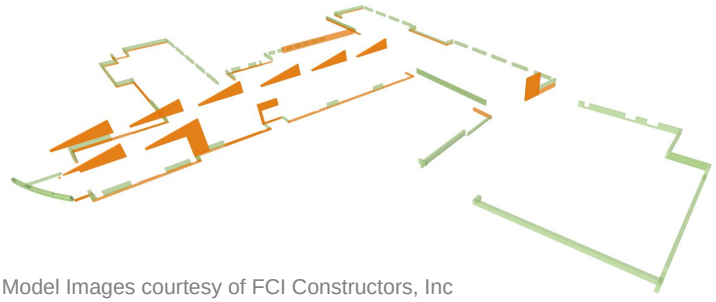
In my experience, the best way to do this is to be involved with more than just BIM in your project team. This includes individuals both internal and external to your organization. Learning how different entities operate, what their challenges are, and what information is useful to them at specific times is key to being able to be a valuable asset.

This may be something as simple as asking questions at team meetings to better understand what a current issue is during the design or construction process, or what people are currently working on. Another great way to be exposed to other areas, is to ask your boss to allow you to learn more about other parts of your organization/ team, spend time with them, and learn some of the details of their job.

### Internal Opportunities

My role in construction is based in the field operations side, office paperwork and field supervision. Finding new opportunities within our organization, I spent as much time as I could with the procurement/estimating department, trying to learn how they operated and how I could bring model data into their workflows. This led to helping them learn projects faster by making models available to them, and also developing a system to augment their QTO efforts.





Model Images courtesy of FCI Constructors, Inc

The way that our estimates were prepared was not super conducive to building and maintaining a template, but the information gained through the process was very useful. I was able to perform take-offs that were more unusual and tricky because it was easier to see how they fit into the project with the model.

Also, based on my experience in the field side of our organization, I was able to leverage model data into some of our processes including submittals review and coordination during the submittal process. A great example of what this can look like is requiring our steel subcontractors to deliver a model with their shop drawings. This can be pulled into Navisworks and/or Revit to compare the fabrication model to the design model, and compare to the other systems in the building.

### External Opportunities

As a contractor, examples of finding opportunities to assist external members of the team meant working with Architects and Engineers, spending time at their offices, attending/calling into coordination meetings, learning how they worked, and at what times they were ready for us to look at the model for coordination reviews. This made sure that we were reviewing the project when it was appropriate, and allowed for issues to be found before it's too late in the design process.

The main objective in determining if and how to apply BIM in your organization/team, is to understand how your team is doing things now, and how that can be supplemented by what you are gaining from the model.

## Learn how to create and use model templates and standards specifically for small projects

Having Model Standards and using templates is a universally accepted norm within the design community, and has been in practice for many years.  This has been invaluable for the design and construction community for decades, and carries equal importance when working in small projects.  The standardization of process, functions, and how BIM is used helps everyone in

your organization work more efficiently from the simplicity and similarity of the process from job to job.

One downside to using BIM on small projects is that you likely will not be able to focus on one project at a time. Having defined standards, processes, and a clearly defined organization structure will enable you (and everyone else in your team) to be more organized, efficient, and help keep you from misplacing information.

When building templates and developing standards, they need to be reflective of your company, and how your company functions. One mistake that I made when initially developing my first set of company standards was developing them based on what everyone else was doing. Our BIM Execution Plan was modeled after examples from design teams, large projects and the contractual attachments that were being used. We were tracking model progression through design and construction in duplicate of the contractual document; it was too complicated and the complexity of what was included in the plan was above and beyond our needs as a general contractor. It also did not fit our company's culture and did not fit within the way our projects were contracted. Simply put, it was more of a burden than a tool to help the process.

Once this was evident, we were able to simplify the document down to information required, standardized it, and made it simple enough to issue as a specification section, or as additional instructions to bidders. It was a document that fit our needs, and was consistent with the way we managed our projects.

## Templates

### *Revit*

Revit templates need to be as universal as possible for your use, while controlling content and eliminating as much set-up as possible for each project. For my use as GC, the emphasis was put on setting up sheets, views, filters, tables, etc., so that as much data and drawing content could be extracted out of the model with as little effort as possible. The templates that I have created are focused on having consistent views for the project team to use, so that it is simpler for them to understand what is being presented to them.

When setting up my templates— to determine what needs to be included in a template— it was helpful to start with one of the base templates in Revit, and modify it as needed through a pilot project. When the project was complete, I stripped the model of the project specific data, and refined and generalized the model to complete the template.

There are a few great examples of creating and establishing Revit Templates and standards on the AU Website from previous years, and I would recommend checking those out. They are far more informative, and cover the subject better than I can here.

As you are developing templates, do not be scared to have multiple templates. We use our templates for creating coordination drawings, so we have one set for vertical buildings, and another for buildings with large footprints. The important thing to remember is that if you have an odd project that requires a lot of customization, keep it so that you can find it again. You never know when it may come in handy in the future.

