DEREK MAIN: All right. Welcome. A couple of things before we get started. If you do have any questions, please hang onto them 'till after. And I did also update the handouts, so when you get back to your office, you can just download the updated ones. Today we'll be discussing how to automate a couple of workflows in Revit.

So for a lot of you that are here doing plumbing designs, you might be frustrated with some of the shortcomings of the software, and you're not quite sure what you can do to speed up some of these tasks that you have to make things more efficient. So there's a couple ways that we can address these. We can manipulate some out of the box parameters, and we can create other parameters to do these items.

So we'll talk about how we can automate the flow calculation in storm, gas, and other piping systems. And then we'll talk about--

AUDIENCE: [INAUDIBLE]

DEREK MAIN: No, that's fine. Let's see. The AV guy said I'd be OK on the volume. Is that better? I'll try to talk louder.

All right, so we're going to discuss how to automate some flow, and then we're going to talk about automating schedules so that we can use them for working tools on our sheets, as well as inserting and design narratives.

I am a plumbing engineer. My secondary role is as a BIM manager. BIM Development Leader for my firm's plumbing group. I have an associate's degree in CADD and a bachelor's degree in engineering. I am a certified Autodesk professional. Autodesk has the free exams while you're here, so why not? And I did co-author my first magazine article a couple of years ago. Currently working on another one.

I've been with CannonDesign for a little over nine years now. I was fortunate enough to start out as an intern with them. I'm located in their Buffalo office. We have a little over 900 employees, mostly in North America. A couple overseas. And we're SFMO, so single firm multi office. Working in a cloud environment quite often on projects where I'm working with an engineer in our New York office, or our Boston office simultaneously.

And I have had the opportunity to work on some cool projects, a wide range. So you'll probably

guess I'm Homer, and hopefully that angry mob is not you after this class. So hopefully that doesn't happen here.

So before we get into how we're going to automate those flows, couple of items. In Revit, there are 11 out of the box system classifications for piping. They are named the same as the system types. You can duplicate the system types. You can name them whatever you want, but the system classifications, that's what you got.

Not all of them can calculate flow, so of all the system classifications domestic hot and cold fixture units and flow, you can also use the pipe sizing tool in Revit. Sanitary is only fixture units, and then hydronic supply and return can calculate flow. That you may think is more for HVAC, but we can use that. So we don't really care what the system classification is. We can rename the systems if we want.

Flow can only transfer through one path, so all open ends need to be capped. If you have a loop system, every branch take off that you have if that's looped, you need to put a valve in there, find a way to cap it so it's not going to flow through there. You have to break that flow, so forcing it to think it's only going one direction.

Connector settings are pretty important. Flow direction needs to be consistent, and this needs to be done before you start the project. If you have a pipe accessory and the connector setting the direction is set to in and out, and you may put that in the project backwards, and you're getting an issue with your flow, you go back to the family, change it to bi-directional, load it back in. There's a good chance that it's not going to work right.

You may find that you think it's working OK, but somewhere along in the piping that is still there that's already modeled it may act a little goofy. So one thing to keep in mind is make sure that your families are set up properly.

And use of shared parameters. These are great. Tags, schedules. Use them in the family environment or in the project environment. Just like any other parameter, you can use them in Dynamo as well.

A couple of classes that may be beneficial to you. I took these in 2014. I thought they were definitely helpful. So you might want to check those out. And also, the Help section for Revit. I do occasionally go to that.

Storm piping. I'll show you what we need to do for calculating flow in both square feet, as well as GPM. I'm sure you're aware that some codes are changing. So 2015, any codes that are following the IPC, they're now sizing by GPMs instead of square feet.

So in the family environment we need to create some shared parameters. You can name these whatever you want, but you want to think about how you're naming them. Keep them consistent.

Rainfall, roof area, wall wash. Total area-- it's a combination of roof area and wall wash. And then square foot and flow and GPM and flow. So that way, if you have these broken out, you can use that roof drain in any project, whether you're calculating by flow in GPM or square footage.

So for square foot, it's total area times 1 GPM. In Revit, it uses units of GPM for flow. We don't care about the units that Revit is using as long as we make it think that's what we want. And we can show that with whatever unit we want in a tag.

For GPM and flow, we know that 1 one square foot is equal to 0.0104 GPM for 1 inch of rainfall per hour. So if we multiply 0.0104 times our rainfall parameter, times our roof area, that will get our total GPM for that drain.

For our connector settings, our flow configuration direction classification. Our flow configuration, anything that's coming into the family, it's set to in. Anything that's coming out of the family, it's set to out.

For the configuration being preset, we're defining a value that's going to be going in there. That's why it's preset. Our system classification, again hydronic return can calculate flow. So we'll use that for the classification. We can rename that system name in the project environment if we want to.

For the actual flow parameter that Revit uses in all of the piping, we're going to associate whatever parameter that we want to use to that for the connector. In both the family editor and the project environment, you want to go to the Manage tab, select our project units. We're going to turn the GPM off for flow in the piping. So that way when you select whatever pipe or whatever it is in that model, and you go down into the type properties, you're not going to see that GPM in there. It's only going to be a number.

