

JASON

All right. Welcome. Thank you, guys, for coming. This is "Major Renovation Work in Revit--The Survival Guide." My name is Jason Boehning. I am the Building Content Manager at 4D Technologies. I help create our CAD learning products. So my focus is actually on the building learning content as opposed to a building content manager at a design firm that creates building content for building models. So just an FYI. I tend to get that a lot.

But anyways, I'm thrilled to be here. This is actually my sixth year to speak at AU. So it's an honor for me to come out here. And I love doing this. It's a lot of fun. I've had the privilege to speak at some other conferences. But what makes it great for me is just interacting with you guys. So I hope that, while we have the next 90 minutes together, I hope that we can also continue this conversation later on here at AU.

Also, throughout the year, as we solve problems together and just connect on the forums, throw stuff out. And that's how we build community, and we continue to advance as an industry. So I appreciate you guys being here. And I'm looking forward to the next 90 minutes we have together.

So just a bit about me. So I'd like to get to know you guys a little bit as well. So how about let's go around the room. Give me your name, where you work, and where you're from. So how about we'll start-- OK, I'm just kidding.

But no, how many architects do we have in the room? Awesome. OK. How about MEP folks? OK. So we got a pretty good mix. What about structural? OK, we've got a handful. Anybody else? Maybe some contractors? All right, a couple. OK.

Well, that's good. Because the way that I wrote this class was so that it could be, basically, how this works in Revit. So let's just jump into my summary here. So basically, I want to go through the process of modeling an existing building in Revit, and then walking through the new design process and having it all in one model.

So let me ask you a couple more questions. Who's strictly using Revit-- all you do is use Revit? OK, what about-- who has not started using Revit in the production environment? Anybody? Got a handful, OK. And then, who's kind of maybe 50-50 or 60-40 or-- so we got a good mix. OK, great.

Throw out some answers to me. So what do you think of when you think of renovation projects in Revit? Just give me one word. Just shoot them at me.

AUDIENCE: [INAUDIBLE].

AUDIENCE: [INAUDIBLE].

JASON So phases? Sorry, what were some other ones?

BOEHNING:

AUDIENCE: Painful.

JASON Painful, painful.

BOEHNING:

AUDIENCE: Extra work.

AUDIENCE: Complicated.

JASON Extra work. Complicated, sure.

BOEHNING:

AUDIENCE: Rework.

JASON Rework. Oh, no. Yeah. Well, I definitely-- painful, I've heard that a lot. And I hope that, as we

BOEHNING: go throughout the next 90 minutes, that we can just show the basics. So my goal is that, after you leave here, you're like, hey, there's no difference in a renovation project versus a new project. And sure, there are some differences in there. But as far as modeling it in Revit, that's what I hope you can walk away from here with.

So here are my learning objectives. I'm sure you saw those when you signed up for this class, or if you've looked in the handout. I won't read them all. But here is kind of my roadmap of how I want to achieve those.

So first off, I want to talk about, why even use Revit for a renovation project? I always want to know why I should do something. What are the benefits for me?

And then I threw energy analysis in there. That was one of my learning objectives, because I think energy analysis is extremely important in our industry today. And so one of my learning objectives was produce a rapid energy model.

And so I want to show you how we can start with an energy model that you could use to even gain some work with an owner. Or maybe you already have the project, and just kind of start the process with some energy analysis that you can take to some of those initial planning meetings, to sit down with the owner to help develop the flow of the project [? and ?] how it's going to go, or what they want to do.

And then, after that, we're going to jump into the nitty gritty of phases and how it works in Revit. And we'll spend a little time there. And then we'll have a little fun and talk about modeling existing conditions. We'll talk a little bit about laser scanning, photogrammetry, and show some drone stuff. Maybe we'll shoot them out of the sky, as we did in the video.

And then modeling new design. Basically, if we can get through the first part, then the modeling the new design is the easy part. And then we'll wrap up with some tips and tricks.

OK. So why should we even use Revit to begin with? So how many of you remember back to when your office first started with Revit, or you first learned Revit? And maybe you're trying to implement it in your firm.

And your boss comes to you-- or maybe it's an owner that wants to do a project, and they're like, oh, you're using Revit now? Oh, so you can create some energy models, and you can do this analysis, and you can create these renderings. Oh, and we can use it for construction, too.

And you're like, wait a minute, I'm trying to set the height of a wall. I'm just trying to create a model. Can anybody relate to something like that? Sure, sure. So that's kind of what I want to start out with, is kind of the after-- so after you have a model, some of the cool stuff you can do.

So the things that I-- some of the whys, the first one I threw up there is BIM. And I'm sure you guys have heard that several times. But there are so many advantages of having an actual model packed full of information. And we could talk all afternoon about the benefits of that, and creating parametric models, and linking parameters together, and using Dynamo. And we could talk about that all day. And I'm sure you've heard it since you've been here at AU. So many advantages. So I just had to touch on that.

And then energy analysis. Obviously, when we have a model, we can run all types of simulations. And the one that I'm going to focus on a little today is energy analysis--

specifically, Insight 360 for early energy analysis. But there's obviously Green Building Studio. Or you can export a gbXML and use some third-party program. I'm sure you guys have been doing that for a while.

And then some of the buzzwords that I've been hearing over the past year-- visualization. Just creating presentations to show people your work. And then several new BIM technologies.

So let's start out with there. I just want to show a couple that I've been seeing around over the past year. And I'll demo one, actually. So let's take a look. Anybody use any of these products? I'm not getting paid. I just want to show them, because I think they're awesome.

So let's just take a look real quick at what you can do after you have a model. See, here's a building model. This is simple. There's really not a lot to it. But check this out. I'm going to show Enscape. Once again, they're not paying me. I just think it's an awesome, awesome product. All the products I showed are awesome. I just want to show how quick this works.

So basically, it's sending up to the cloud. And this is kind of a real-time visualization engine. I think our internet speed is decent. It's going a little bit slower than normal. So basically, once you have a model, and you throw it up into Enscape-- oh, there we go. Let's change to a walk mode. Man, it's going super slow here.

OK. So basically, we did that in less than a minute. And you can actually change the time of day. You can create some screenshots. You can do some screen captures. My point is these real-time visualization engines are so powerful.

So how many of you render in Revit? How long does it take to create some type of rendering? Minutes? Less than a minute? No. You can use the cloud, but it still takes a little bit of time.

Anyways, I just wanted to kind of throw some of these out there. Because they're doing some awesome work. And I think most of these guys are actually here at AU. You can go check them out. I've seen all of them, some demos.

Another thing that I think is really cool, that I actually saw. So this product is called Perceptr BIM VP. So it's almost like augmented reality. So they have where you can export a model, you can take your smart device, go into an existing structure, like a shell-- so you just have floors and beams-- and it will superimpose the model onto your camera inside of an app. So you can just walk around and see the model. Or you can use pictures. And it's like model photogrammetry, where it'll superimpose the model onto your images.