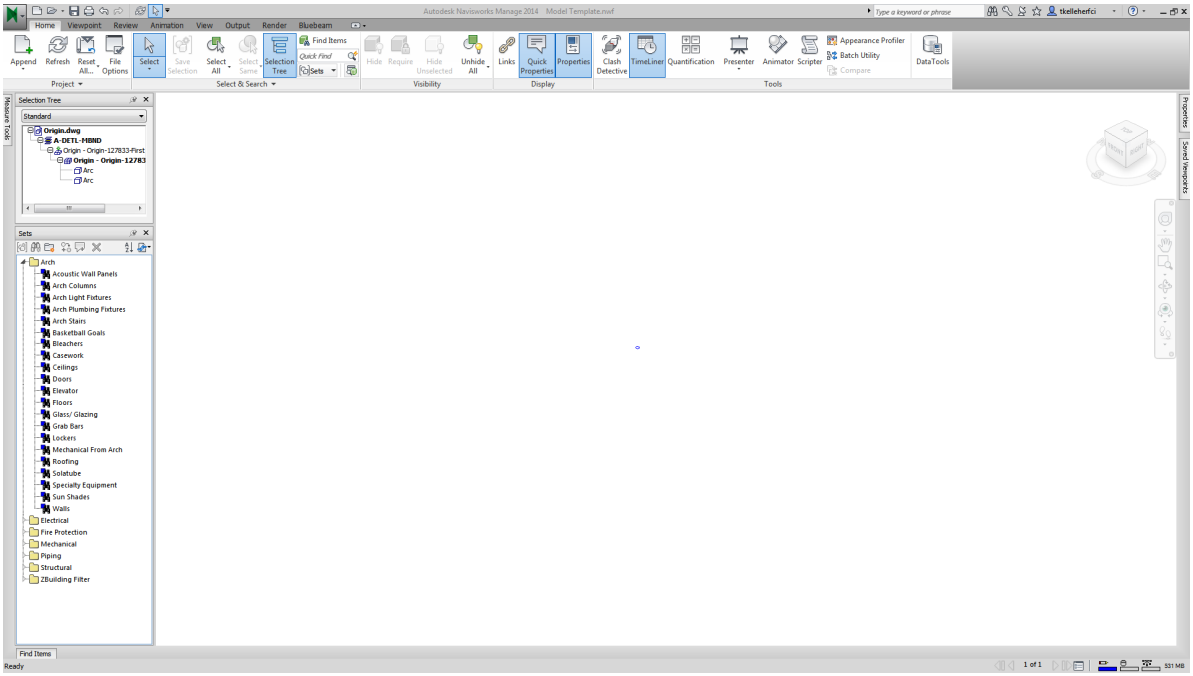
### *Navisworks*

Developing a model template in Navisworks is a very important part of making BIM work on smaller projects, but Navisworks does not really support model templates. What I call a Navisworks template is really an .nwf file with only one small, generic model appended into it. In the model is a standardized set of search sets that are set up to extract data from the different trade models into standardized categories. From these search sets the clash detective tests are all built with appropriate rules applied, the Appearance Profiler's selectors are loaded, and a search set is set up to filter out items that are not needed for general model review.

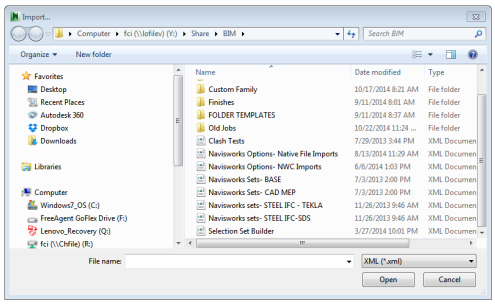
The advantage to having a generic .nwf model file set up like this is the speed of setting up a new job while maintaining standards within Navisworks. When I start a new project, I open the template, append in the model files, make sure the search sets are pulling in the model data correctly, and then I am ready to work. One key to making sure these search sets work as universally as possible is to make sure they reference Revit Families, and make sure to use the "contains" condition rather than "equals" as much as possible. You can also use the search sets to look at the file names, and with proper naming conventions you can make sure the sets are only searching a few model files in lieu of the entire model. This helps the searches operate faster.

There are very good export options for saving the various setting from Navisworks (which I do use), but starting a new job, importing them, and making sure they recognize each other can be time consuming. Having this built and saved is just simply faster.

