

STEPHANIE

Good morning. Welcome to AU2016. We finally made it. You are in Ways To More Effectively Use REVIT For Electrical Design. So if the coffee hasn't kicked in yet and you're in the wrong class, feel free to go ahead and find the correct class this morning.

ELLIOTT:

I am Stephanie Elliott. I work for Jacobs Engineering out of our Houston office. I'm a licensed electrical engineer in three states, Texas, Louisiana, and Kentucky. I'm also a LEED AP. I am REVIT certified in 2015, '16, and I actually just passed the '17 test yesterday for all of those certifications.

In the Houston office, I am a dual role. I'm our BIM manager as well as an electrical engineer. I have been working in REVIT since 2007. For those of you who've been in REVIT that long, you remember how rough it was around the edges back in 2007.

It's light years better now, almost 10 years later, than it was when we were first trying to make it work. I've got experience in aviation, convention centers, data centers, education. High-rise office towers, hospitality, and specialty facilities all in REVIT.

And then I've been a BIM consultant for a million-square-foot airport, as well as campus projects. So I've done a lot of different projects in REVIT. Everything that I'm going to show you today has been used on real-life projects. We've used it successfully in the projects in our office.

This is the class summary that you all read whenever you signed up for the class. I'm not going to read it again. Just in case you forgot. So today, at the end of the class, you will be able to utilize schedules to perform energy code calculations.

You'll be able to utilize schedules to better coordinate electrical, mechanical, and plumbing. We'll be able to use schedules to check our electrical design at both the panel and breaker level. And we'll be able to use view filters to help us catch those un-circuited items.

Putting this out there as a caveat at the beginning, there is multiple ways to skin a cat. This is the way that our office chooses to do it. This is not the only way that you can do things, and there may be differences of opinion in the best way to accomplish something in REVIT. This is what I think is useful.

Some of you may disagree with me, and some of you may disagree on best practices, but we

all have the same end goal of wanting REVIT to work efficiently and effectively in our designs. So before we dive in, how many electrical designers or engineers do I have in the room? Okay.

How many mechanical designers, engineers? Okay. Contractors? Okay. Any architects? Okay, so we've got the whole gamut. We've got primarily electrical with some mechanical, some architects, and some contractors. All right, so let's dive right in.

Energy Code Calcs. If you remember, in the old days, this is what we would do. We would build a spreadsheet and we'd list all of our fixtures in the watts per square foot, or the watts per fixture, the number of fixtures on every floor. We'd sum them up, and that would give us our code calculation as a starting point.

But at least for me, the challenge was always, when do I actually stop and do a fixture count? If you do it too early, the likelihood is, the architect is going to change their mind and move some walls and do something different. And then you got to start all over again.

Doing these type of calculations, we would spend days printing it out, and counting them off, and highlighting them all, hoping we got them all grouped in the right space. Hoping we got all the fixtures accounted for. But now, we can throw the highlighters away and we can use REVIT.

So this right here is a schedule generated in REVIT on a live project. So you can see that we've got room number, room name, square footage, what space type it is, what the allowed lighting per ASHRAE. This can also be set to per IECC. And what we actually have in the room.

The other thing that we have highlighted here is the spaces that are over. So you can see in yellow that right now, my janitor's closet is running at 1.5 watts a square foot when it should really be 0.8. But our storage room, we're doing good.

The other thing that this schedule allows us to do-- so this is the space-by-space method demonstrated to you. If you look at the very bottom, you can see a synopsis of the total [? VA ?] that we have allowed by code, which is 13,000, and then the total that we actually have connected, which is roughly 8,500, 8,600. So as a whole building method, this building would pass because we can trade the watts.

But what this does is it allows me to give a snapshot to an architect, to a lighting consultant, at

any given moment in the project where we stand. And it highlights to us the spaces that we would need to focus on if we needed to do something different. So how did we do this?

So, first, when we're setting it up, we're going to create a space schedule. And this space schedule has room number, name. This is where we set the space type. That space type, you can either set it to building if you want it to approach the whole building method, or you would go through here and you would say, Okay this is a restroom. This is an office. This is a storage room.

And then in here, for the space types, I always try to put the limit offset, which helps me know where the room is bound by and where the space is bound by. Because the thing that you have to be careful of is if our space is lower than the room, we may think we have light fixtures in the space box, but they're not really in the space box. And we'll touch on that a little bit later.

So under Manage, you have the building and space type settings. Out of the box, this is typically set to ASHRAE. You could go in here and you could set it to be IECC if that is your preferred energy code method. But you can see in here that it's got a classroom and training, and it's got all these settings over here that the classroom's allowed to have 1.4 watts a square foot.

So whenever we're using this schedule here and we're defining the space types, it's pulling from this database right here. So if it is not correct in this database, then all of our calculations are going to be off. So before we start a project, we always want to double check that our building and space type settings are correct. Yes?

AUDIENCE: Can you add a different type of paper perimeters if you don't want to use the same [INAUDIBLE] that ASHRAE is using?

STEPHANIE ELLIOTT: I believe you can, but I'd have to double check that. The question is, can you add additional parameters if you don't want to use what ASHRAE has set up. You can change these to be IECC settings.

AUDIENCE: Yeah. In California, we have Title 24.

STEPHANIE ELLIOTT: Yeah, so you could modify these to be Title 24.

AUDIENCE: Okay.

STEPHANIE

There's nothing that says what these are based off of, so you-- out of the box, it's ASHRAE.

ELLIOTT:

You could easily change it to be IECC. You could change it to be Title 24. Whatever you need to set these as for these different categories.

So when I was talking about light fixtures, so a key thing in REVIT. So you've got the light fixture, and then you've got this line right here. This line is the calculation point. So in every family, there is what's called the calculation point. You can either have that calculation point set to where it lives on the 3D model element, or you can take that calculation point and say, I want it to be six feet below the element, wherever that element is, or eight feet below the element.

What this does, whenever REVIT is doing these calculations, it is looking for anything that breaks the plane of the 3D space volume. And so when you take that calculation element right here and you move it down to like six feet below the fixture, you're essentially improving your odds that that fixture is going to fall in the space 3D bounds. Because REVIT is going to look at this point to make sure that it's in the space.

