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MEP Virtual Construction: When the Design Gloves Come Off

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Learning Objectives

- Learn how to better communicate needs to the design team, as well as internal construction team
- Discover additional ways to utilize design models
- Gain some tips and tricks in Revit MEP for construction
- Explore some additional MEP technology for electrical construction

Description

In today's fast-paced world it is becoming increasingly important to know how to utilize the design information received to create the most efficient and accurate plan for the construction of the designed systems. We'll talk about how we work with design models outside of Building Information Modeling (BIM) coordination to get more accurate information to estimators, foremen, and electricians. There will also be a brief overview of how we approach the subject of prefabrication from an electrical view.

Your AU Experts

Cassandra (Sunny) Watts *has worked in the electrical field as a designer for many years in both the engineering and electrical construction industry. As well as working on several projects, she is in charge of development, and training in the Revit MEP® software for the company. She also takes her expertise into her local ATC classroom as an instructor for the Revit MEP software.*

Nikki Divers *has been an electrician at Taylor Electric for 5 1/2 years. Her role within the company has ranged from installer, onsite material handler, Robotic Total Station Operator and now as the Layout Manger.*

In the construction industry some of the major concerns on any job have always been Documentation, Communication, Material and Labor. Managing material for a job off a set of printed construction documents has always, by nature, been time consuming and brings issues with documentation that is not up to-date or is inaccurate. It can also be difficult to understand the full design concept from a 2 dimensional plan. Technology brings with it a new approach to the overall workflow of installation, and faster more accurate information.

Taylor Electric started into the process of utilizing technology with the Robotic Total Station, and soon realized the power of computer generated drawings in AutoCAD. Shortly after that Revit and Navisworks were introduced into the mix. With the ability to coordinate spaces in a 3D model atmosphere, as well as the information contained in the model provided by the engineers, the possibilities of what could be achieved with these programs blew us away.

Learning Revit is a challenge, and finding good Revit designers can be an even bigger challenge. We always like to say "Anyone who says Revit is easy, has never really used it". But the more that Revit has been adopted into the workflow, the more it became apparent that this is the direction that Taylor Electric will take as it travels into the future. It has not been an overnight process, but over time a team has been built that can take the concepts from the foreman and project managers, and translate them into the building tools we use today.

The process isn't over, as we've pushed the boundaries of what we thought was possible with technology we've seen limitations in the software, and challenges in a culture that is still in the process of changing. We want to share with you a little bit of how we do what we do, and how to use some of the tools that we have been given to get the most out of our construction process.

Learn how to better communicate needs to the design team, as well as internal construction team

"You can have brilliant ideas, but if you can't get them across, your ideas won't get you anywhere."— Lee Iacocca

START and Start Early: Utilize in-house kick-off meetings to discuss model information and project needs.

Virtual Design for Construction always starts with an idea, and often that idea comes from someone asking the right questions. In-house kick-off meetings become a perfect forum for discussions on how the technology available can be effectively used to streamline the project process. This is especially important because each job is unique, and not every new process will work for each job. We gather all of our key players: Man Power, Project Manager, Foreman, Safety Manager, and the Virtual Design Department to discuss the needs, expectations, and technologies available, for each new job before the official job planning takes place.

Establish design parameters and practices:

It is the Foreman who drives the work the project site. We have found that many foremen do not know what to ask for, simply because they do not have the knowledge of what is possible. Take the time to listen to the needs of the foreman, and give visual examples of what has been done in the past, and ideas for what can be done in the future. This will engage the foreman, and get them thinking of ways that the Virtual Design could benefit their project.

Some of our best practices have come from the field guys asking if something can be done in the model, and us finding a way to make it happen. The more they feel engaged, the more they will come back for additional design help. If the Foreman is not on board, coordination is dead in the water. And you never truly know what you can do, especially with Revit, until you try.

Set deadlines and formats for requests:
Just as you would set guidelines for material ordering and management; guidelines for Virtual Design help need to be set. Once what is needed in a project is known, plan what each key player can and will provide to move forward. The foreman will generally be responsible to provide the building information and clarification, while a designer will bring the information into the model. Remember that while so much information can be found in existing models, they will most often need to be modified to provide the information in a way that is useful for your team, and that takes time. It's too late to discuss prefab when the walls are being framed on a project.

In addition to deadlines, establish consistent formats for requests. Communicating through consistent forms allows for easier understanding. We utilize Bluebeam forms for faster and easier communication of prefab selection as well as check lists of job requirements, testing, and quality control.

Communication with BIM Coordination
The prefabrication process and BIM coordination process can, at times, seem separated. In our company there are different departments for BIM coordination, and prefabrication. As BIM coordination takes place, be sure to clearly communicate the final use of the model with the coordination team. Will the model be used for prefabrication of parts, or for point layout? The Coordination deliverables do not always contain the information necessary for these additional goals, never assume that because it has been coordinated, the information to prefab or layout the job will automatically be provided.

Often the coordination is taking place while the building is in construction. Understanding dates of when coordination will be finished in conjunction with when different elements need to be ready for the job site will help to prioritize tasks and guarantee that everything is where it needs to be when it needs to be.

Don't forget to be flexible. Construction is a living breathing process, and can change at a moment's notice.

Set a standard for document sharing and distribution:
The power of programs like Bluebeam, Box, Dropbox and BIM360 Field, is in collaboration both with the team in the office, AKA the Virtual Design Team and Estimators, as well as the electricians in the field. Foremen are able to receive documents on a tablet, mark them up, and quickly return for clarification on questions or issues.

Whatever your method of communication is, make it standard and train, train and retrain. The tool is only as powerful as the person who uses it. It's very possible for documents to get lost, marked up incorrectly, or not used at all when the field guys don't know how to use the tool properly.

The way that we communicate as a team will always guide the progress and success of a project. The way we use the BIM models is the strength behind that conversation, and understanding of the project construction.