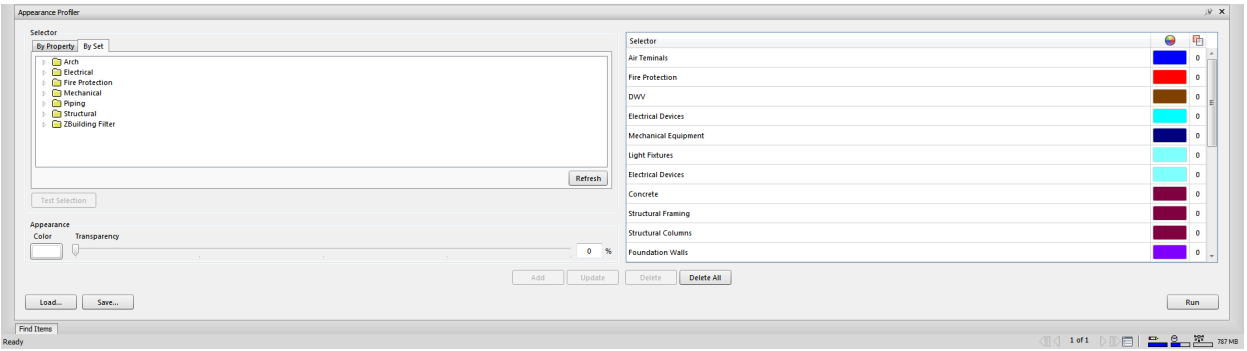
Similar to the method of creating a Revit template noted in the previous section, creating a Navisworks template works best by starting with the base .nwf file, modify it through a pilot project, then at the end of the project clear out the models, viewpoints, clash results etc. You will have to leave at least one file in the model; Navisworks will not let you remove all model files. Below is an example of what the template looks like. As you can see below, I use a CAD file with a cone around the Origin for the file that I leave in the template model.



As you work with different entities, you will find that the changes you make to the search sets are very common between projects and the source file types that you receive. Rather than making these changes repeatedly, go ahead and export the different versions of your sets that you commonly use to use later on a different project. As a base, all of my searches are configured to look at Revit files. When I run into a different file type or a file from a different authoring software, I am able to import the other selection set and replace all of the search sets that are related to the specific file that I imported.



The Appearance Profiler is also a very important tool to ensure that the color standards for your firm are carried into Navisworks. For the other members of our project teams that are not using Navisworks, having common colors between the different programs is very helpful so they can quickly identify what is shown in the model. One quirk to the way we have our colors standards set up is they are set up by system type. For example, all hydronic piping is one color, same with plumbing piping and ductwork. The reason for this is when evaluating a model the constraints of a building's system are more important than knowing what all of the individual parts and pieces are. You can also enable the quick properties (see below), which can be configured to show this type of information by selecting a pipe, and then hovering your mouse above the item.

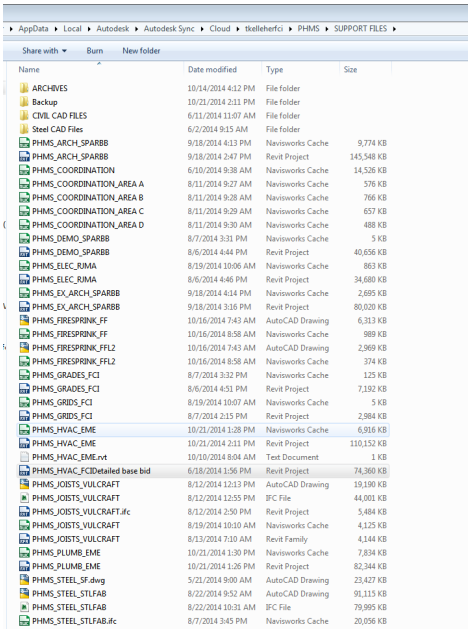



Using the same methodology described above, making templates for many of the documents that you use to support BIM is great to help cut the time investment in the model process. There are numerous documents that you can have a template for that require minimal differences for each project. An agenda for a BIM kick-off meeting is a great example of something that is used on every project, and has most of the same information in it every time it is used. Execution plans are also very similar for each project; having a plan that already has a large portion of the information filled out is a huge time saver.

## Standards

Standards are a very important part of making BIM work on any project. With small projects, standards need to be tailored so that the entire process can be as efficient as possible, to keep the process from generating exorbitant costs.  When you do create standards, make sure that you do not stray from industry accepted norms and requirements. National CAD Standards (www.**nationalcadstandard**.org) and NBIMS (http://www.nationalbimstandard.org/) are very important documents to be familiar with. The whole concept of managing, creating, and following BIM standards is a large and involved topic that is a little too big to go into indepth for this presentation, but again there are great resources on the AU website to help with this process.

***Naming Conventions***- With small projects, you likely will not be able to work on just one project.



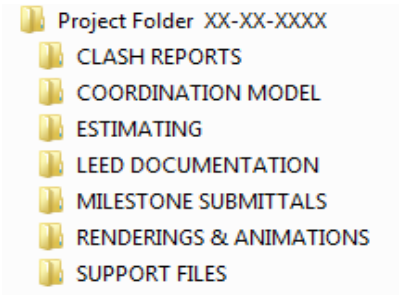

Use a naming system that will help you know what files belong to which project, rather than counting on remembering which files belong to each job. If you are on a project team where more than one person will be accessing the model files, this will help ensure they know exactly what each file is. For these reasons, the naming convention standard developed for our projects uses the abbreviation used for each project is the first thing used in all of our naming conventions. We also include the discipline, company responsible for the model, and a date the model was received.