So this is a way to help combat if you have staff that are not conscious of where they're placing the fixtures, because the fixture has to be within this space for these calculations to work. So along those lines, when you set up a REVIT model, your architectural model needs to have Room Bounding on. If Room Bounding is not on, then the room information will not cross the link, and so the spaces in rooms will not play correctly.

You have to have Room Bounding on, and it's a really simple setting. Whenever you load the model, you just come into the Type Properties and check that box. You only have to do it once and then it's set for the project. If the link breaks and you have to completely add it back again, you'll have to double-check it.

For me, as a rule of thumb, I just make all the models better linked and have that box checked. Then you're not having to think what model is pulling from what. Just have everything have Room Bounding on. So everything that we just went through is how you would set up for this schedule to work.

So the color coding that occurs has to be done through a calculated value. Excel is phenomenal at calculated values. REVIT, not so much. REVIT does not understand if-then statements or any sort of complex formula.

It's always going to be, is this field equal to 1? Is this field greater than 1? Is this field less than 1? Less than some number, greater than some number. It's a very simplistic formula setup.

And so what we're doing here is we're working around that simplicity by creating an allowed LPD allowance field. Typically, I keep this field hidden. I only use it for calculation purposes.

So what we're doing is in the Schedule Properties, we created a calculated value. From that calculated value, we named it Above LPD Allowance. You can name it anything under the sun.

And that formula is simply Actual Lighting Load divided by Specified Lighting Load. Whenever you're doing color coding based off of a formula, I can't even do division. It's equals, greater than, less than. So this is the workaround.

So now, I've created a value that I can easily say, if this value is greater than 1, do this. If it's less than 1, do that. And this is how we created that conditional formatting field. So under the Formatting tab, I've got the actual lighting load per area, and I want to do a conditional format in those columns.

So here's where we're talking about the very simplistic nature of what we can do. Greater than, less than, equal to, or does not equal to. That's about all we can do on conditional formatting.

So in here, I'm looking at above LPD allowance. Is it greater than 1? Yes. Highlight it. So sometimes, we have to get a little creative in our thought process to find ways to make REVIT do what we want it to do. COMCheck. Yes?

AUDIENCE: Can I ask a question about the [INAUDIBLE] Were you able to get a space type from the architecture model, or do you have to assign that from [INAUDIBLE]?

STEPHANIE ELLIOTT: The space type has to be assigned in your model. So the way that REVIT is set up, you can pull room names and numbers across the link, but calculations are always done via spaces. So you will have to have spaces set up in your model.

There's an awesome tool called Space Naming Utility. It's a plug-in that comes with REVIT. What Space Naming Utility does, you bring all the spaces in, you run Space Naming Utility, and it goes and it names your spaces the same way the architect has the rooms named and numbered.

And then you can just run that periodically to make sure that your spaces are named the same way the room numbers are. But REVIT requires spaces. All calculations in REVIT are done off of spaces in your model. We can't pull that data across the link yet. I'm assuming one of these days, we will, but not yet.

AUDIENCE: So we are at the mercy of the architects [INAUDIBLE] , correct?

STEPHANIE I'm sorry?

ELLIOTT:

AUDIENCE: We are at the mercy of architects that they provide the rooms to replace the spaces where the rooms are. If they don't have rooms, then we're going to have to make them manually while defining the border for them.

STEPHANIE If they have not defined the spaces, then we need to push back and have-- or defined the
ELLIOTT: rooms, then we need to push back and have the architects define the rooms.

AUDIENCE: But sometimes, they say that defining the individual space does not work for there, because they need to have a complete unit as one area. That [INAUDIBLE]

STEPHANIE And what we can do is you can do space definitions in your own model.
ELLIOTT:

AUDIENCE: That's what I'm saying. In that case, we have to sit there and define all the spaces when the space is separated, and then check if the volumes have changed or not.

STEPHANIE Yes. The point is, on some projects, the architects say that the way they're defining the spaces
ELLIOTT: and the way that we as engineers would need the spaces defined differs. So their rooms may be an entire airport terminal, and we need that terminal broken up into pieces to define the MEP zones, or the lighting zones etc.

And so in that case, you can still bring the room definitions over, and then you would add space separators in your model to break up the spaces as needed. That is an occurrence. It's one of the things we would have to deal with.

In most of my projects, the architect has defined the spaces as we need them defined, or they've defined them even smaller than we would've defined them. And so if they were to take an airport terminal and break it up into three groups, we don't care from a lighting perspective,

because we can say all three of those groups are assembly space.

So from this setting, if they over-define the spaces, not a big deal for us. We just define all those spaces as the same category. Okay. Yeah?

AUDIENCE: [INAUDIBLE] On the family elements, I remember Josh was writing on this, is that if the load classification is not set to Lighting, it won't generate the watts per square foot. Is that clear?

**STEPHANIE
ELLIOTT:** I'd have to check that.

AUDIENCE: Because this a specified lighting load, and it looks at the lighting load class.

**STEPHANIE
ELLIOTT:** So one of the points that he's making is lighting families, the load classification should be Lighting. And if we have it defined as anything other than Lighting, we probably need to be thinking about why we're using a lighting family with another load classification on it.

But that's just a gotcha. If your numbers don't look like they're checking out, that's one of the things to check. But that brings up a really good point. REVIT is a database. REVIT has a lot of really good tools in it, but it's just like anything else. Garbage in, garbage out.

So if you and your team are not on the same page on your approach to this, then this stuff is not going to work. We all have to understand that we are using REVIT in this manner, and these are the key things that we need to check. Yes?

AUDIENCE: So if I'm coaching my electrical engineers on a [? platform ?] project, and they're going to say, I've never had to draw spaces before. I don't want to draw spaces, which is what they're going to say. When it comes down to it, this is easier to get their code verification and they're meeting ASHRAE than it is any other method. They just have to do a couple steps to get there. Is that a correct summation?

**STEPHANIE
ELLIOTT:** So the comment is, electrical engineers or electrical designers may give push-back on, I don't want to add spaces to my model. It's an unnecessary step for me if the rooms are not already there.