So for our tags, the top one is for the roof drain. So for the flow going through that roof drain,

you're going to add in the total area shared parameter, and then use a suffix for square feet. For our pipe tags, you would use Revit's flow parameter and use either GPM or square feet for the suffix, depending on how you want to show it.

Inputting the areas into the drains. There's a few ways you can do this. You can manually click on each drain, enter the value for the square feet. You could run a Dynamo script where you take all of the roof drains and all of the spaces, and you get the parameter information from the space. Set it to the parameter information of the roof drain.

Or you could use an embedded schedule for spaces that are placed on the roof, and you can quickly add in the square feet there. That you don't have to use Dynamo for that. If you're not up to speed on that, that schedule is actually a pretty quick way to do it.

Another option with schedules is we can use a schedule to quickly find all our piping that is the incorrect size based on the information that we have set. And as you can see, after the information is populated through the drains, it's tagged. The information matches the tag and the type properties.

So to put that all together. We have modeled piping. There's no flow information added to it. All the tags show 0 square feet. Our roof plan, we've placed spaces. There's areas information for those spaces, and we figured out any wall wash that might be there.

We go to our roof drain areas schedule, we'll enter that information matching up for the roof drain that's with that space for that roof. We'll add in any wall wash, and our total area is automatically populating. The required size is actually updating as well, so that calculated parameter that we have for required size is based on the total area going through that drain. And in the schedule we can quickly go through and change the roof drains to the size that they need to be based on that flow.

When we go back to our piping, we can see all the flows populated, all those tags are done. You make a change, you can quickly go through and update it. It will update all those tags to what the flow needs to be. In the roof area you can see it's showing GPM and square feet, and our piping is showing the flow as the tags do.

If you have to include any design roof drainage calculations in your design narrative, you can use a schedule that automatically populates with this information. Print that, insert that PDF in, and then you can use a sizing table.

What's better than actually clicking just one and changing the size here, grab a bunch of them, go back to your 3-D view. You can select all the fittings with it, and change that size to what it needed to be based on the information you put in that schedule.

Now if we wanted to go ahead and put all that information in GPM instead, or say we already had this then we found out after the fact we wanted GPM instead. It's one change. So that piping that's shown in square feet, we're going go to the roof drain family. We're going to open that up. And that associated parameter with the connector, we're going to change that to be the one for the GPM flow.

Load that back into the project. Overwrite those values, and it will change the values from square feet to GPM. All we have to do, select all instances of that tag in the project to the one with the GPM suffix, and everything's updated. So that flow, 541 GPM in that piping, matches our totals in that calculation sheet that we have that we can insert into our design narrative. And that was all of a minute to go ahead and change the entire project from square feet to GPM.

Gas piping. So we're going automate the flow of natural gas or propane in CFH in a pretty similar way. We have two parameters, our input, which is probably Btus or Mbh. Whatever you get from your HVAC engineers or from your cut sheets for your equipment. And then our CFH flow value, which is going to be the input divided by 1,000, or 2,500, depending on the gas, times 1 GPM. Again, we need to make Revit think we want GPM, even though that's not the case.

You may have noticed this where Revit likes to convert Btus per hour to volt amps. That is because of units. There are display units, and there are internal base units.

We know that Btus per hour, watts, volt amps, they're all units of power. And Revit is doing this because not all shared parameters have their own internal units. There may be parameters that use the same display units, but not all of them have the same internal base unit. Not all of them have it, so that's why Revit is converting this to volt amps.

You still get a pretty close number. It works, but we know that it's Btus per hour. We can then just assume it's Btus in our units and use energy. When we do that, we don't get any weird rounding, and it stays in Btus for our formula, and we get what we want.

Just like in the roof drain, our flow configuration, flow direction, classification, and parameter association is important. In this case, because that gas is flowing to the family, our direction is set to in. We're using hydronic supply because it'll calculate flow.

Units. If you haven't already turned them off, you want to turn them off. And then our tags, we'll use CFH flow in the equipment, and we'll use Revit's flow parameter in the piping. You apply the suffix that you want, and you'll get what you see on all your drawings.

So the flow matches in our tag. We can use tags that use the pipeline, or we can have a total length parameter in those tags, so each section between tees or equipment, we can put that total value in. And we can just print out the sheet, look at, use our sizing guidelines or scale. We can quickly figure out what sizes they'll need to be.

So you probably got a good idea of what this is. You can apply it to other piping systems. Outlet counts, hot water return. With hot water return, you can also use the sizing tool in Revit because the system classification is hot water. You can duplicate the system type, hot water return. Use the graphics to manipulate that how you want. But you're still using hot water for the value.

In your piping systems, you have to have that one direction of flow. So where that hot water return is teeing in to your hot water, it's not actually connected. You're capping that tee. You create a cap family, put in a GPM value, put in whatever you want. Say you have a dorm building, and you have 20 risers going up in that building, you want to return a half GPM for each one. You can just put a half GPM into that cap, and throughout the building it'll populate the total GPM that you're returning.