Using proper naming conventions can also play a large role in making the process of updating files in Navisworks more Efficient. The process we use (which may be similar to something you do) is as follows:

W*hen a file is received from a sub, it is renamed, and saved in the SUPPORT FILES folder <u>without</u> the date on the end. If the file is an update to a previously issued file, then it should be replaced. A second copy of the file is saved in the ARCHIVES. The files that are referenced into Revit, Navisworks, and CAD etc. should come from the SUPPORT FILES folder. This way, as you get new models, the various applications will always reference the most current version that has been received. If there is a reason why you would need to go back to a previous version, then that would be very easy to accomplish by locating it in the ARCHIVES Folder.*

### *Folder Structure*

The benefits of having a common folder structure are similar to having a standardized naming conventions. Maintaining proper file paths is essential to make templates perform at their greatest potential by making sure that relative-path hyperlinks work properly. Again, this is especially helpful for projects where more than one person will be accessing the model files so they know where to look, and which files are the most current.




The hard part with standardizing BIM to align with other parts of your organization, is that it doesn't always mesh very well. When attempting to create a template for Navisworks QTO I wanted it to be very similar to the take-offs that were being performed by the estimating department. As we dug into it, we determined that there was not enough standardized information between the different individuals in the department to make creating a template a

worthwhile endeavor. That did not mean that we could not use the model; I had to learn to tailor the information to the individual with which I was working.

Sometimes this meant just having strong descriptions, so they knew what I was quantifying. We were still able to generate rich data that would have been very difficult to get from the contract documents as quickly, and accurately.

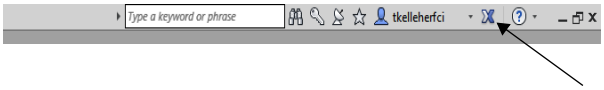
Even though it was not standardized and templated, the information from the model was still useful and brought value to the project.

## Learn tips and tricks designed specifically for smaller projects

The tips and tricks listed below are all based on the 2014 versions of Navisworks and Revit. I have not tested them to see their functionality in other versions, so before proceeding in a different version, please test them to ensure they will work correctly.

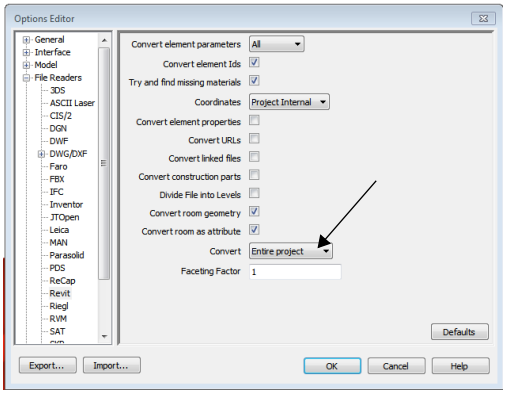
***Exchange Store.***

I promise that no one from Autodesk asked, persuaded, or required me to mention this in the presentation. I do genuinely believe there are good apps in the store that make things simpler, and work better and many of them are free. The best way to find them is to click the X shown below from the program you are using. It automatically goes to the store for that product.




***Native File hosting in Navisworks.***

As with the running theme of making sure that everything you do is focused on saving as much time as possible, one way that I have found to save time is to import all files into Navisworks in their native format, especially Revit. .DWG and .IFC files are easy to include into Navisworks natively, but including Revit has been a contentious issue due to controlling visibility settings. .DWG and .IFC files can be appended without any issue, and work very well without any modifications.

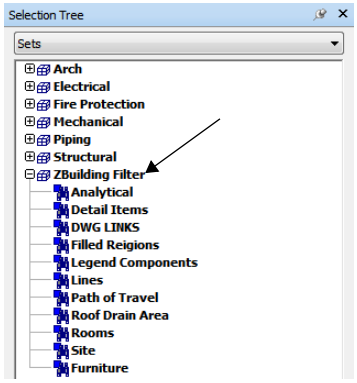



There is no doubt that the more common method of exporting .nwc files from Revit is a very good way to get Revit into Navisworks, but starting with the 2014 release of Navisworks, the conversion process from Revit has become more reliable, and includes all of the systems elements. (For example, in previous versions of Navisworks, pipe fittings were not converted when Revit was appended natively.) To make sure you know what model elements are imported into Navisworks, ensure that the Convert option is set to Entire project. This is the best way to know that everything in the model is going to make it into Navisworks without having to export, create views or adjust the visibility graphics in Revit.

There are downsides to this method; mainly items imported from the Revit model that you do not want, and excessively long load times.

### *Combating Long Load Times/ Extraneous Model Items*

To combat the extra items in the model that are not desired, I created a grouping in the search sets in the Navisworks template that automatically grabs the items that are typically in Revit that are undesirable. After you get your models appended, just select the folder that has all different sets and hide it. There may be a few oddities to how these sets work, but they can be simply adjusted to filter out the model items.