So basically, when you're on the site, you can snap some pictures. And then you'd project the model onto here. And it's extremely precise. I think we're looking at an accuracy of somewhere of 3/8 of an inch per 50 feet, which, if we're talking about laser scanning, you're probably going to have more tolerances than that in there.

But anyways, my point is there are some amazing technologies out there. But to use them, you have to have a building model. You have to have some type of model in Revit. But our industry is advancing rapidly. And it's really cool to see what's going on.

And then, who's heard of Dynamo? Who's using Dynamo? All right. If I could give you one piece of advice, learn Dynamo, and implement it immediately. It will change your life. I promise you. I want to show a few examples with Dynamo at the end. But another new, cutting-edge technology.

OK. Let's get back into the flow of what you guys came for-- of renovation projects. So let's say you've identified a project, a building. Maybe the owner's already said, hey, I want you to-- you know, you're the guy. You're doing this project, or you're trying to gain it. And you want to create an energy model, just to be able to sit down with the owner and show them some options. So that's kind of what I want to step through, is how to rapidly do that in less than a day-- sometimes, depending on the size of the building, in just hours.

So a couple of things I would recommend. So first off, when you're working in Revit, and you're just going to create just a simple model to use for analysis, focus on the building envelope. So all you need is exterior walls, exterior glazing. Obviously size, location, orientation. And then materials. That'll get you going.

And then, obviously, the systems. When I say systems-- the things in the building that are consuming energy. Obviously, HVAC systems eating up a ton of energy. Lighting systems, electrical. You know, your plug loads. All that stuff. You need to have a basic idea of what's there.

And then, obviously, the usage of the building, the schedule. Is it an office building? Is it a restaurant? Basics. Just the basics.

And then, after that, don't model out every single room. Just do some thermal block zoning. So basically, what I like to do-- I used to do this all the time, by the way, at my previous job. I

would select all the walls, move them, and offset them, like, 12 feet. I think that's an Ashrae recommendation.

And then create a space-- create a space, not a room-- for every exterior exposure. And I say spaces instead of rooms because spaces have so many more parameters that deal with energy analysis than rooms do.

And then, after that-- OK, sorry. So first off, to get to that point, to create that model, you can't just create it out of thin air-- just open up Revit and start creating a model. So in my experience, there's two scenarios.

Scenario one, you have some type of existing as-built drawings. And that's the easy one. Because all you do is import them into Revit, trace over it, and you're rocking and rolling. Maybe do a site visit, double-check a few things. And you're rolling right along. We're talking hours as opposed to-- or less than an hour, possibly.

Scenario number two, there are no existing drawings available. So I've experienced this before, too. And this is where it gets a little fun. This is where you've got to experiment a little bit. So who's used Google Earth before-- take some information off of it? Yeah. Yeah, there's a lot of information there. Or some other type of map application.

So in Google Earth, there's actually a measure tool that you can use. And then, in Google Maps, or another map application, there's obviously a scale. You can do a screenshot, get it into Revit, get your scale correct, trace over that. You're rocking and rolling.

Another thing-- just, this is kind of a bleeding edge technology that's developing that I've talked to some people about, since I've this week just found out about some of it. It's called OpenStreetMap. It's like an open-source map application. I don't know if anybody's ever heard of it. But it's starting to develop in some of the bigger cities.

But they are basically just adding information to this application about existing structures. You can use Flux to get the information. You can put it into Dynamo. And then you can put it into Revit. And you have the shell of a building. And then you can just model it up from there.

So just keep that in the back of your mind. And look for that maybe next year, or the next couple of years, somebody teaching a class on that. Because then we're talking minutes to start creating some of these models.

OK, a couple more things after that. I think it's a good idea to do a field visit, just to verify some of the things that are going on. And then, if possible, obtain some energy bills. And let me just tell a quick story.

So one project I remember that I did, it was a five-building campus. And I think each building was five stories. And I used Google Earth just to extract some data off of there, created the model in Revit in, I think, like, a half a day. Did a site visit, double-checked a few things. And they also gave me their energy bills.

And what that helped me do is, when I started running the simulations, I was able to kind of chart it over the course of a year. So you know, obviously, in the summer-- I'm from Houston. So in the summer, our energy bills spike because the AC is going like crazy. So you can look at the results of your energy simulation and kind of see if you're on the right track.

Now I don't think energy analysis should necessarily be used to predict exact energy usage, because that's probably where we can get ourselves in trouble. When you're going to tell an owner, hey, you're going to spend \$5,000 a year on your energy bill, and then, after it's built, and they're spending \$30,000 or something, there's some issues there. But obviously, I'm sure you guys know that. I won't get into all the details.

But anyways. So then we can run the simulations. So let's walk through this process real quick. So let me open up this building right here. So this is something I didn't pull from Google Earth. But just FYI, if you haven't used Google Earth, just check out some of the information there.

So this is downtown Houston. You can count some stories. You can see materials. You can even orient up to a plan view. You can use this ruler tool and start measuring the [? sides ?] of buildings.

And just really quickly, you can start to get a primitive model to use for energy analysis. And so I'm a huge fan of this. I used to use this all the time. It's a great way to see what the existing conditions are.

This, I just sketched this out in, like, 15 minutes just for this example. But just to give you an idea of what I'm talking about with the thermal zoning-- like I said, just offset your walls, create these spaces, and then you're ready to rock and roll.

And what I'm really excited about is Insight 360. Is anybody using Insight 360? Nobody? Great. Well, let me give you a five-minute overview of Insight 360. If you have a Building

Design Suite or one of the new Autodesk collections, then you have access to Insight 360. I'm, like, 99% sure.

So once you download the add-in, on the Analyze ribbon, there's this Generate Insight tool. So what you do after you create your model, you've specified your energy settings, you've specified these space settings, just click Generate Insight. So it's going to shoot it up to the cloud. You don't have to do anything. You just wait on it. You can continue working. And then you're going to get an email saying, hey, your insights are ready.

And so when it initially gets created, it's going to-- well, if you've never used it, all you're going to see is this All Uncategorized tile. And then there's this button right here called Create Insight. When you create an insight, it's essentially creating a project, like a container. It's not really an insight. You generate the insights from Revit. And here, you're just really collecting-- you're creating a container to collect that information.

So I've actually already created one for us, AU Insight. So I'm going to click on this tile. And it's going to open up the insight. Now you can see the model right here. I do want to point out some settings real quick. So you can control the units-- imperial, metric.

And then the key metric that Insight is working off of is what's called the EUI-- Energy Use Intensity. It can be measured in cost. Well, it says energy use intensity right there. It can be measured in actual energy usage per square foot per year, or cost per square foot per year of that energy usage.