And the question or clarification is, is it worth telling our electrical team, put the spaces in, it will save you time? And I would say, yes, it is. So a lot of these schedules were pulled from a airport job. 250,000-square-foot job.

If you're doing that by hand, just to count the fixtures-- in the old days, to do it properly and to do your space takeoffs, because you're going to be in CAD drawing the rooms and clicking to calculate the spaces, easily three to four days. Easily, by the time you're working through all of this.

Drawing the spaces in CAD or calculating the square footage. Counting the fixtures, because you've got the drawings. You're commandeering a conference room, have the drawings spread out, and are highlighting everything trying to keep it tracked. To draw the spaces in, maybe an hour. Maybe.

So you have the argument of, take the extra step, draw some spaces that weren't there that you need. And once they're there, you can keep running these calculations over and over again. You have to keep in mind where you modify the spaces to make sure that you're checking on them periodically, if you get a massive background change.

However, it's going to save time. And you're going to look like the hero when the architect calls up and says, how's the lighting look? And you can easily pull it up at a snapshot and say, you know, we're right on track, or, we probably need to look at these rooms.

Because the other challenge that comes in, and we never like to admit it, we always wait until the last minute to do these calculations because we don't want to do them twice. But with fingers crossed, we hope we meet energy code. When we don't, now we're starting this ripple effect of, I know we're two weeks away from the deadline, but we don't meet energy code, so how do we fix it?

When we're doing these type of calculations, using the real-life data at our fingertips, it cuts that off at the pass. It creates the open communication of exactly where you are at any given moment. The other challenge that we have is COMCheck. COMCheck is the bane of my existence.

For those of you who have filled it out, you understand the pain, because you got to go in there and you got to define every space. You got to define every fixture. Put the counts in there. Now, I can generate a COMCheck schedule that tells me exactly all the information that I need to put in COMCheck, and I can hand this off to somebody else.

Give this to the junior engineer, give it to the intern to populate into COMCheck, but all the information is already compiled for you. It's broken down based off of what space they're in.

You've got all of the-- what the type mark is, what the type. You know how many lamps, what the lamp type, all the way down to the count at the end.

And this is a live update, so as you change things in your model, this schedule will update. I hate to admit it, but I forgot about COMCheck on my airport job. We're pulling all the PDFs together, we were getting ready to send them, and someone goes, hey, where's your COMCheck form? Oh, got to fill that out.

But it wasn't a big deal. I pulled up this schedule, it was all right there. Took me 20 minutes to populate it, whereas before, we would've been scrambling, trying to determine-- get our spreadsheets. Is the spreadsheet correct? Is it current? When's the last time we ran it?

This type of data, using REVIT this way makes our life easier and more efficient. Now, one of the tricky things with REVIT, cove lighting. Cove lighting is always a challenge, because I don't know how you draw cove lights, but typically, I'm going to get one fixture and I'm going to stretch it the entire 200-foot cove and call it good.

When you do an entire 200-foot cove, REVIT thinks it's one fixture, so that throws off our counts. You can program the fixture to where it understands that for every linear foot, it's 4 watts. And then do a formula that says length times linear watts per foot field gives us the VA that's in the connector.

So we've done that, so I'm not worried about the VA being correct of the fixture. It's relative to the length. But how do I get the count right? So what we can do, if cove fixture count is greater than 1, use the cove whole number. Otherwise, use the manual count.

So what I've done is there's a formula in my cove fixture, and it says, "Take the length of the fixture." Its nominal length off the shelf is 2 feet, 3 feet, 4 feet, whatever your definition is. So take that the length divided by the nominal off-the-shelf parameter, and that gives me the count.

So it's taking the overall length, and I've told the fixture, by definition, you are 4 feet when I buy you. So then, I come up with a count. For this, REVIT it has a Round up or a Round Down command.

I will typically round it up, because that's the conservative answer. Because I'm not going to go through here and try to determine where I need the 1-foot segments in the cove length. You could do it, but it's not something that I think is worth the effort for projects.

And so then, what I'm doing with the combined count field is over here, this combined count takes the highest fixture count across the board. So right off the bat, the count is 301 for this recess continuous linear LED that's actually a co-fixture to a degree. So this is the real fixture count, 447, based off of the nominal, off-the-shelf length. So my count field is taking the higher of the two to make sure that we're getting the correct count.

If you look down here at our F42s, that is a standard fixture. It's a standard housing. There is no cove to it, so you can see it took the 108 fixtures that we have. There's nothing in the cove count because it's not a cove fixture, so the count total is still 108.

So what this does is it presents the data to you, to where you can see the number of Revit families or elements in your job is the count manual. The cove whole number is where we've modified the cove count for the typical off-the-shelf length.

Because remember, I draw my cove fixture as one long, linear fixture. It may be 200 feet long. The only thing that defines the length of my cove fixture is when I hit my 20 amp circuit limit. That's where I break up my fixture.

So I'm going to run it up to 12 amps, 16 amps. Whatever you like to load your circuits to, that becomes your maximum length of a cove fixture. Yes?

AUDIENCE: Does that mean that when you have one, you just tag it once? Or do you use tags? Or how do you--

STEPHANIE ELLIOTT: I tag it once and then I put a comment in there that contractors love, "Modify the count to make sure that you're matching this length. Provide the number of fixtures necessary to fill this entire cove." Yes?

AUDIENCE: [INAUDIBLE] so it's going to be much easier, visually, for the [INAUDIBLE].

STEPHANIE ELLIOTT: Yeah, you can. It's a matter of preference. What he's stating is you can modify the graphics of a family to where it would put a line in the cove fixture periodically, based off of your pre-determined, off-the-shelf length. 2 feet, 3 feet, 4 feet, and it's just a graphics setting in the family. And it's a matter of preference.

AUDIENCE: Yeah. He's going to reach down and base it on the lights we find anyways, so--

STEPHANIE

Right.

ELLIOTT:

AUDIENCE:

[INAUDIBLE]

STEPHANIE

So my preference is not to. I've defined it to cove. The contractor's can go in and figure out where they need the 1-foot segments and where they need the 2-foot segments, etc.