As for combating long load times, there will always be load times when hosting Revit files this way. It is somewhat inevitable with the current software, but in my experience this is still faster than going into Revit and dealing with managing the visibility that way.

If the files are taking too long to load, I would suggest that you check to see what parameters are being converted. The more that you convert, the slower the load time.

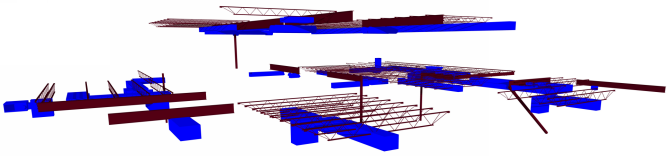
The second item that likely has had the most impact on my projects is making sure the Revit file is in the same release year as the release of Navisworks that you are running. Assuming you are running a newer version of Navisworks than Revit, you can open each file you need to update, then save it in the newer version. This is also a good opportunity to save the files with the correct name in the correct folders.

An alternate way to upgrade the files is to use the App from the exchange store that batch updates files by folder.

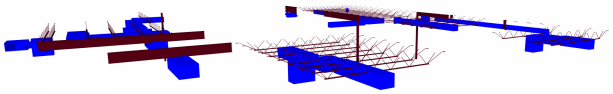
### *Section planes for clash tests.*

Sometimes when you are running through clash reports— especially on projects with large footprints— if your model files are not divided into sections, you end up in a situation where you have to either coordinate large sections of the building at one time or you have to manually sort the results from your clash tests into the separate areas. When you are dealing with model files in their native format from the author, this also a common issue. The way that I deal with this is by using the section tools in Navisworks to control the visibility of the clash results window.

Since every clash needs to pass a visual test to determine the validity of the clash, the appropriate action to resolve the issue, and the entity responsible for making the changes, this trick focuses on clashes that are visible in the current view in addition to the previous criteria.



*Clash test without Sectioning*



Clash test with Sectioning

Model Images courtesy of FCI Constructors, Inc

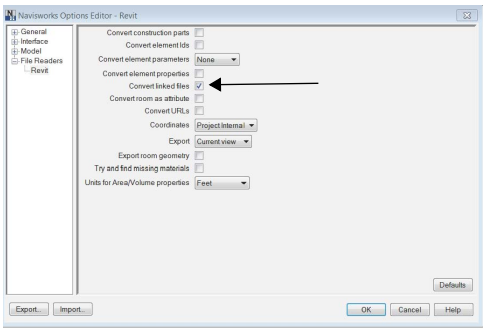
To make this work, I use a specific workflow when running through my clash results. The first task is to set the section planes (or boxes if you are interested) so that only the portion of the model that you are focusing on is visible. Once this is done, it is time to run the clash tests.

After all of the tests have been run, I combine all of the results in each test into one group. Then I adjust the visibility of the model so that only the clashes are shown, and the inclusive filter is on. What you are left with is a view of only the issues within the specific test, and within the boundaries set by the section planes. Now by selecting geometry that is problematic, the inclusive filter only grabs the individual clash results that are related to that item. Once I have the individual clash tests grouped by pertinent issue, then I combine them into a new group, mark the status appropriately, and move onto the next issue.

At some point you will have gone through all of the issues that are visible, but there are still numerous open items in the results window. I will go ahead and turn off the sectioning to make sure the balance of the results are not a part of the area that is currently the focus, and then mark them to be reviewed later.

### *3D Section Boxes in Revit*

When attempting to limit the amount of the model that is pulled into Navisworks, the tip listed above for using section boxes is a work-around that is effective, and works well. This can be done using Revit as well; limiting the visible extents of a model in a 3D view in Revit is easily achieved by section boxes. When you get the model's visibility correct, the referenced files lined up correctly, and their visibility correctly configured, you can export the entire view into an .nwc by making sure the check-box for export linked files is selected.