Discover additional ways to utilize design models

Revit as a construction tool –
Information in Revit is intuitively linked to dynamic geometry, which is placed into a 3D model environment capable of creating detailed views of rooms, objects, assemblies, and systems. The information can then be extracted into smart schedules. Because Revit is a 3D model environment, it is possible to enter a space before the ground is every broken. This makes Revit an incredibly powerful Design Tool, but what about when the design is complete, the Architect and engineer have done their job, and the construction is about to begin? Once you understand how to extract additional information from Revit, which may not be included as part of the 2 dimensional construction documents, Revit will become a powerful construction tool as well.

The power of Revit schedules for construction

Utilizing schedules to obtain counts of equipment and material.
Revit schedules have the power to read information from a variety of parameters that either exist in the model already, or can be added according to your needs.

FOR EXAMPLE: A foreman came to me and asked if I would be able to count all of the GFCI outlets for a job of his which had been modeled in Revit.

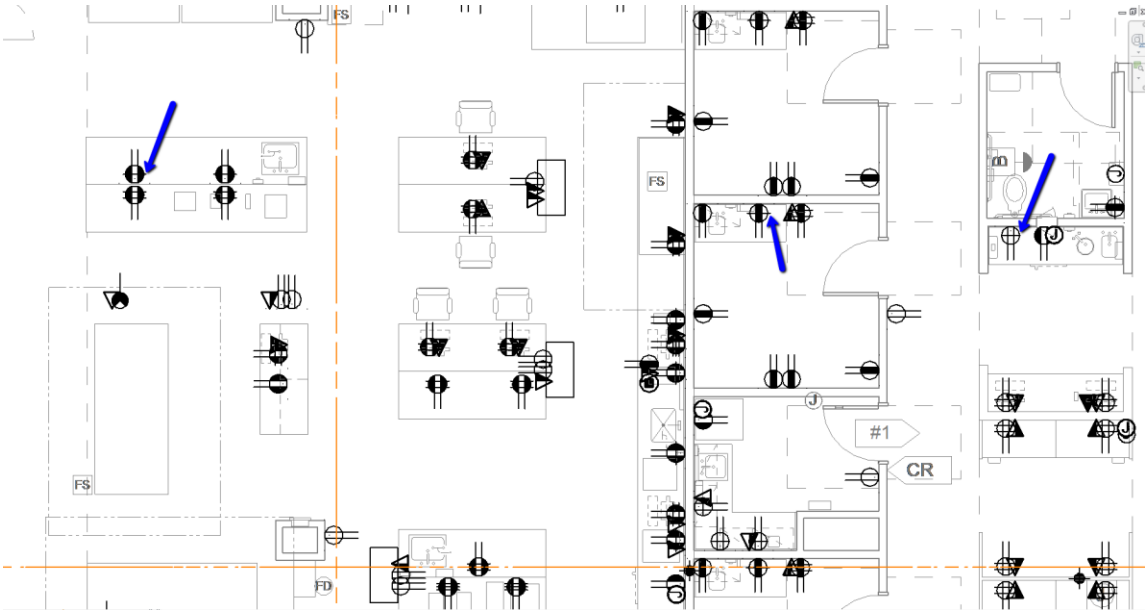


FIGURE 1: PORTION OF FLOOR PLAN SHOWING THE GFCI OUTLET.

The only difference between the symbol of any type of receptacle in this project and a similar symbol representing a GFCI receptacle is a tiny horizontal line in the center of the symbol. Trying to look through four floors of plans to find each of those symbols would be a daunting task for anyone, and has a potential for errors.

After creating an electrical fixture schedule, I decided to filter the schedule so that only the devices which were GFCI would show. Normally in Revit it would make sense to use the Type Mark parameter to filter the schedule, by inputting "GFCI" into the Type Mark parameter field of all of the receptacles that were marked as GFCI in the "Type", since Revit doesn't have the ability to filter it's schedules by the "Type" parameter. However in this particular model there were some circumstances which would have caused some miscounts had I done it that way.

1. Some of the "Type" parameters said GFCI, but some did not, so there was no way of knowing which outlets were GFCI or not in the schedule out of the box, without manually checking the counts to make sure (see Figure 2).
2. There were actually about three parameters in each Family controlling the visibility of the GFCI Symbol; this meant I could not use the visibility parameter directly to determine the count of the symbols.
3. Sometimes the parameter controlling visibility of the GFCI Symbol was an instance parameter, meaning that one instance of a type could be GFCI and another instance could not be GFCI. And Type Mark is a type parameter, meaning it would count both instances regardless of the actual fixture being GFCI.

<RECEPTACLES - GFCI>

A	B	C	D
Panel	Count	Type	GFCI - YES
1L1C	3	GFCI Above Counter EM	Yes
1L1C	1	GFCI Above Counter EM	Yes
1L1C	1	GFCI HG EM	Yes
1L1E	1	GFCI	Yes
2L1C	1	Coffee	Yes
2L1C	18	GFCI Above Counter EM	Yes
2L1C	4	GFCI Above Counter EM	Yes
2L1C	1	GFCI EM	Yes
3L1C	1	Autoclave	Yes
3L1C	2	GFCI EM	Yes
3L1Q	1	ICE	Yes
4L1E	1	GFCI EM	Yes
4L1Q	1	Autoclave	Yes
5L1Q	15	GFCI EM	Yes

FIGURE 2: SCHEDULE SHOWING GFCI OUTLETS FOR PROJECT, USING THE ADDED PARAMETER

Work Around-

In each family I added a yes/no shared parameter called "GFCI-Yes" and told it to be yes IF any of the visibility parameters for GFCI was yes. I was then able to filter the electrical fixture schedule by the "GFCI – Yes" parameter, ensuring that all of the outlets which showed the GFCI symbol in the plans would be counted in the schedule.