So just a couple of notes there on the-- oh, sorry, one more thing. Right here, where it says Organize by Importance-- yes, when you organize-- let me just show you real quick before I try to explain it. So when you go into a model, you're going to see all these tiles, once it loads.

OK, while it's loading, let me just show you. Right up here, you're going to see the model in this window. Right here, this is your EUI. So energy usage per square foot per year.

OK, here come the tiles. All these tiles down here are the factors that affect the energy usage. For example, operating schedule, plug load efficiency, lighting efficiency, HVAC system. Then, off of all those factors, it calculates the EUI. It benchmarks you're building based on the Ashrae 90.1 and Architecture 2030 benchmarks.

And you can see the value here. It's either going to be yellow-- or sorry. Yeah, red, orange, or

yellow-- whatever you want to call it-- or green. If it is red, that means it's above the Ashrae 90.1. If it's yellow, it's in between those two benchmarks. And if it's green, it's below the Architecture 2030.

So let me show you how it's calculating all that. OK, let me pause a minute. Back to my previous statement of organizing them based on importance. Basically, this is your benchmark. This is model history. So those really don't count as far as factors that affect energy usage.

But when you start right here, it's basically saying, this is the most important factor of energy usage in your building. This is the next most important. This is next. This is next. So that's what I mean when you organize based on importance.

So let's just take a look at the HVAC system here. So you're going to have a little graph. And then you're going to have a gauge. These options right here represent different types of HVAC systems. The triangle is what's actually modeled in your BIM-- in your Building Information Model. And it's labeled as BIM. And then, as you go below, you can see that there's a savings per those systems. And as you go above, you can see that there's a cost.

Now what's cool here is, when you sit down with an owner, you could say, hey, if we use this system, we're going to save approximately \$0.14 per square foot per year. And he's saying, OK, well, maybe that's expensive. Let's take a look at three systems.

So you can use these sliders right here and say, OK, we're going to use one of these three systems. Or maybe you say, hey, we are going to use this specific one. But as you notice, as I'm dragging these little sliders here, the EUI is updating. The EUI is based on the average of all the factors.

And then you have a maximum. And then you have a minimum. That's based on the minimum and the maximum-- your little sliders here-- based on all of these factors. So it's basically saying, if you go with all the worst-case scenarios, you're going to be up here. If you go with all the best-case scenarios, you're going to be down here.

And when you hover your cursor, you can see what those values are. And then it also shows you the Ashrae 90.1 benchmark and the Architecture 2030 benchmark.

Make sense? Easy enough? So you can sit down with a client. And it's very visual. That's what I like about it. It's very visual. And just, when you generate an insight, it creates so many

options very quickly. So you know, anywhere from an hour to, maybe-- well, maybe 30 minutes to two or three hours, depending on the size of the model. Two to three hours would be an extremely huge model.

Anyways, I think it's a great tool that you can use to rapidly create a model in four hours, eight hours, really quickly, generate some insights, go to a meeting. And you can start to say, hey, if we go with this option, this is what we're going to be. And maybe they're thinking, oh, wow, he ran all these options and spent all this time creating this energy model. And all you did was do one click and continued working. So that's what I think the power of Insight 360 is.

OK. Let's continue on. So we talked about creating this rapid energy model to kind get the ball rolling-- maybe help you gain some work, give you a good in with the owner, impress them, show them some fancy things. Now it gets down into the nitty gritty. Now you've got to model this building in Revit. And you've got to run through all your new design. And you've got to keep it all looking the way you want inside of Revit.

So that's where phases come in. I heard a lot of you say phases. I'm sure you've worked with them before. Phases allow a project to be aware of time. And so each phase in the project represents a distinct time period in the life of that project. And we'll talk about that as we go forward here.

So as I've looked at phases and taught people how to use phases, I basically boil it down to four things that you must understand-- the phase of the view, the phase status of model elements, the phase filter assigned to the view, and then the graphic overrides assigned to a phase filter. So let's talk about each of those in detail.

So each view has two phasing parameters. It has a phase parameter and a phase filter. So right now, I just want to focus on the phase. So in Revit, you can create phases, like I said, to represent a time period in the life of that project.

A default Revit project has two phases-- Existing and New Construction. And those will get you a long way with most projects. If you do some type of strip center or commercial building that's going to have 10 buildouts, then maybe you can create a phase for every single one. But for now, let me just focus on those two to kind get the ball rolling here.

So when a view is set to a phase, and you create elements in that view, the elements are going to be created in that phase. So continuing that thought, each model element also has

two phasing parameters-- the Phase Created and the Phase Demolished.

So based on those-- based on just those two phasing parameters-- it's going to create four phase statuses. And phase status, that's a very important thing to understand. The four phase statuses in Revit are Existing, Demolished, New, and Temporary.

So if an element is Existing, its Phase Created is obviously Existing. And then it's not demolished It just continues to exist. It's an existing element. It exists in the future as Existing. A demolished element is obviously-- it was an element that's Existing. So its Phase Created is Existing. And then it was demolished in the New Construction phase. So that means it's demolished in that New Construction phase.

A New element obviously did not exist before. And so the Phase Created is New Construction. And then it's not demolished. And if an element is temporary, then it's created in the New Construction phase. And it's also demolished in the New Construction phase. So if you have, like, a temporary dust partition, or some type of temporary wall that's just going up to block the construction zone from part of the building that's actually occupied, that's something that's temporary.

OK. Continuing on are four things to understand. The next thing is the Phase Filter. So remember, the view had a Phase and a Phase Filter. So basically, the Phase Filter controls which phase status of elements are going to appear in that view, and how they're going to appear. So as you can see here, when you create a phase filter, you can control each phase status. And we'll jump into that in a little bit as well.

But just to give you an idea of some of these phase filters, this is Show All. When it's set to Show All, all phase statuses are going to appear. Show Complete can create a phase filter for Show Complete for your final drawings, your new drawings. So you're going to show what's Existing to remain, and then the New elements.

And then Show Previous plus Demo is something you can use for demolition drawings-- show what's Existing, and then showing the elements that are going to be demolished.

OK. So phase filters-- there's basically three options for each phase status. So remember, there's a phase filter, and then there's four options, one for each phase status. It can be set to By Category, Overridden, or Not Displayed.

When you choose Overridden, then the graphic display of those elements is going to be controlled by the settings on the Graphic Overwrites tab. And there are settings for each phase status once again. So that's why the phase status is extremely important.

OK, so let's take a look at some of this in Revit. We'll kind of start to tie some of this together. Let me just open up a new-- I created a new project here. OK, so when you start out, you're going to have your existing views-- you know, a level one and level two.