ELLIOTT:

Because part of the thing that we're trying to do here is find a happy medium. So where we're giving the contractor what they need, but that we're not giving them more than they need. And we're not spending more of our fee doing something that's not really part of our scope. The line is graying and blurring these days on what is designers' scope and what is contractors' scope.

AUDIENCE:

So if it's a note and it only shows up in drawings, then that's frustrating for us. But if it's actually a linear feet of cove lighting, we're good.

STEPHANIE

Okay.

ELLIOTT:

AUDIENCE:

Because I don't want to have to mess with the drawings. I want to use them all.

STEPHANIE

Okay. So, basically, a contractor's saying, hey, if we actually have it drawn in the model and he can do some takeoffs, loves it. If there's a note that says, "You figure it out," we're probably not his favorite person that day. All right, moving on.

ELLIOTT:

Mechanical equipment checks. So this is always a challenging thing. This is one way to do it. Some people are going to love it, some people are going to hate it. So, old-school checks. Once again, our handy highlighters.

Color coding it. This matches, this doesn't match, etc. Where you've got the whole mechanical schedule, you're praying that the mechanical team has actually updated their schedule.

Because sometimes, they give you the cut sheet, and the schedule and the cut sheet don't match. You're like, well, which one's right? But that never happens. Our mechanical guys are very communicative.

AUDIENCE:

Sure.

**STEPHANIE
ELLIOTT:**

So a strategy that we have employed is a little bit of out-of-the-box thinking, but it's copy monitoring mechanical equipment. But before we get too far, I'll walk you through it. There's this in-copy monitoring.

You have two options. Option one, if it's an air handling unit in the mechanical model, I want you to bring in that exact same family into my model. Air handling unit for air handling unit.

The other option is to do what's called [? type ?] mapping. So where in a [? type ?] map, you are able to say, in the mechanical model, the air handling unit family uses this. But when you copy that family into my model, I want you to use this family.

So you're still copying monitoring it and you're still pulling the data, but you're using a different graphical family. So it says, "a equals b." So what I do, that is my air handling unit family.

And so what it does is it achieves two things. In this family right here, I would typically have a connector. We like to show the connector family on mechanical equipment if we've got a remote disconnect somewhere. That's just our preference.

You could make this be a disconnect if that's your preference. But the reason I chose to use the connection symbol is because in order for this to work, this family has to be defined as mechanical equipment. It cannot be defined as electrical equipment.

And so by using the connector, then I'm going to put the loads in here and connect it to a disconnect that is electrical equipment. So then it will start doing the calculations that I need downstream. So you've got this family.

You can make this look like anything you want. Here's that little calculation node that we were looking at with the light fixture earlier. Every family's going to have one. You can choose to use it or not, but it's there.

So this graphical interface-- so whenever I do a copy monitor, take an air handling unit and I say, [? type ?] map it. Use this family instead of the air handling unit family. That same premise can be used with light fixtures. If your lighting consultant has a model or your architect has a model, but you don't like the architect's families, you could copy monitor their light fixtures using your families.

AUDIENCE:

Do you then just [INAUDIBLE]?

STEPHANIE ELLIOTT: In copy monitor? Yeah. So like for VAVs and such, I'm not going to copy monitor that. I'm just going to put a disconnect switch, a [? motor rated ?] disconnect switch. It's 120-volt.

So anything that I care about the horsepower, that it's going to change-- if it's going to be a standard, run-of-the-mill VAV box that's always 120-volt fractional horse, I'm not going to copy monitor that.

AUDIENCE: So your workflow, you're always looking in the mechanical model?

STEPHANIE ELLIOTT: Leaving it live-linked?

AUDIENCE: Yeah.

STEPHANIE ELLIOTT: Yes.

AUDIENCE: [INAUDIBLE]

STEPHANIE ELLIOTT: Yes.

AUDIENCE: So you're always [INAUDIBLE]

STEPHANIE ELLIOTT: Yes, we typically do. So the question is, do I always leave the mechanical model linked when I'm working. Yes, I do, because I'm also using it for VAV box locations or other things where I'm not doing this copy monitor.

I don't typically like to redraw families in my model. Because then when I turn off the mechanical model and not leave it linked, what's going to happen? They're going to decide that they're going to rework the space.

And then I'm going to get that RFI from the contractor that says, you show a VAV in room 1. There's no VAV in room 1. What do you want me to do? And so I want to have that reminder that their equipment is on and that things could be changing.

AUDIENCE: Do you ever do it where the mechanical's live in your model? Where your model has mechanical and electrical, and it's not [INAUDIBLE]

STEPHANIE So the question is, do I prefer or ever do work where MEP is all in one model rather than

ELLIOTT:

linked models. Here's where that caveat came in at the very beginning. Best practices, disagreements.

I personally believe that every discipline should be in their own model. There are some exceptions to that on very small projects, because it's not worth setting up multiple models on very small projects. And I mean very small projects.

We like to believe we're one big happy family, and that we're all going to play nice in the same model. But the things that happen-- if I'm in the architectural model and I need six more inches in my electrical room, what's to stop me from sliding that wall out six inches to make it work? I'll tell them I did it, but then we forget to tell them.

And then now, we've just broken the egress corridor pathway. So I think everyone should be in their own models to protect us from ourselves. And whenever you have disciplines in the same model and you don't understand what you're looking at, things get deleted. Things get hidden in views, and people are like, where did it go?

So from a idiot-proofing our models as best as we can, I don't like being in the same model. There are arguments against that and being in the same model. Because what happens when we're in the same model, I can now directly connect to an air handling unit and pull the loads from that family.

So there's arguments that if you're in the same model, you can pull loads and it saves some effort. I don't like that either, and here's why. Once I circuit a piece of mechanical equipment, the initial circuitry will tell me if I've overloaded a breaker that first time I connect to it.

If someone comes back and changes it, from a 10 horsepower to a 20 horsepower motor, the loads are still going to pass through if it's a live link and I'm directly connected to that air handling unit. But I will not get a warning that load has changed.