Graphics		
GFCI - YES	☑	= or(or(GFCI, GFCI WP, HG EM GFCI))
Wall Mounted	☑	=
UPS	☐	=
HG EM GFCI	☐	=
HG EM	☐	=
HG	☐	=
GFCI WP	☐	=
GFCI	☑	=
Floor Recept	☐	=
EM	☑	=

FIGURE 3: FAMILY WITH ADDED "GFCI – YES" PARAMETER AND FORMULA

The project hadn't been set up to do that kind of counting, because that is not the Engineer's use for the model. It took time to figure out the best approach, as well as time to go through the families, but in the end I was able to get an accurate count based on what my foreman would have seen on his plans. And it was much faster than the foreman going through and individually searching for each of the symbols.

Be prepared to have to modify the models a little to get the correct information out of them. Be creative, try different methods. What works on one project, won't always work on the next. The method which you used once, maybe not be the best way to approach the problem in the future.

Tip: Utilize the information already contained in the schedule. The fastest way for me to change families was to sort my electrical fixtures by family, and then systematically go into each family to add the desired parameter; this ensured each family was changed appropriately.

Utilizing Schedules to generate labels for receptacles on the site

FOR EXAMPLE: A foreman came to me and needed a physical label for the receptacles in the field showing the Panel Name, and Circuit number for his job. This task was pretty simple because the panel schedule, and circuit number for each receptacle is established automatically when an electrical system is assigned to that receptacle.

First, I verified that the wiring into the physical panels matched what was entered in the virtual panel. We all know that things are never built exactly the way they were designed in the computer, but it is usually pretty close. I made any necessary changes in the model to ensure accurate counts.

Once all of the information was corrected I simply created an electrical fixture schedule, and filtered it by the desired panel. Using the "Panel" and the "Circuit" parameters, I made sure that each instance was itemized. This gave me a line item for each of the devices on each of the circuits in that particular panel, and provided the information the foreman requested.

<Electrical Fixture Schedule>

A	B	C
Family	Panel	Circuit Number
P-Fourplex Receptacle	1L1	3
P-Fourplex Receptacle	1L1	3
P-Fourplex Receptacle	1L1	4
P-Duplex Receptacle	1L1	5
P-Fourplex Receptacle	1L1	5
P-Fourplex Receptacle	1L1	5
P-Special Purpose	1L1	6,8
P-Special Purpose	1L1	7,9
P-Duplex Receptacle	1L1	12

FIGURE 4: ELECTRICAL FIXTURE SCHEDULE FILTERED BY DESIRED PANEL

I exported the schedule out as a report, and then used the Mail Merge feature in Microsoft Word to automatically generate the desired labels to the correct size, with the requested information. Super Slick!

The power of Revit visualization

"Of all of our inventions for mass communication,
pictures still speak the most universally understood language." - Walt Disney

Provide views of specific rooms, details, as well as additional dimensions for question resolution.
Even the best of construction documents may seem ambiguous to the electrician during the time of construction. 2D plans, by nature, make it difficult to properly convey a complete concept for an entire space. Often times, information for items that are related within the construction of a space may, of necessity, be placed on separate sheets because they are different systems. This causes time consuming searches between hard copy plans to obtain necessary information or to answer questions. If the plans were created in Revit the full project is contained within one file, and it is relatively easy to modify existing views or create new views to reflect the desired information for the electricians in the field to refer to in hard copy, or through a pdf reader like Bluebeam.

FOR EXAMPLE:
Below is a floorplan which shows the coordinated layout of the lighting fixtures for one floor as well as the floor boxes for the floor above it. The light fixtures in the floor below will be supported in the decking for the concrete floor for the same level where the floor boxes will be installed. Supports for the light fixtures need to be drilled and dropped through the floor, and floor boxes need to be located and put in place before the concrete can be poured on that level. In the original construction documents the floor box locations were shown on a separate sheet from the lighting fixtures because: 1. they are elements in two separate levels, and 2. One sheet is meant to show power components and the other just the lighting components. To streamline this process we went into the Revit model, adjusted the view depth, and added filters for each category, and cleaned out any unnecessary elements to make the plans easier to read. Additional dimensions which had been requested were added, and the new document was sent as a PDF and hard copy back to the electricians in the field. They were able to easily find the placement for all components based off of information contained on one sheet.

FIGURE 5: FLOOR PLAN REFLECTING BOTH LIGHT FIXTURE AND FLOOR BOX LOCATIONS.

Generating 3D views and details of the model in conjunction with construction documents to increase understanding.

As powerful as 3D views are, they often do not end up in the final documentation of the project. By generating 3D views from different angles, the foreman can gain a better understanding of each space, and the plan for how it should be built, as well as answering any questions about ambiguous symbols and placement in the construction document.

FOR EXAMPLE:

Below you see how it can be difficult to tell what is happening in the space with the dark rectangle, and the two overlapping disconnect symbols. But when a 3D view is generated it's easier to understand that the rectangle is a bus duct, disconnects are stacked on top of each other and mounted to the bus duct. The information in the view existed in the model, but the view was not readily available to the guys in the field.