So let's just do level one. So I'm going to duplicate this view. Let's rename it. And we'll do Level 1 Existing. Oops. Let's rename this view, Level 1 New. I'm going to rename this, Level 1 Demo.

So now you go into your existing view. And you change your Phase to Existing. The New view, obviously, is going to be New Construction. And the demo view-- we'll touch more on this in a little bit-- the phase of that is also going to be New Construction.

So then, from there-- in your existing view, that's when you're going to start modeling existing conditions. And maybe you already have some of this model already created, if you created a model for energy analysis. But let's just draw a few walls here.

So when I select this wall, you can see that the Phase Created is Existing. And then it's obviously not Demolished. Now when we go over to the new plan, you can see how the graphics change a little bit. That's because of the phase filter that's applied.

So now let's say this wall needs to be demolished. There's a couple of ways you can do that. You can select this wall, and you can change your Phase Demolished parameter right here. And I can demo it just like that.

Or there's actually a Demolish tool. On the Modify ribbon in the Geometry panel, there's this Demolish tool. And when you select an element, that Phase Demolished parameter is going to be changed to the phase of the view. So I think it's easier just to change the parameter. But you can obviously use that Demolish tool if you just need to do individual elements.

So that's kind of it in a nutshell, as far as how phasing works in Revit. But I do want to point out-- one thing that I hear a lot is, why not create a phase for demolition? And I think the simple answer is, well, because Demolished is a phase status, and it's not a phase.

Now you can. You can create a phase for demolition. But there's not a lot of benefit to it-- in

my opinion, anyways. Some people may argue. But at the end, we'll talk a little bit about rooms and spaces, and kind of how they behave. And I'll touch on it again there in a minute.

But OK. So that's how you change the phases of the view, and then the phases of the elements. But you can also-- let's look at managing phases in Revit.

So on the Manage ribbon, you can click Phases to open up the Phasing dialog. So here's where you can add phases to the project. You can add however many phases you want. And then you can create phase filters, as we discussed. You can set it to By Category, which means the elements in that phase status are going to display based on their category settings.

Yes?

AUDIENCE: In those phase filters, is there any way to show demo only [INAUDIBLE].

JASON BOEHNING: Yes. Uh-huh, you can do that. Just set everything else to Not Displayed. And then Demolished elements however you want them.

And then Graphic Overrides. You can control the lines, patterns, so on and so forth. All right. Simple enough? Everybody on the same page? OK. That's kind of the basics. That's the foundation of phasing in Revit.

OK, now I want to look-- let's take a look at something that has several phases, and just kind of walk through some of this real quick. So here's just a simple model. The Phase of this view is Existing. And these elements are obviously Existing.

Now there are six phases in this view. So when I go to Phase 1, these elements are New in Phase 1. You can see that they're bold. And then those Existing elements have gone dim. Phase 2, we add more elements. And then we demolished an element. Oops, sorry. I jumped to Phase 3.

So as you can see, as we progress through these phases, the Existing elements are unchanged. So they remain Existing throughout. So regardless of the number of phases you have, if you have a New element in one phase, then it's going to be Existing in all future phases. If you have an element demolished in a phase, it's Demolished and only that phase. And in any future phases, it's not going to exist. It was demolished, so it's obviously not going to persist in the model. A New element is New in whatever phase it was created in. And in all future phases, it becomes Existing. And then Temporary elements only exist in their individual phase.

AUDIENCE: [? Are ?] [? they ?] [INAUDIBLE]?

JASON Sorry, what's that?

BOEHNING:

AUDIENCE: The temporary elements, [? are they ?] [INAUDIBLE]?

JASON Yes. OK, so that's kind of my halfway point. So if you don't mind, how about stand up? You

BOEHNING: can move around, stretch a little bit. Meet somebody next to you. Introduce yourself. And I'm going to get the next half set up, where we'll jump into a little more fun stuff, if you will.

AUDIENCE: Can I just ask a question?

JASON Sure.

BOEHNING:

AUDIENCE: Does this get more detailed or intricate, or is it kind of at this level for the rest of the presentation?

JASON Yes, we'll talk about laser scanning, photogrammetry-- some more of that as we go on. And

BOEHNING: then we'll try to wrap up with some Dynamo.

All right, guys. How about 30 more seconds, and we'll keep rolling along? All right. Y'all ready to keep rolling? All right. Can we shut the doors back there? Thank you. All right.

OK, so now we covered the basics, right? That's the easy stuff. So now I just want to touch on a few things here. So as far as setting up a project, I'm not going to go through all the details. But I want to focus on just some basics of creating the project, and then working with linked models.

I'm going to show you some things with working with phases and links. And then I want to definitely encourage you to create a plan for visibility and graphic display. And we'll talk a little bit more about that when we get there.

But basically-- oh, sorry. So when you create a project, if you have a template, you can obviously use the template. Well, if you don't have anything-- if it's the first one you did, then you've obviously got to create all the settings from scratch. But if you need to, you can transfer

the phase settings from another project. Is everybody familiar with the Transfer Project Standards tool? Great. So you can transfer the phase settings.

So let me ask you this-- what does not come across when you transfer phase settings?

AUDIENCE: Phases.

JASON BOEHNING: Phases, exactly. Because the phases are really not a setting. They're phases in that project. But your phase filters come over, and the graphic overrides come over. But the phases do not. So if you need additional phases, you'll have to create those in that project.

OK. Now I want to spend a little bit of time focusing on linked models and working with phases inside of links. So let's look at an interesting scenario. So this is the model that I showed you earlier with the six phases. This is a host project that only has two phases.

Now this can get a little tricky. So when you select a link, and you go to the Type Properties, there is this Phase Mapping parameter. So when you go to this Phases dialogue, you can map phases from the link to the phases in your current project.

Well, first thing, I should say this. The best practice is to create phases one to one. So if you have phases in this project, create the same phases in the other project. Keep them one to one. You'll be good to go.

But there are, every once in a while, these weird scenarios where-- OK, for example, you MEP folks, if you're working with an architect, and they have this huge project that has all these buildouts, and you only got one of them, and they send you this project with, like, 20 phases, you don't need to create all 20 phases in the MEP model. Or it can be whatever, depending on whatever the situation is. Sometimes, it makes sense. Sometimes, it doesn't.

But the important thing to understand is that you map them correctly. For example, back to this MEP example, if you're building out one of the spaces, and they have that on phase 10, then you're going to want to make sure your New Construction phase is mapped to their phase 10.

And then everything in their host model, all those phase statuses, will behave the same in your model based on your phase settings. And then you're good to go. But if you have them mapped incorrectly, then you're going to show the space next to them, and your space is going to be blank. Or who knows what's going to be going on? So that's an important thing to

understand is phase mapping.