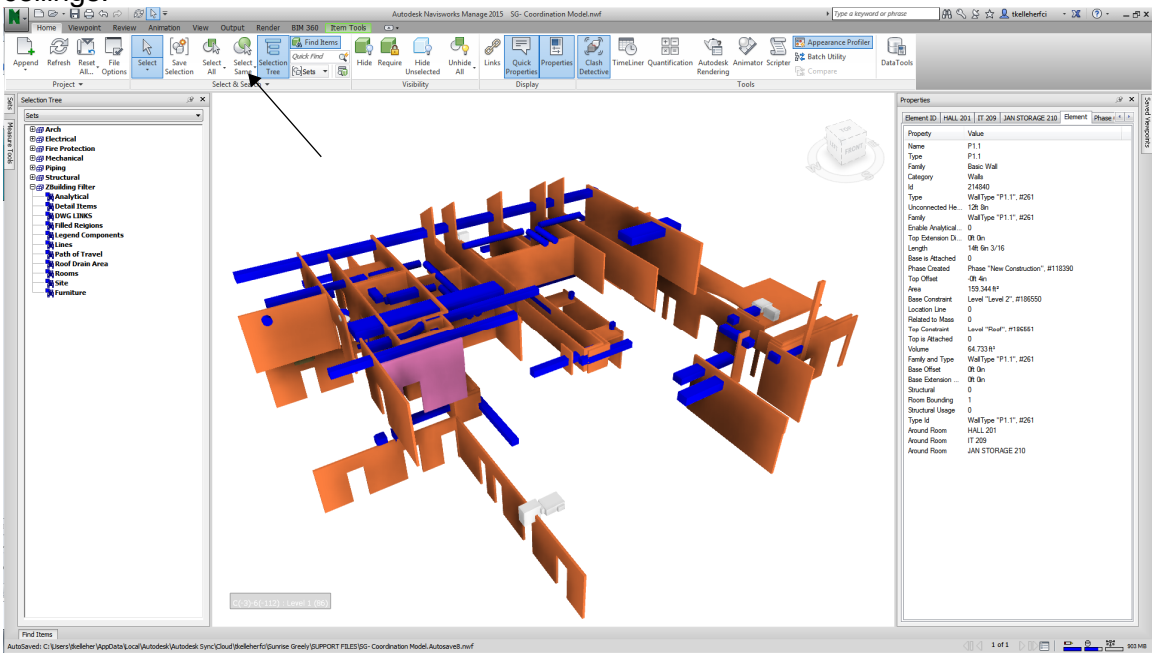

This will export everything in the view, just as it appears in Revit.

It is worth noting that I have had issues getting IFC files to export reliably using this method, but for Revit files it has worked spot-on. I have found this method of breaking projects up very useful for constructability reviews during the design process when most of the models are from Revit.

### *Use the Select Same option for reviewing Clash tests*

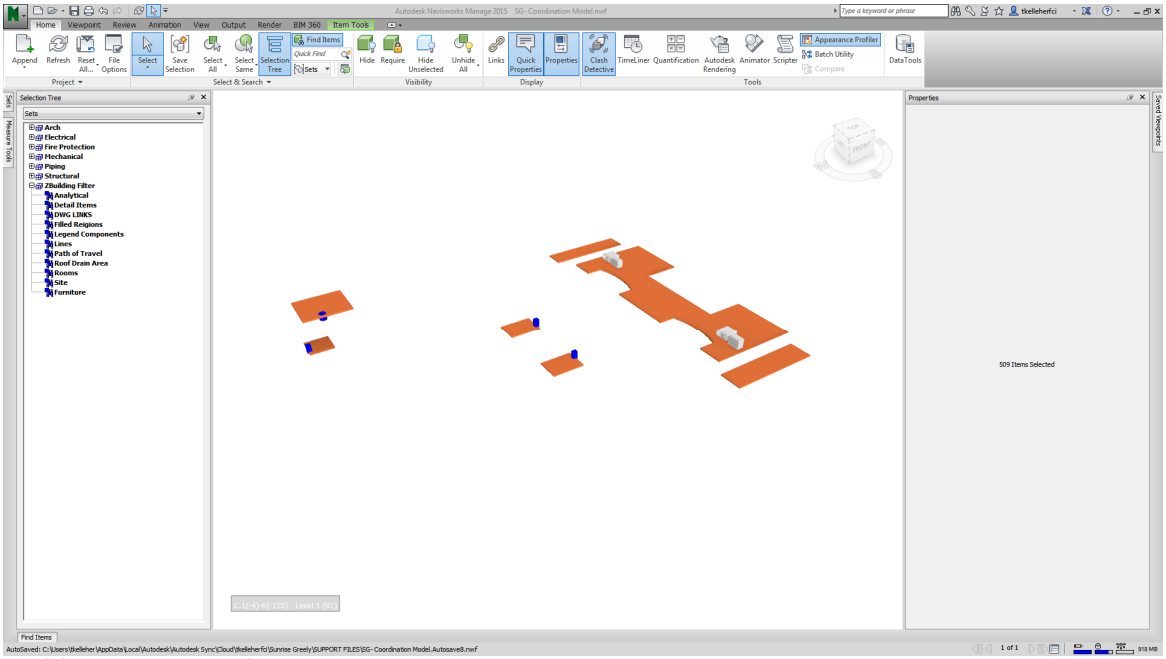
Getting false results in Navisworks is nothing new, and the rules function in the clash detective does a really good job in making sure that you can eliminate these from tests. I do use rules, and am a big fan of them. However they are not always the most practical way to deal with pesky false-positives in the clash detective. Usually you do not know there is an issue with the groupings until you have run a clash test and viewed the results. If it is an issue that will come up over and over on a project, then creating a rule is definitely the way to go. But if it is only something that is going to happen once on a project or a few times, I will use the "Select Same" functions to grab the problematic objects, combine them into a new group, approve it, and move on. It is much faster because you don't have to find the problem objects, create a rule, and re-run the test to get the same result.