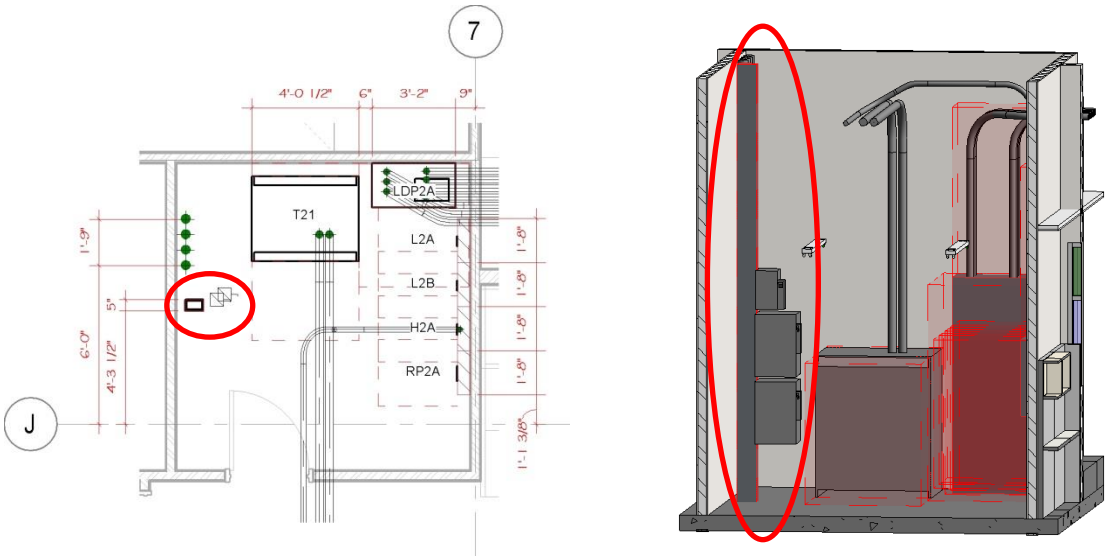


FIGURE 6: CLARIFICATION GIVEN THROUGH 3D IMAGE OF ELECTRICAL ROOM

Remember:
The model itself is not the contracted information, and the official construction documents should always be referred to.

Plans change. Not just in the design process, but clear through construction. Proposal Requests, Requests for Information, and Change Orders may not be reflected in the design model. Utilize the information provided in the model, and update the information that wasn't final when the model was created.

Replacing simple models with complex assemblies and systems for use in Prefabrication

Changing from AutoCAD to Revit is a culture change for many reasons. One of those reasons is because in AutoCAD a system, whether it be walls, doors, HVAC or electrical, can be drawn before any final design choices have been made. Those final design choices are often controlled in a schedule that is separate from the system itself. This workflow lends itself to much of the work of the project happening at the end of the project, making the initial design process simple, but causing a miserable crunch time at the end**.**

Revit requires that the correct information be entered into the family, for information to be available in a final schedule. This shift means that in Revit, much of the design work must happen closer to the beginning of the design process, and a little less at the end with automatically generated schedules of items.

Prefabrication works much the same way. On a job site, components like receptacle boxes would not be constructed until the studs are in place ready for the boxes to be installed. This sometimes leads to a time crunch which has the potential for loss of material, inaccuracies in building, and higher labor costs.

Taylor Electric has always recognized the importance and benefit of the prefabrication workflow, and is a leader in the industry for Prefab. In the prefabrication process, assemblies are constructed in a controlled environment, and delivered to the jobsite ready to be installed. Traditional prefab comes with its own set of problems and inaccuracies. In a traditional prefabrication situation, the foreman would determine the construction of each type of fixture, in this case the receptacle box, and manually do a count of each type. In additional to being time-consuming it could be inaccurate by the time of installation, because construction documents remain a living breathing document until the project is complete. Decisions made at the beginning of the project may not be the final result. If counts are completed manually, proper documentation does not always exist. This causes a need for an entirely new count. There are also limitations for the information that can be provided. While box types and counts can be relatively easily determined, wire lengths are difficult to pull from a 2D floor plan. It also leaves room for additional mistakes in the installation because there is no solid reference for the electricians who are doing the installation.

With the use of 3D models, it is possible to go into the space virtually, and visualize how the Receptacle box is going to be built and how it fits into the wall construction. Cable or conduit paths can be determined in the model as well giving a better overall understanding of a complete system. Views, schedules, and labels for devices and fixtures can be easily generated, giving the prefab department clear building instructions. It also provides clear installation instructions for the electricians in the field.

FOR EXAMPLE:
We were holding an internal Kick-Off meeting for a local student housing project. The project had a lot of repetition, and was being built in such a way that prefabrication was an excellent option for construction. We decided instead of using the manual method for prefabrication of the receptacle devices within the space that we would utilize the Revit model already provided for the project, and modify families.

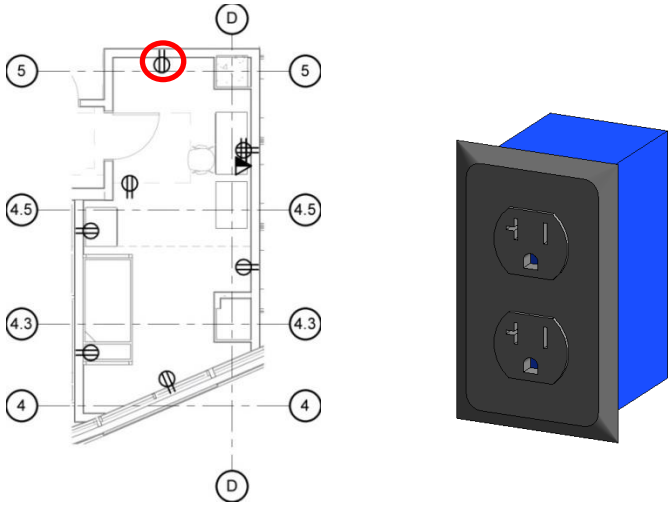


FIGURE 7: TYPICAL ROOM AND RECEPTACLE FIXTURE FROM ENGINEER GENERATED MODEL.

Figure 7 shows typically what physical information would be given in an engineering model. Since the construction team decides how the final receptacle will be constructed, the engineers typically place a generic receptacle family inside the model to provide placement, and general electrical information like type of fixture, height on the wall, as well as load.

With the help of the foreman we were able to make decisions for how each box type should be constructed in detail, as well as determine which color of wire should be run to which boxes. Using the 3D model I was able to go into the space and replace the generic model with a more complete receptacle assembly, and run the MC cables virtually through the walls, giving us the correct length needed for each.