So typically, it's one to one. But in cases where it's not, just make sure that, if you're the one that has less phases, that your New Construction phase is matched up to whatever they hired you to do, onto that phase. Make sense? Kate?

AUDIENCE: But your phase filters also have to match the [INAUDIBLE].

JASON True, true.

BOEHNING:

AUDIENCE: Because otherwise, they won't have any phase filters [INAUDIBLE]. [? A ?] phase filter [INAUDIBLE] linked to another [INAUDIBLE] will fail.

JASON That's a great point. That's a great point, Kate. Yeah. I saw Kate back there. She's done a lot

BOEHNING: of renovation sessions before. I figured she's trying to get me on something.

AUDIENCE: You're learning.

JASON No, great point. And that's one thing, especially on the MEP side, if you're working with an architect, transfer those phase settings over, and you're going to have them all.

But the other thing I want to point out, too, is that, once you map your phase settings, you can also control the the phase and phase filter of the link individually. And so this really isn't recommended.

But maybe, for whatever reason, if you need to show a different phase in a view, you can control, right here in the Visibility Graphic Overrides, you can control the phase and the phase filter of that linked model. But most of the time, they should be the same.

OK, let's continue on.

AUDIENCE: I had something.

JASON Sure.

BOEHNING:

AUDIENCE: I don't know [? if ?] [? I'd ?] [? want to ?] actually transfer a copy of [INAUDIBLE] filter or [INAUDIBLE] filter overrides from the arc model. Because you don't want your-- I mean, you could do it that way through the link. But you want your own graphic overrides for your demo

or existing work. Because the architect may show demo as something else, while you show demo as, you know, [INAUDIBLE]. [INAUDIBLE] [? may ?] show it as, whatever, [? hash, ?] or something.

JASON Sure. Yeah, that's true.

BOEHNING:

AUDIENCE: [INAUDIBLE] transferring their actual settings. Because I think, when you actually transfer the settings, it does the graphic overrides [INAUDIBLE].

JASON It does.

BOEHNING:

AUDIENCE: That's something that we learned the hard way, that you don't [? want to do it ?] from the arc model.

JASON And yeah. So if you want to transfer them, get their phase filters, and then adjust the graphic

BOEHNING: overrides, you can do that, too. Or not even mess with them. That's fine, too. But just make sure, like I said, have those same phase filters so that they're lining up correctly. OK. So have a plan for visibility and graphic display.

So one of the things that I have the privilege of doing is I'm an Autodesk Revit Mentor All-Star. There's a lot of names tied in there. But basically helping folks that are just opening up Revit for the first time on a trial version.

And other than, hey, I just bought Revit, where's my license, the second problem is, man, I created a wall, or I created some component, and I've no idea where it is. I drew a wall and it said, element does not exist in this view. And so then it becomes like a witch hunt-- where is this element? So have a plan for how you're going to control visibility and graphic display.

So let's talk about visibility first. So I have this little upside-down pyramid, whatever. And I kind of have some levels here. These are just my recommendations. They are not necessarily set in stone.

But I recommend starting with worksets. Because first off, worksets are great in Revit, because they allow you to-- you know, you don't have to open them all when you're working on a model. You know, it saves system resources. Or you can use them to control the display of elements.

And why I have it at the top is because you can add any element from any category to a workset. So theoretically, you could have a wall, a beam, and a duct all in the same workset. And they're different disciplines, different categories. I mean, that doesn't make sense. But I'm just saying, you can throw in any number of elements from any different categories into a workset. And then you can control the visibility for all of them in that workset.

The next thing is filters. Filters also allow you large control of elements. So basically, you can add multiple categories of elements to a filter, and then apply some type of rule. However, filters can be a little tricky, a little time-consuming to set up.

The next thing is phase filters. Phase filters also control the display of multiple categories of elements based on what? Phase status. So that's kind of the next level of control that I would recommend.

And then, obviously, your visibility settings in the Visibility Graphic Overrides dialog, which is what we're all used to working with a majority of the time. And then, if you absolutely have to, hide elements. But try not to, unless you absolutely have to. Because that's really when it becomes, where did this thing go?

All right. So when something is turned off anywhere along here, it's turned off. There's no order of precedence. However, when we get to graphic display, there is an order of precedence. And I'll show you this.

So object styles, that's where you start. So the object styles control the graphic display for all categories in the entire project. After that, you can control them on a view-by-view basis with the Visibility Graphic Overrides dialog for all the categories.

And also, for you MEP folks, you know your systems-- like duct system, pipe systems? There's a graphic overrides for per-type that also falls into this category. But those graphic overrides, they do override the graphic overrides in the Visibility Graphic Overrides dialog. Sorry, I'm saying visibility graphics so much. Does that makes sense? OK.

After that, your phase filters. Your phase filters are going to trump those. So anything, when the phase filter is set to Overridden, the elements in that phase status are going to override anything you have defined here.

And then, if you create a filter, the filter is actually going to override the phase filter. And then,

if you do individual element overrides-- which, once again, only if you absolutely have to. Not recommended. But they will override anything that's applied to it. Make sense? Anybody not agree?

AUDIENCE: I just have a question. What about in linked models?

JASON In linked models?

BOEHNING:

AUDIENCE: Yes. [? So if you ?] can't do an element override, [INAUDIBLE].

JASON You can, yes. Yes. Yeah. Basically, your link will kind of follow these, as well. Or you can

BOEHNING: override it for that specific instance. All right. Everybody good on-- yes?

AUDIENCE: They also have materials that [INAUDIBLE] interfere with this pyramid.

JASON I'm sorry, what's that?

BOEHNING:

AUDIENCE: [? They'll have ?] [? materials ?] that can interfere with that pyramid.

JASON So yes, you can control the material in those, as well. And so then, it'll override based on--

BOEHNING:

AUDIENCE: The [INAUDIBLE] filter [INAUDIBLE].

JASON What's that?

BOEHNING:

AUDIENCE: [INAUDIBLE] filter [INAUDIBLE]. Like, if somebody has a material that has a white surface finish [INAUDIBLE], and you try to put a filter on it, it won't work if the material's empty. [INAUDIBLE] [? filter. ?]

JASON OK, sure. I see what you're saying. But sorry, can you control the material with a filter, though?

BOEHNING:

AUDIENCE: [? I ?] [? think ?] [? you can. ?]

AUDIENCE: Yeah.

JASON

You can? OK. OK. But yeah, that's a good point.

BOEHNING:

OK, so let's talk about modeling existing conditions a little bit. So I know we talked about it in the beginning, to kind of create a rapid energy model using Google Earth or something like that. But now let's say we need a more detailed model. We need the interior. We need to model everything out. So let's talk about some options to do that.

OK. Oh, first off, I should mention this. First off, I would recommend, only model what is needed. So in the beginning, you're obviously going to create some type of BIM execution plan. There's going to be all types of contracts involved.