So I may sign a drawing that the breaker and the wire size are wrong. And personally, I would rather get the RFI from the contractor that says, you say it's a 20 horsepower. Mechanical says it's a 30. What should it be? But when I issued it, I was correct.

My assumption said I was working off of a 20 horsepower. My breaker and my wire matched. Rather than issuing something where I've got to explain how the heck I issued a circuit that is clearly undersized because loads automatically updated without my knowledge. Yes?

AUDIENCE: I was just going to ask about the other problems. Unless you're actually using work steps for [INAUDIBLE] and checking them out, [INAUDIBLE]

STEPHANIE ELLIOTT: And the other point is, if you're not using work sets and you're not using the right "layers" is what I'm going to call them, or that the families aren't defined appropriately as mechanical equipment, you're going to run into problems with things showing up on the wrong drawings that shouldn't be there and things just disappearing.

Once again, that is my personal preference. There are BIM managers in here who have written me off and said, you're wrong. And that's okay. But from my personal experience, it has not been successful.

The other challenge that you run into, and then we'll get back on track, is that Revit has an upper limit of how well it will work with the number of hands in the model. The more people you have in the model at a given time, the slower it's going to run. And the more times you're going to get, Johnny has x. Please ask him to relinquish it.

And then you're going to call Johnny. Johnny can you save to central? And then you're going to work for five minutes, and then you're going to run into another thing where someone else has it. And you end up losing efficiencies because you're locking each other out due to ownership.

Once again, my two cents, but I've experienced it. I have done projects where we were all in the same model and it was not very successful. We spent a lot of time on the phone saying, hey, can you save? Can you save? But, okay. So continuing along with the assumption that this is a linked Revit model into our model.

So we've copy monitored in a family. So now what we've done is we've created a mechanical equipment schedule. The important thing here is that the family that we copy monitored in, that mark field is named the exact same way that the mechanical model has it named.

So if they have it AHUNC1A, then our connector family mark field has to be named the same way. So when we're doing that schedule, we want to make sure that we're including elements in the link. That's what's going to bring across the mechanical side of things. We also want to make sure that we do not itemize every instance.

So what happens here is it's doing a count. So it's looking at the mechanical model, and it's

looking at our copy monitored families and it's comparing them. So for AHUNC1A, there's a count of two. Which means there's one in the mechanical model, there's one in the electrical model. Awesome, both of them are accounted for.

The supply fan is green at 7 and 1/2. Which means that I think it's 7 and 1/2, and the mechanical model thinks that air handling unit NCN1A is 7 and 1/2 horsepower. When you look at the next one, AHUNC1B, you can see that both models have it, represented by the 2, but that that field is blank.

So the mechanical model thinks it's 1 horsepower, we think it's a different horsepower. So now, that flags us. We need to go back and look at that air handling unit and find the correct horsepower.

And then if you look at AHUNC1C, you can see there's only one. Which means we don't have it in our model, or the mechanical team deleted it. So we need to figure out why there's only one.

AUDIENCE:

Don't you ever run into contact with the architect having sometimes used a mechanical equipment in their model just for the space issues? And then they'd have this one, including the linked model, so how are you going to [INAUDIBLE]

**STEPHANIE
ELLIOTT:**

So the question is, does this schedule ever run into issues if the architect is using mechanical equipment families in their model. One of the things that we can do-- I've actually filtered it. The architect model, highly unlikely that their families are going to be named the way the mechanical team has it set up. Highly unlikely, so you can filter it.

So here, I'm looking at air handling units. So I look at a filter on this schedule that says, "Mark contains AHU." So I'm only bringing in mechanical equipment where the mark contains AHU in it. But that does bring up a point.

We actually had an issue on a job where the architect was using-- they were placing diffusers and they were using diffusers labeled as mechanical equipment. So we were having a hard time turning them off. I don't like to edit the Revit links themselves and turn them off that way.

You run into a lot of problems when you edit a Revit link and start turning off categories. You always want to use the Visibility Graphics front end over-arching settings whenever possible. And so we actually had them change it to generic. We said, go redefine this family and make it a generic model.

Because they don't care what it's defined. And that solved our problems. But it brings up a point where you have to communicate among the disciplines and the architect and tell them, hey, I need you to redefine this family, or, I need you to do this differently. Okay.

Yeah, so this is talking about how we're sorting by the mark, and that we're not itemizing every instance in this schedule. Electrical loading checks. So the other thing that we're running into is a challenge in this industry is the fact that you've got so many different generations working on these projects.

I've got some guys who said, I will retire before I ever open a Revit model. They've been around that long. And they've gone through the board drafting days and the transition to AutoCAD. If you make me get in Revit, I'm retiring. And those are your knowledgeable, senior engineering guys.

They are the ones that need to see the data that we have in these models. And so these next steps that we've done is ways that-- we're using the data in a way that our QA/QC, our quality check teams, our engineering reviewers, can see the data and use it in a way that's useful to them.

So one of the other challenges that we always had, load calcs. Are you doing Excel spreadsheets and then you're linking all the spreadsheets together, and then getting your overall load calculation at the front end? Are you hoping that everyone linked all of the spreadsheets together correctly and didn't break something in there?

Revit can do those calculations for us. Garbage in, garbage out. This goes back to that load classification thing. If you're going to use load calcs in Revit, your team has to understand how load classifications in families and circuits work. Because if they don't define them correctly, then this will not work correctly.

But this is a summation of the entire load on one of our switchgear on a project. The other things that we can do, some jurisdictions require us to put those load calcs at the bottom of the panel schedule. So rather than having to manually calculate all of it, it's already generated for us through the circuits.

It understands that we've got cooling load and heating load. One thing I do want to point out, out of the box, Revit does not understand non-coincidental loads. It does not understand that

for heating and cooling, you take the higher of the two. Doesn't understand that.

So this schedule, and even the load classification, has a calculation at the bottom called non-coincidental heating versus cooling. It's an if-then statement and it says, "If heating is greater than cooling, take heating. Otherwise, take cooling."

So what it does in here-- so you've got the total estimated demand, and then this is the calculation that tells you which one is greater. And we're going to-- oh, sorry, I have that reversed. It tells you which one is less. And then we're going to back that less value out of the total estimated demand.