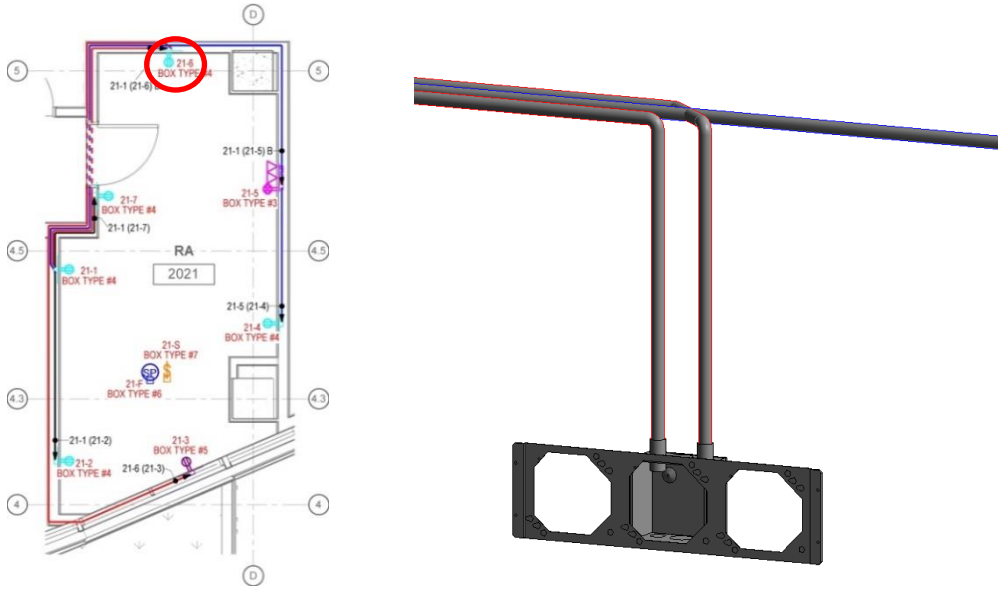
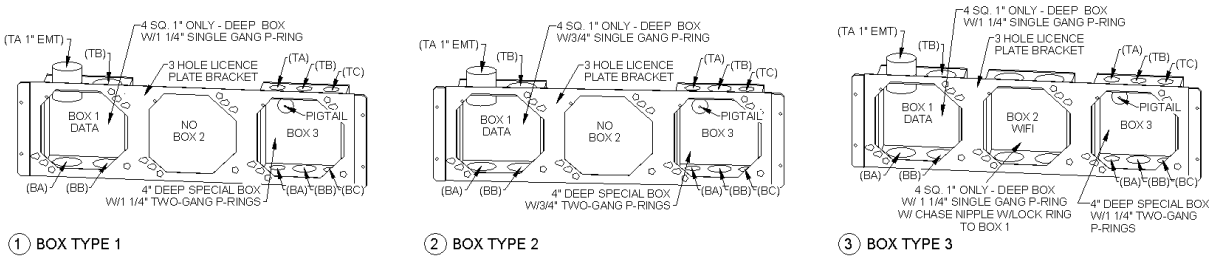


FIGURE 8: TYPICAL PREFABRICATION READY ROOM AND RECEPTACLE FIXTURE FROM MODIFIED MODEL.

After the modeling of the space is complete, we were able to create views of each box type, as well as create detailed schedules including the information for each box construction, and appropriate cable information.



① BOX TYPE 1 ② BOX TYPE 2 ③ BOX TYPE 3

TYPE	BOXES AND LENGTHS	BOX DEPTH	PIGTAILS	P-RING TYPES	P-RING DEPTH	PLUGTAILS PER ASSEMBLY	TOTAL PLUGTAILS	ASSEMBLY COUNT
BOX TYPE #1	BOX 1 - 4 in, NO BOX 2, BOX 3 - 4 in	DEEP	BOX 3 PIGTAIL	BOX 1 SINGLE GANG, BOX 3 TWO GANG	0' - 1 1/4"	2	16	8
BOX TYPE #3	BOX 1 - 4 in, BOX 2 - 4 in, BOX 3 - 4 in	DEEP	BOX 3 PIGTAIL	BOX 1 SINGLE GANG, BOX 2 SINGLE GANG, BOX 3 TWO GANG	0' - 1 1/4"	2	48	24
Grand total: 32							64	

AREA D - MC CABLE LENGTHS

ASSEMBLY	WIRE COLOR	TOTAL LENGTH
2021		
21-1 (21-2)	BLACK	15' - 0"
21-1 (21-5) B	BLUE	49' - 0"
21-1 (21-6) B	RED	36' - 0"
21-1 (21-7)	BLACK	11' - 0"
21-5 (21-4)	BLUE	12' - 0"
21-6 (21-3)	RED	54' - 0"

FIGURE 9: PREFABRICATION BOX CONSTRUCTION, AND MC CABLE LENGTHS

All of the information together made construction in a controlled environment a snap, and made installation on site faster and easier. It also meant that we were able to catch the majority of questions about any given installation early in the process, and answer them long before the installation became an issue on site. Finally the prefabrication process provided material control because each room was packed in a box containing everything that was needed for the construction of that particular room. No guess work, no losing material, no problem!

Just as the process of construction is a living and breathing element. Developing the best methods for moving that process forward will always continue to change and grow. Anytime a new system is introduced there will be a learning curve with bumps along the way. Revit has its own unique set of limitations that require work-arounds, and finding the best mode of communication is a constant challenge, and will need to be refined. But as we work more with utilizing the software's abilities the right questions will be asked to the right people to make the overall process easier, and more fluid within the Revit software.

Gain some tips and tricks in Revit MEP for construction

Visualization tools native to Revit are not just for the architectural design team.
Just as additional detail views can help expand understanding in the construction process, understanding how to leverage the visualization of those views will increase the power of the model for

the construction team. Here are a few of our Virtual Design Department's favorite tools that we use on a regular basis that helps us to work within the Revit Software.

View Filters:

View filters are probably one of most visually powerful tool in Revit. They are a visual constraint for an object parameter.