Make sure you understand what you have to model. Because there are ways to get around not having to model everything. And I'll show you a couple of those. Filled regions is a great way to show areas like, hey, everything in this area, just leave it alone. Or everything in this area, it needs to be demolished.

So make sure you know what you have to model. Because if you do something like this, and they're like, hey, you're supposed to model all of that out, because we want a model of our building, then you're going to have to go back and redo it all. And so that could be a major problem.

One more thing-- color fill legends. This may be a stretch, but could be worth a shot.

All right. So once again, when you're going to fully model out your existing conditions, there's two scenarios-- you have existing as-built drawings. So once again, you can import them in, do some field visits to spot check. Or scenario two-- there are no existing drawings available, so you've got to figure it out on your own.

Option one, laser scanning. Option two, photogrammetry. Option three, which I had to do all the time, was go out to the field with my tape measure. And I think that's why I have back problems today, is all my field measurements. But oh my gosh, that's so terrible.

OK, let's talk about laser scanning.

AUDIENCE:

I'm sorry. I missed [INAUDIBLE]. You have import images and CAD files. For people that are starting off, they should know that they [? shouldn't be ?] importing [? CAD into your ?] [? models ?] [INAUDIBLE]. It can cause a lot of problems with your model.

- JASON** Yeah. Well, linking them, typically, if it's going to change. But if you're just going to import it-- because it's not going to change, because it's as-built drawings. You can just trace over them, and then remove it. But you can obviously link them as well, too.
- AUDIENCE:** I think the point there was that there's a lot of information [INAUDIBLE] [? a lot of ?] [INAUDIBLE].
- JASON** Sure. OK, sure. That's a good point. That's a fair point.
- BOEHNING:**
- AUDIENCE:** One of the things I've done is I've taken a CAD file that I'm not going to be adjusting and make a family out of it. That way, it's phased correctly.
- JASON** OK, OK.
- BOEHNING:**
- AUDIENCE:** When you just import it, you can't phase it. And so you end up having to use graphic overrides in all your views. But if you just take the CAD file and make a family out of it, you can phase it. And now it follows all the Revit phases in there.
- JASON** Sure. That's a great tip. Yeah, that's a great tip, too.
- BOEHNING:**
- AUDIENCE:** Can you repeat it?
- JASON** So he said, you can also link it, so that you can phase it. Or sorry, sorry.
- BOEHNING:**
- AUDIENCE:** Make a Revit family.
- JASON** Make a Revit family so that you can face it as well. And then you can control it like that. So
- BOEHNING:** that's a great tip.
- OK. So everybody familiar with laser scanning? Basically, huge laser shooting beams, measuring the distance, and creating all these points. And it's going to create a point cloud. That's going to give you some type of output. Or the point cloud is going to be your output. It's extremely precise.
- And depending on what your situation is, you can buy a laser scanner. Maybe your firm wants

to purchase one. Or you can rent one. Or you can outsource the process and have somebody else that specializes in that do it for you as well.

However, one thing that I have heard is that, if you do outsource this to somebody, create some type of deviance standard. Because a lot of these guys, they'll go out, and they'll scan an entire building, and then they may even model it for you. And then you could have walls that may be off by, like, one degree. And they model it like that.

Well, that's going to cause issues for you. Or maybe you want it like that. Maybe, but probably not. So set some type of deviation there. Whatever it may be-- 1%, 2%. And just be aware of that.

All right. The other thing that's kind of coming around is LiDAR. Anybody ever heard of LiDAR? That's the technology that's being used on vehicles to sense what's around it. And it's actually being used in a lot of places. But it's similar to laser scanning. It kind of falls under that same category, if you will.

And basically, LiDAR sensors, they're cheaper, they're smaller, they can be mounted on all kinds of things, really. It's used a lot in civil applications. You put it on a plane or a helicopter, and it'll go out, and it'll scan a field, or just open terrain, or whatever, to create some type of model.

So let's talk in a little more detail about the workflows of each of those. So with a laser scanner, you're just going to go out there and scan it. And then it's going to spit out some type of point cloud for you. And relatively simple. But like I said, right now, it's kind of expensive.

But here are just some images. Laser scanners, large. LiDAR sensors, very small. So like I said, you can mount them on other things. And typically, they have their own software that's going to take all the data, and it's going to generate a point cloud for you.

The other option that's becoming more and more popular is photogrammetry. Tree And I think one of the reasons is probably cost. But anybody have any experience with photogrammetry? OK, I'll touch on it just briefly here.

So basically, instead of using a laser or some type of light to measure distances off of points, it uses photos. And then it matches all these photos together. And I don't know exactly how it works, but it's pretty cool. But it just takes thousands of thousands of photos and starts to

match them all together. And then it can create a point cloud for you as well.

It can also create some other things, like some 3D texturized meshes or orthomosaics. But those are used more in a civil application. But photogrammetry's becoming more and more used in the AEC industry. So it's less precise than laser scanning, but it's definitely worth a shot, because it is pretty accurate.

OK. The workflow here is similar, but there's this data processing step. And you have to have some type of software that can take all these images and create the point cloud for you. So once again, you're going to capture data, process the data, and then you can output it.

So the cool thing about this that I have seen is you can mount it on a UAV or some type of robot. So I do want to note-- I think it was maybe September or October-- there were some new laws passed. You have to have the proper licensing and certifications to fly one of these commercially. So I hold no liability for you guys just going out and trying it out. So just be aware that there are laws now by the FAA that you have to abide by.

OK, so in Houston, my good friends at Axoscape, I go over to their office sometimes. And they show me some of the cool stuff they're doing. But they use drones to take photographs that they can use to create a point cloud. Or they also have built a little robot that they can use inside of buildings, and just send it into halls, into rooms, and it's just snapping pictures.

And then you can use that to then put into some type of software. Here are a few of the popular ones on the market. And it'll generate a point cloud for you.

So this is useful information right here as far as the cost, and then how many images you can use in there. So Recap 360 Pro, I don't know if any of you guys have that. It is an Autodesk product. Pix4D is actually a popular one that a lot of people are using as well. But there's a couple more, if you want to give it a shot.

So here's what your output will be. So this is actually a point cloud. So it almost looks like a video camera mounted on a UAV. But this is actually a point cloud. So you can see the amount of detail. And this isn't laser scanning. This is photogrammetry. So it can still get pretty precise.

All right. Then, the goal is to take that point cloud, put it into Revit, and then create your model off of that. Now I know people have been talking about point cloud for years, but it's not like it's super easy. So you still have to manually trace over it, and make sure you're snapping to the points, and all that. But it's still a better option than field measuring, which I despise greatly.