So when you look at the total demand current, we've manually backed out the heating versus cooling using a formula. This is the exact same panel schedule. We can turn off the load classifications at the bottom and still have it do the calculations on the side.

As a whole, load classifications work very well, and the demand factors work very well. In Revit, you can define what you want your demand factors to be. There are out-of-the-box definitions that are based off of Autodesk interpretation of the NEC. But you can go in and redefine what those are under the Manage MEP Settings tab.

Revit does understand largest motor. So it will look at the summation and say, here's the largest motor. Take that at 125%. Everything else, at 100%. It understands how to do the receptacle calculations. First 10k at 100, everything else at 50. It understands all of those settings.

Another thing that Revit does that's important to understand, it always passes through the connected load. It does not pass through the demand load. So if I've got this panel 1LAAA, and I've got these loads here, I will be passing through this 55 KVA to my transformer. Which will then be passed to the high-voltage panel.

The reason that's important is we don't want compounding demand factors applied to our load. So Revit will take the connected load, pass it through, recalculate the demand at that new panel location. And then it will pass through the connected load again and recalculate the demand again at that panel location.

Because things like kitchen, I may only have three kitchen pieces of equipment on this panel, so I can only take a certain percentage. But then when I get to the distribution panel, I may have 10 pieces of kitchen equipment. So now I can diversify the kitchen equipment connected

at the distribution panel level because of what is connected there.

It's also part of how it recalculates the largest motor. So it looks at the largest motor on this panel, and then passes through the connected load and starts all over again. What is the largest motor on this panel?

AUDIENCE: So [INAUDIBLE]

STEPHANIE ELLIOTT: That's a loaded question. There's two parts to that. For feeders or anything that there is one piece of equipment on a circuit, the wire sizing is fairly accurate. Revit understands the XYZ coordinates, so it doesn't do it as the crow flies. It does calculate wire runs XYZ.

And it understands voltage drop, and for the most part, it's very accurate there. When you get to more than one piece of equipment on the same circuit, that's where you start running into problems. And the reason being is Revit assumes everything is connected in series. Light fixtures, receptacles, everything is connected in series.

So if you imagine a 277 volt lighting circuit with 50 fixtures on it. Revit thinks that all 50 of those fixtures are connected in series, so it's going to assume the voltage drop at an absolute worst-case scenario. So in that case, no. The wire size will be very conservative for what's really going to happen in the field.

AUDIENCE: How do you [INAUDIBLE]

There's two ways to do it. One, we've done an Override field where it's a check-box. So there's the question of if Revit is right 75% of the time, do we really want to spend the effort populating in those wire sizes when 75% of them are right? And so we determined no.

Because one of the options is to make a new parameter that you manually enter in the wire sizes for every single circuit, or you do your general. Unless I've told you otherwise, assume it's number 12s. This one is set up to where we have a check-box off to the side that says, if you don't like this wire size, check this box and put this one in its place.

This is one of the shortcomings of Revit when it comes to wire sizing. The voltage drop calcs are great, but it does not understand how the contractor is really going to connect everything in the field. They're going to bring it out to a junction box. They're going to spider it apart and do different runs to where the circuit will never be the length that Revit thinks it will be.

But feeders between panels, or where there's one piece of equipment on it, yes. We've done hand calcs and compared them and it's very accurate. Okay, equipment loading. One of the other challenges that we have is whether our transformers and panels are appropriately sized.

So what we have done is we've created what we call a z series drawing. Nobody uses z. There's few projects that you actually have a z, but we make drawings where the drawing numbers start with z. And those are what we use as our quality check drawings.

So if I'm going to print out a set of drawings and give it to my engineer to review, I'm also going to print out the z series. The schedules that you're going to see going forward are what would be on those z series drawings. So now, I'm giving that guy who threatened to retire on me access to the data to where he can use it in a useful way in reviewing the drawing set.

So right here we've got the mark, so this is all our transformers. We've got the KVA. We have the total connected and the total estimated demand. And so what we're looking at here is we're trying to highlight where transformers are underloaded to where we need to look at, maybe they should be a 30 instead of a 45.

Or also, where transformers might be overloaded, because we're not always the best at monitoring transformers. Panel schedules, it tends to jump at us that we've overloaded it, but then we got to think about the transformers. So here we have a formula that is set to where if the transformer is-- if the total connect-- or the total estimated demand is within 80% of the transformer loading or rating, flag it.

You can set that percentage to whatever your team is comfortable with. Maybe you want to load the transformer all the way up to 100%. Maybe you only want to load it to 60%. That's all part of the formula. Is this value greater than the transformer loading?

So everything in yellow, we've overloaded those transformers. We need to look at shifting load, or we need to look at up-sizing the transformer. Everything that we have in this teal color, those transformers are loaded to less than 20%. Do we really need that transformer if we only have 20% of load on it?

A perfect example down here, 1TBEB has nothing on it. Now, this is where we still have engineering judgment. The schedule tells me I don't need that transformer. But maybe that's the tenant fit-out transformer, and we know load is coming, but it's not part of our project.

So I'm not saying that this is the end-all, be-all. That this schedule tells us, change the

transformer, get rid of the transformer. This schedule is simply presenting the data to us so that we can double-check whether we have it sized appropriately and whether we even need it.

We can do the same thing with panel boards. It's the same premise here to where we've got the total connected, the total connected current, and the total demand current. We're looking at the main's rating relative to the connected. Everything in yellow, I've overloaded that panel by greater than 80%.

I've assumed that all of my breakers here are your standard breakers that can only be rated up to 80%. I'm assuming I don't have any 100%-rated breakers in this, but this, once again, is where engineering judgment comes in. You may know that this panel is going to have a 100%-rated breaker, so we're not over.

We've got some panels here that are underloaded in the teal. Same premise. 1EHAEA, there's 8 amps of load on it. Do I really need that panel? Well, it happens to be a life safety panel, so yes, I do. But those are things that as an engineer, as your review team, they would need to use engineering judgment on.