FOR EXAMPLE:

Let's say I needed to see all of the receptacles on a specific panel within a plan. In the view I could create a filter for that panel name and set all of the receptacles that are assigned to that panel to appear in a specific color in that view. In this example the receptacles for Panel 3L3-1 will be Magenta, and Panel 3L3-2 will be Green.

- Open the visibility graphics dialog box by typing the shortcut VG
- Navigate to the Filters Tab

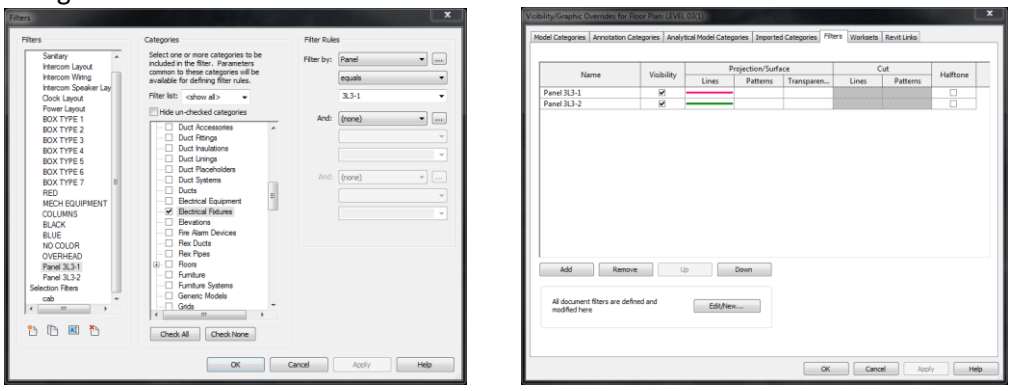


FIGURE 10: FILTER EDITOR AND MANAGER DIALOG BOXES

- At the bottom where it says "All document filters are defined and modified here" Click on "Edit/New…"
- Click on the new filter button to create a new filter definition.
  - This filter will be for "Panel 3L3-1"
- Select the category of component in the project to assign the filter to.
  - Receptacles are "Electrical Fixtures".
- Establish the Filter Rules by:
  - Selecting the desired parameter to control the filter
    - In this case it would be Panel
  - Deciding the qualification
    - Equals, doesn't equal, contains etc.
  - Selecting the parameter result to filter by
    - The actual panel number you want the filter to search for ("3L3-1")
- Select the new filter definition from the filter list
- In the filter definition in the Visibility/Graphic Override for Floorplan dialog box override the Line color, weight, or pattern as desired.
  - Change the 3L3-1 Panel filter to be Magenta and change the line weight to 4 or 5.

Repeat steps for panel "3L3-2.

FIGURE 11: FINAL FLOOR PLAN WITH FILTER APPLIED

Orient 3D view to established plan view:

As has been discussed, 3D visualization is one of the most powerful ways in which Revit models can be utilized. The Orient to View option within the 3D view settings can quickly set any 3D view to show a detailed callout of a specified area.

FOR EXAMPLE:

If I have a detail of an electrical room (ELEC 3120), and I want to see the 3D view of that room I would:

- Create a new 3D view, or navigate to existing 3D view to use
- Right click on the View Cube  in the 3D view
  - Hover over "Orient to View" option
  - Select type of view (IE: Floor plan, Elevation, Section, or 3D views)
  - Select which view to orient to (ELEC 3120)

  And Viola! Revit crops the 3D view to match the extents of the view specified, including the specified view's orientation. From there any desired settings for the view and cropped areas can be modified. This is especially helpful when the room is off axis in the model, but the detailed view is rotated to project north.