All right. Modeling new design. So at this point, I'm just going to scroll through some of these. This is where it gets easy. So if you've been able to model your existing conditions accurately, and you have a solid model, then it becomes easy. Then it just becomes like what you normally do on a new project. You have your existing conditions. You've demoed what you don't need. And then you just add all the new work in there.

So once again, I think it's important to have a building information model, because so many things you can do. You can leverage the information in there to dramatically speed up this design process.

And I've taught a few classes on parametric modeling using Dynamo-- you know, using formulas and calculated values and all that. And I'm a huge proponent of that. It can dramatically speed up your modeling. But I can't talk a lot about that. I could talk for hours, but OK.

So some tips and tricks. I threw through rooms and spaces in this category, just because they work a little bit differently than normal model elements. And the reason is because they only have a Phase parameter.

So there's no Phase Created and Phase Demolished with spaces. There's just a Phase. So if you create an existing phase in an existing view, and then you go to a new view, that space or room isn't going to be there. And so that kind of poses some problems, especially when you deal with demolition views.

And so let me show you kind of the industry-standard workaround that I would say is widely accepted. So let's take a look at this. So here's a simple model. I've got my rooms here. And you go to the New Construction phase. And I have my new rooms.

So you can see, here's my existing rooms, here's my new rooms. But then, when you go to the demolition view, well, these are the rooms that appear, because demolition is-- the Phase is set to New Construction. So that's where this issue arises.

So what I would recommend is-- let's see, did I put it up here? Just so you can see this real quick. So turn off the rooms or spaces in the demo view. So let's just hide the category here. And then let's go to the existing view. Or you know what? Let me just hide, select all, turn on my spaces. Or sorry, am I dealing with rooms?

OK. So now, in my existing view, all I have is rooms. And in the demo view, I have no rooms. So then, when you go to your demolition sheet, you have your demolition view. And if you want to show the rooms and the tags, just take that existing view, and just throw it right on top of there.

However, I would recommend creating a new viewport not showing the viewport title or the line. And that's kind of the workaround. So I realize it's another step.

But here's the alternative, in that some people will say, well, if you create a demolition phase, then you can kind of get around that. But you have to copy over those existing rooms. So then you have existing rooms in the existing phase. And then you also have existing rooms in the demo phase.

And I'm not a huge fan of that. And sure, I can use Dynamo to link those up. But you can just create another view. You can even use Dynamo to place them on the same sheet. And so, in my opinion, it's a little bit simpler. And I think most people would agree that, maybe, that's a little simpler option. But you can obviously duplicate the spaces as well.

OK. How are we doing on time? OK, we're good.

AUDIENCE: Would you have to duplicate the spaces anyway if you have spaces that are not touching, for example? Because sometimes, what we do is we'll model, like, a buffer zone around the plan in order to get the geometry correct. And so those rooms end up being in the model as well, not in your CAD plan. So you end up having to [INAUDIBLE] those as well.

JASON BOEHNING: OK. So the question was, wouldn't you have to duplicate the rooms anyways? So yes. So going from existing to new, those rooms that are going to remain the same-- yes, you do have to duplicate them anyways. But a lot of projects that I've been a part of, they're going to change numbers or something anyways. Or maybe they'll remain the same, and you can just leave them alone. But yes, that is a good point.

But I guess my point was, if you create a demolition phase, then you're going to have to duplicate them twice. And you end up with a ton of rooms or spaces. And it can create a huge mess.

All right. What else do I got? Oh, MEP connections. This is going to be just a little tip for the MEP guys here. So let me just show this real quick. It's kind of interesting. So I'm going to

create a new-- this uses the mechanical template here. Let me change this to-- sorry, I'm going to keep it at New.

If I create a duct here, and then I change the Phase Created to Existing-- so see, I'm just modeling an existing duct. And now I want to connect to it. Let's say I demoed part of it or whatever. And I create a duct, and it's same size, same height, and I connect it up, it merges it together. And now it becomes a new element. Like, uh, that's not what I wanted.

So to get around that, you have to place a union fitting. So if I add that, and then I create my duct, now I have my existing and new duct. And it can be a part of the same duct system as well.

So just a quick note there, if you are trying to-- maybe it's going into another room, and something is being modified on the other side of the room, so you need to demo the rest of it, and then you're adding the new duct, just make sure you add a union there. And then you can create your new duct after it.

All right. Dynamo. How many people said they use Dynamo? Awesome. So I do want to show a few things of how you can use Dynamo in a renovation project. So let me go back to this little sample model here. And let me open up Dynamo, which now installs with Revit in 2017. So you have it-- if you have Revit 2017, it's there. If you have a previous version, you can still go get it for free at dynamobim.org.

But let me just show you some cool things that you can do. So let's say I want to change the phase of all the walls. So say you had some intern or somebody that doesn't really know what they're doing, and they just modelled all this out. And they didn't change the phase as they were going or whatever. And now you want to change the phase Demolished for all the walls at once.

You can use Dynamo to do that, besides going in and changing them all. And granted, you can select them all, but maybe they're in different locations, whatever.

So here's this graph. So here's kind of my basic overview of Dynamo. When you're working with Revit, you select elements, and then you perform some type of task. It's pretty simple. You can either get parameters, you can set parameters. You can get parameters and use it to set other parameters. I mean, we could go on and on. I'd love to spend another two hours talking about Dynamo.

So when I run this and go back over here, this is my existing view. So let's go to the demo view. So now all those walls are demolished. And so that's just some of the power of Dynamo, just to give you a brief glimpse that you can do with phases.

And the reason I show this is because this little node right here is recently new in Dynamo where you can select a phase. Therefore, you can use this SetParameterByName node, and you can set the phase. So that's a big upgrade in Dynamo that we've recently got.

Also, let me just show you this other graph here. Change View Phase. So let's say that you have a huge project-- you know, hundreds of views-- and you need to start changing the phases of these views. You can use Dynamo to do that.

The thing that I did with this graph-- and I'll upload these two to the AU website. So you can have them all. You can play around with them and kind of start to see what it's doing. So once again, I'm going to select views. So you're going to select an element. And in this case, I'm basically searching, because I want to filter out views based on something that they contain.

In this example, I was just messing around. I put Level. But maybe you want to put Existing. So any view that contains Existing, you want to change the view phase to Existing. So you could do that as well.

Right here, all I'm doing is filtering out the ones that contain Existing. And then I'm using-- well, ignore these. These are just so I could see what it was grabbing, making sure it was grabbing the right thing. But the same thing-- the Element.SetParameterByName node, very powerful. You can set parameters, link parameters together, and really speed up these processes.

Once again, the Select Phases node, where you can use this dropdown to select a phase, set it, keep chugging along.