We are presenting the data to them in a way that they can quickly analyze how the project is set up. Not the end-all, be-all, get rid of, change, etc. It's highlighting where you might have a problem and should consider reviewing. The answer may be, it's fine, and that's great. It's just presenting the data in a useful form.

This schedule is a modification of this one. What this schedule does, some of our panels that look overloaded have a non-coincidental demand load on them. So when I take the connected load or the demand load, remember, Revit doesn't understand that I can diversify heating versus cooling.

So this panel right here, 1DBJ, looked overloaded from the initial connections. When you consider the non-coincidental, the heating versus cooling, it's no longer a problem. So this column is just helping us to really make sure we understand what's happening on the panels.

So these are the formulas that we used. Overloaded, greater than 80%-- or 80%, 0.8, which is what gives us the conditional formatting. Over here, overloaded is less than 0.4. And that overloaded is a calculated value off to the side where it compares the main's to the demand load.

The other thing that gets us in trouble at times is our circuits themselves. So we want to make sure that our circuits are appropriately sized. This presents all the circuits to the engineer to review. Revit refuses to size breakers. Legally, they have decided that is not an area that they want to get into.

So whenever you do a circuit, it will always default to 20 amps. Always. It will give you a warning that your load is greater than 80% of the rating of the breaker when you try to circuit to it, but it will always default to 20 amps. So in this case, we obviously missed resetting that breaker to the appropriate size, because a 20-amp breaker on 3,400 amps is not the appropriate breaker size.

AUDIENCE: [INAUDIBLE] change that default in the [INAUDIBLE] settings to whatever they want. It's a Google setting.

STEPHANIE ELLIOTT: On the default?

AUDIENCE: Yeah.

STEPHANIE ELLIOTT: And they may have changed that in years past. Used to, it defaulted to 20.

AUDIENCE: [INAUDIBLE]

STEPHANIE ELLIOTT: Right, it's always going to default to 15, 20 amps. Revit does not want to play on the legal realm of appropriate breaker sizing. They think wire sizing's fine, but breaker sizing, oh, no. That's a whole other ball game.

So it's the same premise here, where we're highlighting-- in this case, we've got some circuits that have no load on them, but we have a circuit. Why would we have a circuit with no load on them? We're presenting the data in a way that we can look at it objectively and analyze that we've got things circuited correctly.

That type of scenario where we have nothing connected, in years past, in the AutoCAD, Excel days, probably would've made it through to the field. Because by the time you're reviewing it, you're trying to go line-by-line. But on a big project, there's so much, sometimes it's going to slip through. This is helping to present the data in a quick manner that our review team can

clearly see what's going on.

In this option, we can put wire size, length, voltage, voltage drop, all of that. Once again, this time, we're looking at the breaker loading and we're flagging if the breaker is loaded greater than 80%. We're also looking at whether the breaker itself is equal to 20 amps. I want to flag those 20 amp ones because it's probably not right.

All right, final thing. View filters. I can't tell you how many times we've gotten RFIs that say, there's receptacles in this room that have no circuit. Please advise what circuit to provide. Those are the worst RFIs to get. You know the contractor is kind of laughing when he's writing it.

But if it's something really simple that we can do to circumvent it, we save everybody a lot of time. So what we can do is we can do view filters. So Revit is set up to where it has three levels of circuits.

In this green right here, I have not tried to circuit it in any way, fashion, or form. I've not tried to put it to a panel, I've not tried to circuit it. It is not connected in any circuit.

This red, I tried to circuit it. I clicked the power button, power the circuit up, but I didn't select a panel. So it has no home. So Revit thinks that it's circuited because you told it to circuit it. But it has no home. It doesn't know what panel to make the final connections to.

Sometimes, that happens because the panel that we want to circuit it to, we had spare breakers so we couldn't connect to it. We had to release some of those spare breakers in order for us to connect to it. Or we didn't have the distribution voltage set, the distribution system set right on the panel. So when we went to click on it, it wasn't an option.

So it circuits it, but it doesn't tell it what panel. So here what we're doing. I leave these filters running. So after I hit the DD phase-- so DD, we don't typically circuit receptacles. Stuff's going to change, stuff's going to move. It's not necessarily worth circuiting on this low level at a DD, design development, phase.

Once we roll in the construction documents, I turn on these two filters, and these filters live live throughout the entire project. So when someone looks at the model, right after we turn them on, everything's going to look green. But it's helping to highlight where we've missed things.

AUDIENCE:

Do you have ways [INAUDIBLE] the System Check?

STEPHANIE ELLIOTT: The button at the top with the little--

AUDIENCE: System Browser.

AUDIENCE: System Browser.

AUDIENCE: Because this one here, you still have to go to check the view, by view, by view. Where the System Check will give you an image of an entire model without even opening any view.
[INAUDIBLE]

STEPHANIE ELLIOTT: System Browser is another way of doing it. I use them both, honestly. For stuff like this, when I've got a drafter, or a junior engineer, or an intern, it's much easier to send them through to find all the green or to look for red, because you're just looking at this visual thing.

System Browser is really good for a snapshot, how many things do I have left to circuit?
Rather than going there and right clicking Show In Model, then you go to it and you circuit it.
It's two different ways to get to the same end.

AUDIENCE: So it's a preference?

STEPHANIE ELLIOTT: It's a preference, yes. It's a preference. Both ways will work. I personally like the fact that graphically, this is going to jump when you're looking at a floor plan. It's going to be obvious to anybody. Even my "I'm going to retire on you" guy, he can [? look ?] at my screen and go, why is that green? Or look over anybody's shoulder, why is that red?

The other thing that I love about it is our pin table settings on our printer make these print like halftone or weird. So then when the QA/QC-er is looking at it, our quality team, what's up with this? Why is this weird? It's another check.

Whereas that System Browser, it shows you the same information. You are correct. The exact same information, but it's-- not everybody understands how the System Browser works. And the System Browser can get convoluted if your families are not set up well.

And the fact that if you don't circuit fire alarm devices, out of the box, fire alarm devices have a connector on them. So they're going to show up in the System Browser as one of the 5,000 things that are not circuited. I take the connectors off those families, but not everybody does.