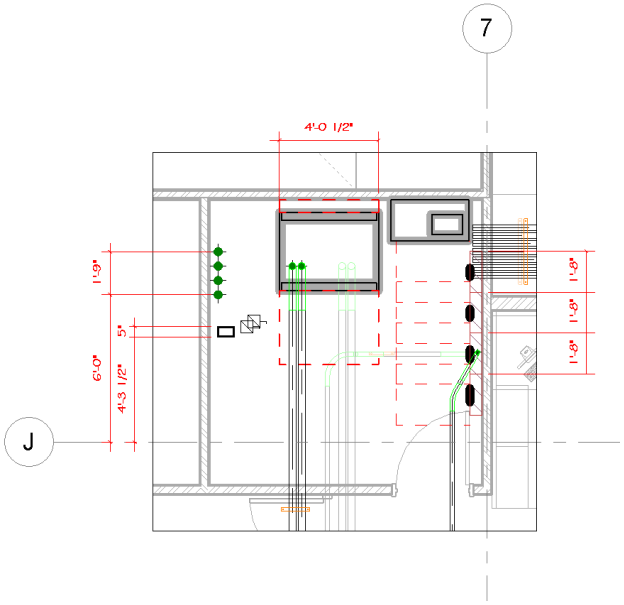


FIGURE 12: DETAIL VIEW OF ELEC 3120

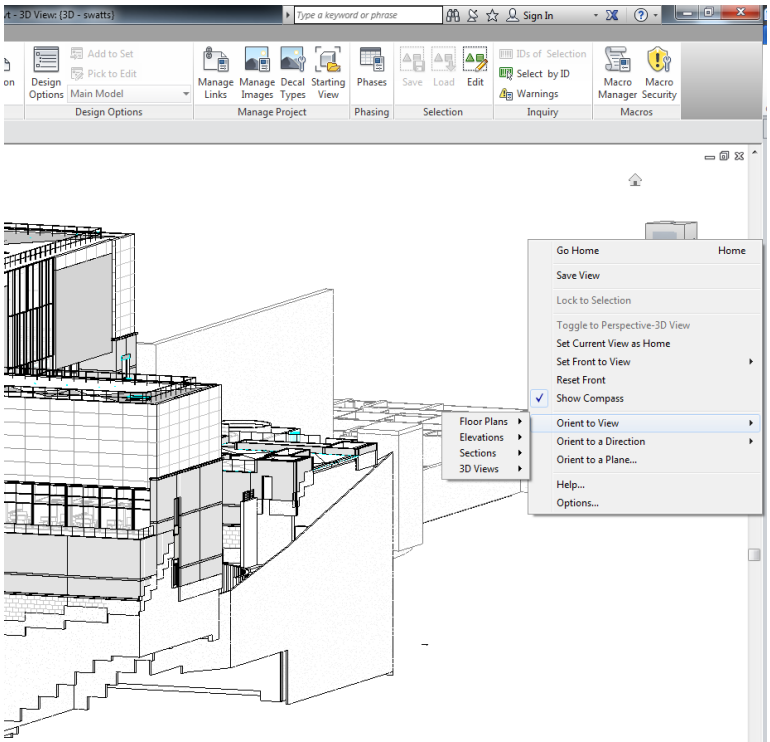


FIGURE 13: OVERALL 3D VIEW TO BE ORIENTED AND VIEW SETTINGS

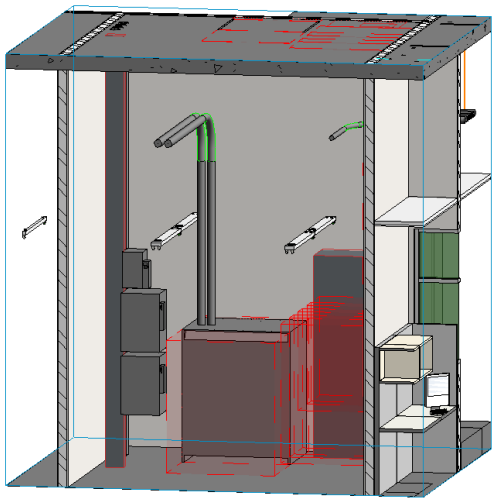


FIGURE 14: DETAILED 3D VIEW – ORIENTED TO ELEC 3120 PLAN VIEW

View Templates:

When leveraging the power of visualization in Revit, views will need to be created and modified to contain pertinent information for project clarification. View templates can quickly transfer one view's setting to many views.

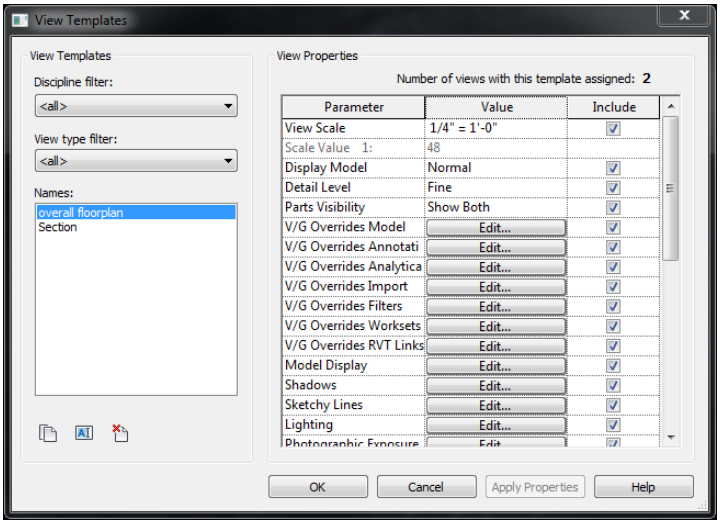


FIGURE 15: VIEW TEMPLATE DIALOG BOX

View templates can be created from scratch within the Mange View Template tool, or can be created from existing views once settings for that view have been selected.

View templates may contain all of the setting for the view type, or only a few select settings, and can also be set to automatically apply to any new view created in a specified category.

This is an incredibly powerful tool, and is well worth your time to learn and explore.

Shared Parameters and Project parameters

Parameters are the guts of the information Revit can Leverage.
Shared Parameters are parameters which are stored in one central external file, then applied to families and schedules in many different projects. The best way to ensure that a parameter is available in a family, and that the schedule can read information from that parameter is to make it shared parameter.

Be careful when working with shared parameters. If the shared parameter file is deleted, then any time an update needs to be made to that shared parameter, the file must be recreated, and then reapplied to all of the families and schedules which need to be updated, which is a lot of work. Make sure Shared Parameter files are stored in safe locations, where they can be easily found in the future.

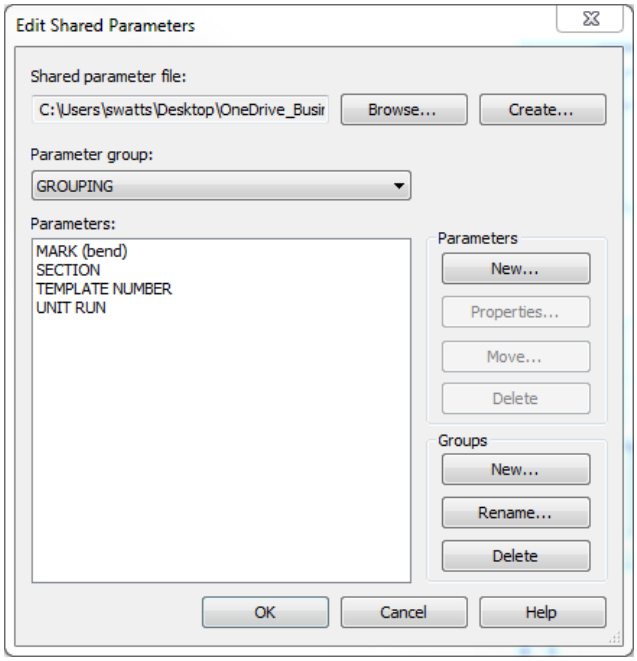


FIGURE 16: SHARED PARAMETERS DIALOG BOX

Project Parameters are parameters which are applied to families inside of the project itself. Much like a view filter, a project parameter can be established and assigned to a specific category of element within the project.

This is especially useful for systems elements like conduit and cable tray, which have parameters established within Revit settings, and are not loaded from an external family file, but the practice can be applied to other components as well.