So once again, I wish we could just talk about Dynamo all day. I'm a huge fan of it. And maybe next year, I'll try to submit a class on using Dynamo for renovation projects. But anyways, I encourage you, if you don't know Dynamo, come talk to me. I can show you some resources that are out there available.

Dynamobim.org-- lots of free stuff available to help you get rolling with Dynamo. But like I said, just like Insight, you should have it. Or sorry, Insight, you have it along with your suite. Dynamo, it is free. Even if you're using 2015, 2016, dynamobim.org-- it's free. 2017, it installs

right along with Revit.

OK. So that's basically all I have. So anybody? We've got about 15 minutes. Anybody got questions? In the back.

AUDIENCE: I had a question about [INAUDIBLE] existing [? doors ?] in a linked model. Could you have those [? existing ?] [? doors in the ?] original model [? but in a ?] New Construction phase, [INAUDIBLE] [? schedule? ?] How do you actually go about handling a situation like that?

JASON I'm sorry. I couldn't quite hear everything you said.

BOEHNING:

AUDIENCE: So existing doors from a linked model, [? in the ?] New Construction phase in your model, [? if you need ?] to add information or just update the door, would you [INAUDIBLE] [? with a ?] linked model and put it in [? your new ?] model?

JASON Yeah, you could. So create a schedule. OK, so the question was, you have a linked model with existing doors, and you want to create a schedule in the new model?

AUDIENCE: [INAUDIBLE] [? all your ?] doors, do you capture both existing and new? [INAUDIBLE] modifications to, say, the [? hardwood ?] on the existing door.

JASON OK, I see what you're saying.

BOEHNING:

AUDIENCE: [INAUDIBLE] in your schedule, you can link [? and pull doors ?] from the old model [INAUDIBLE].

JASON Yeah. But if you schedule existing doors as the phase is set to Existing, so you're not going to get new doors?

AUDIENCE: [INAUDIBLE]. [? Now you're ?] [? just ?] [INAUDIBLE] linked models [? in your ?] [INAUDIBLE]. [? Otherwise, ?] [INAUDIBLE].

OK.

AUDIENCE: [INAUDIBLE] [? schedules. ?]

AUDIENCE: [INAUDIBLE] [? schedules. ?]

JASON Yeah. OK.

BOEHNING:

AUDIENCE: [INAUDIBLE] [? doors ?] [INAUDIBLE] one model [INAUDIBLE] [? door from the ?] other one, [? that can ?] [INAUDIBLE].

JASON Sure, sure. Yeah, OK.

BOEHNING:

AUDIENCE: [INAUDIBLE] phase filters [? set up ?] [? so that you ?] have all the doors in one schedule. The issue that [? we would ?] have [INAUDIBLE] and you want to add [INAUDIBLE]. [? Like I ?] [? said, ?] something to show off [INAUDIBLE]. [? And ?] [? it'll ?] pick [? up ?] [INAUDIBLE].

JASON Cool. Anybody else?

BOEHNING:

AUDIENCE: [? How ?] do those photogrammetry software programs give you [INAUDIBLE]? Are any of them [INAUDIBLE] quality [INAUDIBLE] reverse of an object? [? Because I ?] [INAUDIBLE] [? model ?] take a picture around something, but like the reverse of that. So like a room. So can it make a scan of a room [INAUDIBLE]?

JASON So you're saying, if you took pictures of the inside of the room, and then you want to view--

BOEHNING: OK, sorry. What do you want to view?

AUDIENCE: I want to use photogrammetry like a laser scanner. But I would want to do [INAUDIBLE] room, not [? on ?] objects. Because all the ones that I see, you have to take a million pictures around an object or a building. [INAUDIBLE].

JASON Oh, OK. OK, yeah. So you're basically saying, put a camera in the middle, shoot pictures.

BOEHNING: Yeah, you can. You can. There could be problems like, for example, with white ceilings. If it was all white, there could be issues there with it being able to read surfaces. But the point is, I guess, with photogrammetry is that it's so much cheaper than laser scanning. It's definitely worth a shot to go through an initial pass.

AUDIENCE: [INAUDIBLE].

JASON What's that?

BOEHNING:

AUDIENCE: You just don't get the results. The LiDAR is a good [INAUDIBLE].

JASON Yeah, LiDAR is a good option, too. So yeah. Yeah.

BOEHNING:

AUDIENCE: LiDAR's really expensive, though, right?

AUDIENCE: [INAUDIBLE]. OK, so if you can build [INAUDIBLE]--

JASON Go ahead.

BOEHNING:

AUDIENCE: So we do a lot of work with [INAUDIBLE], a lot of [INAUDIBLE]. [INAUDIBLE] can do that with [INAUDIBLE] [? tools. ?]

JASON Yeah, let's talk afterwards and talk about that. Yeah.

BOEHNING:

AUDIENCE: With MEP objects that have been demolished, have you guys worked around with modifications to the demo plans? Like, if you're working off of an existing CAD bounce, and you modelled everything out, [? turned a ?] demo, and then you go out and field survey, and you find out that that's not actually true and change [INAUDIBLE] revert current back to existing. All that system information is lost.

JASON That's a great point. So yeah. OK, that's a great point. So the question was, so when you're

BOEHNING: modeling existing conditions in MEP-- thank you for bringing this up, I forgot to mention this -- and you demo it, it basically disconnects everything. Therefore, you lose all your system assignments.

So my recommendation with that-- and it's kind of a tough workaround, too. But if you just keep everything as Existing, save the model, you can use Dynamo to demo everything that you need to, create your plans. And then, if something changes, you can go back to the other model.

But basically, just try to keep it as Existing as long as you can. But you can use Dynamo to change them all to demo for any deadline that you need.

AUDIENCE: But when we've tried to [INAUDIBLE] copy and paste from an older model back into our newer model, [? we'd have ?] duplicate systems.

JASON Yeah, yeah.

BOEHNING:

AUDIENCE: And so that causes a lot of [INAUDIBLE] issues. So what we've actually started doing is we've separated off [INAUDIBLE], disconnected the duct system [? and pipe ?] system, and then turned it into [INAUDIBLE]. [? They just turn it ?] off, and then [INAUDIBLE].

JASON That's a good option too.

BOEHNING:

AUDIENCE: The only issue is that, when we go to [? do clash ?] detection down the road, the person doesn't know about the [INAUDIBLE]. Then you have a lot of issues.

JASON Yeah. Yeah. No, that's a good workaround. My tip-- and it's just something to try. But you

BOEHNING: basically just create a copy, demo everything, print out your drawings, and then delete it, and then keep everything to where you're not modeling in two different ones. But basically, you're just demoing in order to plot some sheets, and then move on.

So everybody's heading out, so I just want to throw up my contact information for you guys, in case you want to connect with me. And yeah, let's continue some of these conversations. So I definitely appreciate your attention and your input. And thank you.