In the image below, my clash test was set up to check ductwork vs. architectural walls and ceilings.



Model Images courtesy of FCI Constructors, Inc

I was able to isolate the test results to just issues between the ductwork and the ceiling by selecting a wall, then using "Select Same Name" function to eliminate all of the walls from the view.



Model Images courtesy of FCI Constructors, Inc

### *Limit the use of worksharing*

On most small projects, the teams are very small, and only one person may be assigned to the project. For this reason, we very rarely use worksharing. It is an extra level of configuration, and notifications to deal with that may not be necessary.

Without worksharing enabled the ability to lock of model elements is somewhat limited, but to control this I create items that I do not want editable (grids and levels usually) in a separate model, and reference it in. I also make sure that all items that I do not want moved, especially linked models, are pinned.

### *Host 3D CAD Files as a Generic Model Family in Revit*

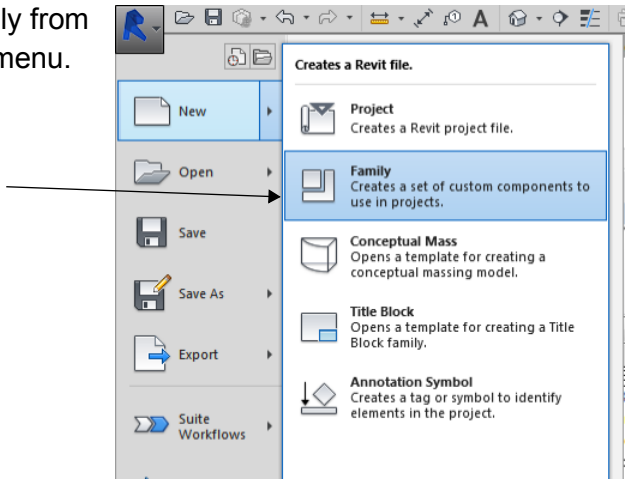
As was previously mentioned, making BIM work on smaller jobs is somewhat dependent on being creative with sourcing your models, and focusing on getting fabrication based models rather than models created for coordination. When working with CAD models in Revit there are known issues with the way Revit cuts the CAD models in section and plan views, and some types of models do not appear at all without some work. This is the process that I run through for every project, with great success in getting CAD models in Revit.

The first step is to process the files in AutoCAD. I keep it fairly basic, and run a few commands; PURGE, Set PROXY GRAPHICS to 1, EXPLODE everything in the model, then lastly run the CONVERTOMESH. You can simply run these commands individually or, if you want to make the process a little easier, you can record a macro to run all of these commands for you with the action recorder. This is great for a guy like me who does not write code, but would like the benefits from a customized program. More information on how this works can be found here: http://knowledge.autodesk.com/ If there are any changes that you would like to make to the

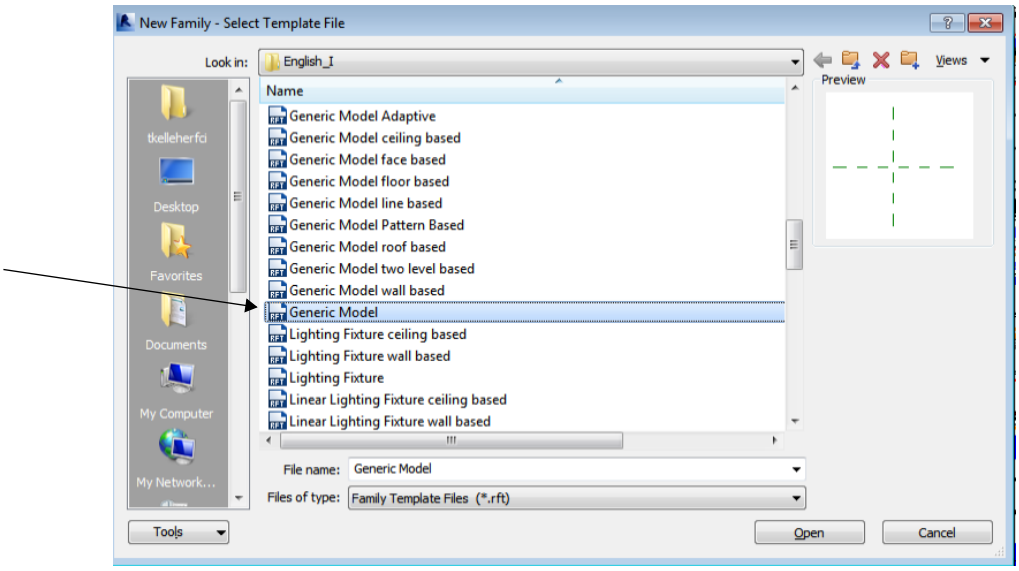
colors of the items within these files, it is easier to do in CAD before you pull them into Revit by modifying the layers in the layer manager.

Once you have modified your CAD files, it is time to pull them into Revit. I have found the best place to host CAD models is in a Generic Model Family. Hosting CAD in a generic model file eliminates issues with controlling the view ranges, as well as not “bogging” down Revit as CAD files are known to do.