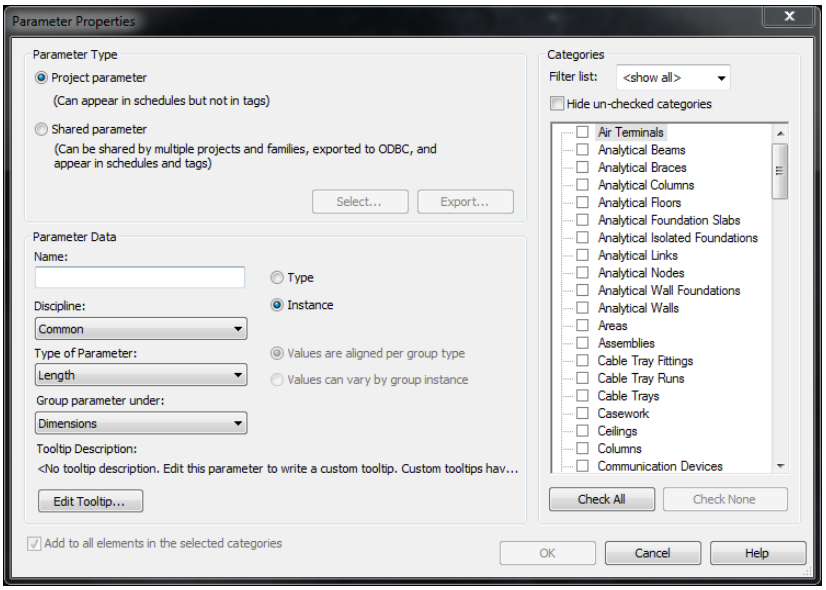


FIGURE 17: PROJECT PARAMETERS DIALOG BOX

Calculated Values in Schedules and families:

Detailed families and smart schedules that read family information are some of the most powerful tools in Revit. By using calculated values it is possible not just to obtain counts, but also to combine results of several different parameters into one column, add footage to wire lengths, determine a result based off of several parameter values, and the list goes on and on. Calculated Values can automate the scheduling process and give clear and simple final answers for complex problems.

Just as with any new language, learning the language of how to enter formulas into calculated values in Revit takes time, and a lot of trial and error. Building robust schedules will involve a lot of testing, and tweaking. But once a good schedule is built, it can be transferred from project to project. And in the end it is the best tool for the job. Learn it, you won't regret it!

Non Revit native Plug-ins for Revit. (AKA: a couple of our favorite plug-ins)

Coins Auto Section Box plug-in Vs. Revit Native View

While Revit now offers a 3D Selection tool natively in Revit, our Virtual Design department still prefers the Coins Auto Section Box plug-in. It is offered for free on the Autodesk Exchange website. This tool is great because it creates a 3D view based off of selected objects in a plan view, or elevation. The real power of the Coins Auto Section Box plug-in is that it allows the user

to choose the distance around the object to cut around. Designate any buffer area, from a few inches to several feet and a 3D view is generated. The Coins tool also provides a way to name the 3D view as it is created, making it easier to find and use that view in the future. Did I mention that it's FREE?!

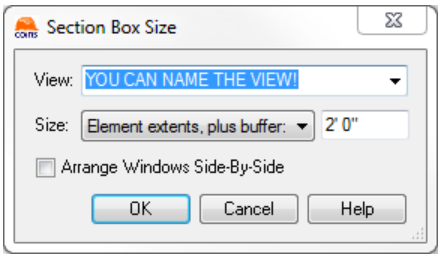


FIGURE 18: COINS SECTION BOX TOOL

Palladio X BIM Windows Layout

When working in a multiple screen environment this tool makes utilizing the Real-estate of the screens more efficient. This tool helps to quickly organize multiple open views in Revit into panels across several screens. With this feature it is no longer necessary to toggle between views. All opened views are easily available, and organized.

FIGURE 19: PALLADIO X BIM WINDOWS LAYOUT TOOL

Explore some additional MEP technology for electrical construction

Point Creator and Robotic Total Station for layout.

Traditionally when there are layout needs during the construction process, tape measures, strings and few good electricians will be needed. This method is time consuming, labor intensive and can yield inaccuracies. Robotic total stations can alleviate these stresses, by quickly locating elements to be laid out on a jobsite based off of building models in Revit and AutoCAD.

Taylor Electric recognizes the power of this technology and the system was adopted in its early stages. As layout technology has progressed into the use of coordinated models in Revit, the true power of layout has been realized. With the use of Revit it is easier than ever to clean up views and isolate the components needed for layout, gain a better understanding of the construction of a space, while focusing on just one level at a time. It also becomes easier than ever to manipulate drawings to represent layout requests from the electricians in the field.

Tablets for document sharing, and Viewing

A few weeks ago one of the Project Managers in the company made the comparison between tablets and cordless drills. While the job could technically be completed without a cordless drill the amount of time that a job takes without that tool no longer makes sense in today's fast paced world.

While not everyone on the jobsite may have access to a tablet yet, the industry is really being driven in that direction. Because apps like BIM 360 Glue and Bluebeam, box and drobox give the ability to view and mark up drawings on a small hand held device that can be carried around the jobsite easily, as well as document questions or issues with the camera contained in each tablet; they have really become the best way to get the most up-to-date information to everyone on the team, both in the office and in the field.

In Conclusion:

The construction world has many players, as well as parts and pieces which make it a complex process, with unique challenges. As technology continues to progress it gives to us better ways to communicate ideas and concepts which help us to meet those challenges head on. Revit, as with any technology, is only as good as the people using it. It is us who drive the industry to take the steps forward to provide for the needs both for our companies, and the buildings we construct. As we work to improve communication, and utilize the design tools, plug-ins, and robotic total stations we will discover new approaches and solutions, as well as finding ways to address current limitations in the software.

The best way for us to move forward is together. Through forums like AU, local user groups, online forums, and research projects through the software companies, we see a bright future with endless possibilities.