Aux sensors. I don't typically circuit the aux sensor in. It has a power pack and we've got ways that we address it, but I don't typically directly circuit an aux sensor.

An aux sensor out of the box has a connector, so it shows up in the System Browser as one of the things not circuited. So here, I'm just isolating in a "dummy proof," in quotes, way that everybody can understand something is off. But you're right, System Browser works.

AUDIENCE: So will your aux sensor show up as green like everything else on this filter?

STEPHANIE ELLIOTT: No, because it does not have the connectors in it.

AUDIENCE: Thank you.

AUDIENCE: Well, [INAUDIBLE] The reason I'm asking, because I want to see what other people are doing. The way we do it, [INAUDIBLE] Also, we have a schedule. We showed up and there's equipment that's [? powered, ?] or something that's not [? powered. ?] We could see them [INAUDIBLE].

STEPHANIE ELLIOTT: You can use schedules to achieve the same thing. It's a matter of preference. The thing with schedules, the thing with system browsers, you still got to go find it on the drawing to correct it. Here, we're just presenting it exactly where the issue is. Two different ways to get to the same thing.

So how did we do it? We've got filters set up. So filter 1 filters by whether the panel category name equals blank. It's also looking to see whether the circuit number equals blank, meaning that nothing is connected at all. The other filter is just looking at whether circuit number equals unnamed.

This filter is going to catch where we thought we circuited to a panel, panel got deleted, something went wrong. It didn't actually land on a set of lugs in a breaker to completely circuit it. And then I pick red and green. You can pick whatever colors you want.

I'm one of those weird people that I work in AutoCAD on a black background. And Revit, I work on a white background. And part of that's just because when Revit started in 2007, it was a white background, and I've never changed. Some people work on black in Revit now. I just can't get comfortable with it.

So my color choices are typically based off of a white background. But the color's not significant as long as your team understands what the colors mean. So same thing. Now that you've seen the filters, this is how they apply.

Wrapping it up, important things to note. Length calculations follow structure. They follow the sum of x, y and z axis, and they assume series connections. That's the key component, they assume series connections, so they will be worst-case scenario.

So your contractor's going to send you RFIs and saying, why do I have number 4 wire on this receptacle circuit? I can't land it on the receptacle. What do you want me to do?

Voltage drop. Voltage drop is calculated off of the length and the circuit ampacity. So it looks at what is actually connected when it's doing those calculations. Wire size, however, is based off of the length and the breaker ampacity.

So Revit understands that there's a correlation between a 30-amp breaker needing number 10 wire, and so it's going to tie that correlation together. But they don't play in the breaker realm, but they understand that that correlation is there. And breakers will default to a nominal value of 20, or 15 if you were to change it. And it will always default to whatever your default setting is.

Additional software, if you don't already have them. We use Space Naming Utility plug-in. It's a phenomenal tool. This is the tool that takes the room names from the architect's model and corresponds our space names to match the architect's room names.

Rushforth Tools, how many people have heard of Rushforth Tools? For those of you who are not, you are missing out. David Rushforth, spoken here before, licensed electrical engineer, wrote this program. This program bridges the gaps that Revit does not do well.

So some of the things that Revit can do-- Revit, when you're working in the schedule fields, it's very tedious. If you need to populate 10 cells in Revit, you're going to click on the first one, do the dropdown. Say, 20 amps. Then Revit's going to think for a minute, and then you're going to do the next one and work your way down.

It's very painful and tedious. What Rushforth tools allows us to do is export that schedule to Excel. And then you've got the drag-and-drop features. You've got some of the filter features.

You can massively update things. Like if you've got an electrical connection scheduled with

horsepowers in it and you need to put the capacities associated with it, you can export it out to Excel, do all your work, and then import it back into Revit. Perfect example is drawing list.

If you need to populate in a parameter for a drawing list, export out your 100-and-some-odd drawing list, populate in issue for construction. Drag it down, you've populated 150 sheets. Push it back in. Five minutes, done. If you were doing that exactly in the Revit schedules, it would be much more painful.

And also with the scheduler, another thing you can do is you can renumber sheets. So on one of our jobs, we had multiple phases. So they wanted to put a number in front of all of our sheets to represent what phase it was. So I exported out my schedule, I did a search and find, and found the e and said, make that the 5e.

And then it found everything, and then I pushed it back in. My sheet numbers were updated, five minutes. Whereas otherwise, you'd be manually going through and doing it.

Parameter adder. As we're working through the intelligence of Revit, parameters are important. We need our families to all have the same parameters. All the light fixture families need to have the same parameters to populate our light fixture schedule, etc.

So what this tool does is it allows us to make a template that says, every light fixture family should have these parameters in it. And so then, I can make a schedule that has all my light fixtures, run this tool, and it will do a check. Does fixture a have the five parameters it should? Yes? Good.

Does fixture b? And then it will push the parameters that are missing to the families. So it saves you a bunch of time when you've got 10 families missing a parameter. You can run this and it will add that parameter to all 10 families. Five minutes flat. Once again, it's very quick.

I've been playing around with it a little bit, this last one, the parameter linker. And what it does is it-- it allows you to take the element ID number and tie it to another parameter so that it would push the data back and forth between these two parameters. I'm not as familiar with it, but it is an option that Rushforth has.

David Rushforth has actually put out a couple updates recently that have added a lot more functionality to it. Last time I checked, the license for this was like 150 bucks or something. It's a really good license. He has a site license where-- I forget what the fee is, but you can pay a flat fee and then as many users at your company that need it, you just give them the key and

they can rock and roll. Very useful program.

So if you hated this class, come see me. I have a paper survey for you to fill out. If you loved it, please fill out the survey. It helps us to improve the classes year over year. It helps the speakers to improve on what went well, what didn't go as well so that we can understand how to improve.

So please take the time to fill out the survey. Keep in mind, you like to Strongly Agree. No, fill it out honestly.

Another thing is, if you didn't know, the AutodeskUniversity website has a lot of these courses from this week being recorded, as well as former AUs. And a lot of them are free to view, so go out there and look at what courses and additional education you can get from those.

Questions?