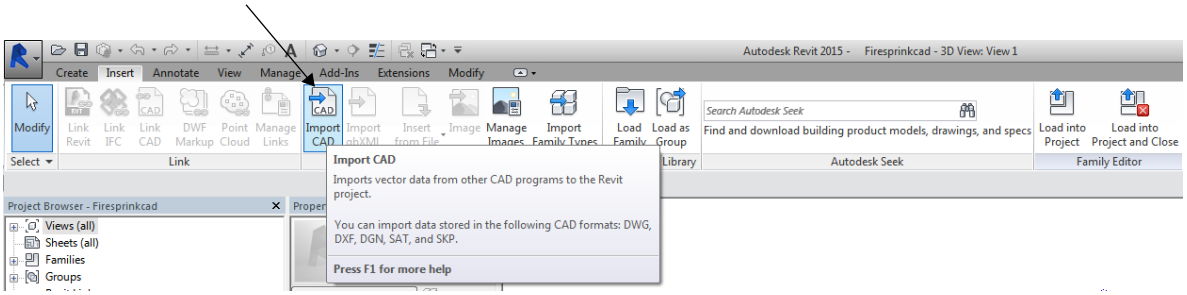
I usually will create a new Generic Model Family from scratch by going to New> Family from the file menu.

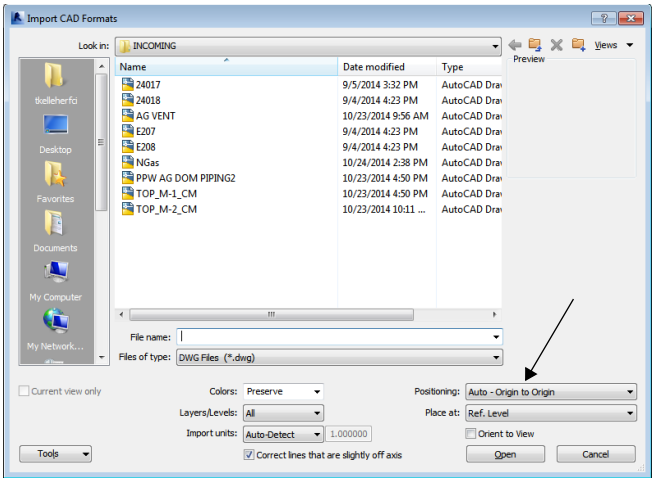



Make sure that you select the Generic Model from the different Family templates in Revit. There are many different options that are close to Generic Model, but this is the one that works the best.



Once you have the model open, you will go to the Insert Tab, and choose import CAD.




In the Import CAD Formats Dialog Box, make sure that the position is set to Auto Origin to Origin. Note: this is not the default setting for Revit except for 2015r2. The other default settings are ok.

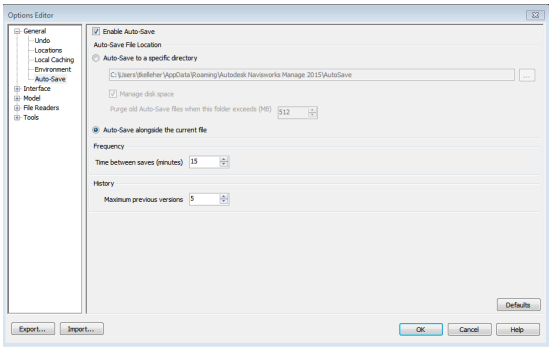
Once you have the model loaded, go ahead and save the family, and load into the current project. Since you loaded the CAD file to the origin point of the family, you can now place the family at the correct horizontal location in the model at correct floor. I prefer to load the new family from a floor plan at the base level of the CAD model because it is usually the easiest way to accurately place the model.

The process for updating the CAD files in Revit is similar to adding new files. You start by opening the Family in Revit, delete the CAD file, and re-import the updated file into the same spot. Save the family, then re-import into Revit, and you will want to replace the modified version with what was in place before. You will not have to re-position the model if you just modify the existing family.

### *Cloud Services for Models*

This is a really straight-forward tip. Being on the go will require that you have to have all of your data with you all of the time, and you will have a need to back it up, because you are on the go. I use Autodesk 360, because it is a service that is already paid for with our subscription, it allows me to easily share and collaborate with others while backing up my files, and since it comes with the suites a lot of Autodesk users already have the software installed on their computer. The desktop link that the program installs with the software is a little clunky, and can be slow if your internet connection is slow. If you create a link directly to the folder where the files are stored, rather than going through the software's interface, it is much faster to load and work with files that are stored there.

### *Auto-Save in Navisworks*




It is not often that I see other Navisworks users enabling and customizing it, but Navisworks does have an Auto-Save feature. This was a great discovery for me because stuff happens, and this keeps me from losing large amounts of work, or saving all the time. I also like to keep the files where the model file is saved so it is easier to retrieve the files if I need to.