This image is actually from a project where one of the requirements were we had to show the fixture units, we had to show GPM. I was able to automate all of that. Same idea.

Gas outlets. Oftentimes we're laying out the design for our medical gas or lab gas. We have to count up all of our gas outlets. Use our size and scale based on the pipe length. Size them. You may have sheets where you're writing down all these numbers as you go through it. You may lose the sheet. Why not just put it in the model?

If you put a value of 1 to each outlet and associate that with the flow parameter, for every outlet that is connected in that piping system it'll have a value of 1 for it. If you go through they make a big change or something, well, you repipe it. And you have all your new outlet counts

to check the sizing if you have to adjust it. You don't have to go back and manually count that.

Schedules. They can be placed on drawing sheets. They can be used as working tools. Estimating can use them. We can use them for design narratives.

Being placed on sheets is probably the most common use of them. Having these prepopulated in your templates setup, pulling the information from all your families. They're populating themselves. All you have to do is go to your sheet, make sure that it looks correct.

Use for design narratives. Fixed unit loads, roof drainage, gas loads. Whatever you could think of, you can probably find a way to use these to automate that. Instead of having a separate Excel spreadsheet, you can make your schedule look like what that spreadsheet would look like printed out, and you can insert that instead. It's populating itself. A couple more examples of that.

And then, as a working tool. So this one, pipe sizing table. They're based on conditional statement for column E for pipe size. Column F is another calculated value for if the required pipe size matches the actual pipe size. So how this works is we're filtering out all our piping. That is that storm piping. We have our total area, the flow through that pipe. We have our rainfall rate. We have the actual pipe size. Conditional statement-- in this example it's this if statement.

And then for verifying that, it's setting the pipe size equal to the value that it requires for the conditional if statement. This example may not work quite often from project to project. You'll run into different rainfall rates. You're going to have different GPM values. It'd be great if we could apply key schedules to piping.

You could also use Dynamo for this. That is an option. It does speed up your time quite a bit.

For that fixture unit load schedule, this one, you're filtering out all those plumbing fixtures in the model. You can subdivide it by level, by area, whichever you'd like. We have our quantity, the fixed units for each fixture, and then the total based on the quantities.

So we have calculated totals for the quantity, the fixture unit totals for waste, cold, and hot. And those totals for waste, cold, and hot are calculated values that are set equal to each fixture unit in column lines D, F, and H. The only difference is your checkbox and calculate total under the formatting for it.

For the 75% load for the hot water, you're just taking column F times by 0.75 in a calculated value. And then for column K for that total it's set equal to column J again in the formatting setting it to calculate totals.

That was actually the quickest hour I've ever seen. If you have any questions, I'll open it up to that. If not, please fill out a survey. Let me know how I did. Find me on business cards, find me on LinkedIn. Yes.

AUDIENCE: Question. So when you're first defining your parameters, where in the beginning you're saying your flow could be GPM, right? As a unit. I'm curious about the units and the other ones are just numbers or integers? Is that what you're using?

DEREK MAIN: So you can use numbers or you can actually take that shared parameter. So if you had, say, the roof area. That parameter type, it would be piping and flow. Yeah. Or you could use a number.

Where it matters what the units are is what the flow is for the piping. So if you took that and you put that in for your flow parameter, you're going to get inconsistent units. So you have to multiply by 1 GPM. You're factoring by 1. It doesn't change the value, but it gives it the correct units so that Revit thinks it's in GPM. You're not actually using those units. You're using tags to specify what that suffix is.

AUDIENCE: OK, so because you can have the option when you define the parameter, to define it as a flow parameter. You're saying you're not doing that. You're getting it through a GPM [INAUDIBLE] assign that a connector, it must be [INAUDIBLE] doesn't have to be a GPM. Does it have to be in GPM units?

DEREK MAIN: It has to be GPM when you assign it. It does. I'm using piping and flow for the discipline and type for those shared parameters, and then I'm just factoring by 1. On The other values, like rainfall, I'm just using an integer. Just a number and you're just multiplying by that.

AUDIENCE: And then for when you showed the gas example there, [INAUDIBLE] the caps. So are you actually having the [INAUDIBLE] for gas load. [INAUDIBLE] have the gas connector on it, or are you, as a plumbing engineer, putting on a connector [INAUDIBLE] area [INAUDIBLE]?

DEREK MAIN: So that's an either or. Whether you're working in the same model, or if you're in a separate modeling and you're copy monitoring those units, you can connect right to that gas connector. And if they have that information, it's going to populate through your piping.

If you have instances where you don't have that information, you could just take the out of the box cap family, and you could just add those parameters right into it, and rename it, and use that as your connector. Because if it's calculating that flow, you're still saving time by doing that.

AUDIENCE: I guess likewise for your plumbing fixtures. You're not using the plumbing fixture that's in the model right? Are you using capped endings for all those [INAUDIBLE]?

DEREK MAIN: You could do either or. You could do either or. It's the information in the connector that matters. I have fixtures that have the information in it. Currently the architects that I work with, I'm not using their fixtures. I would place a fixture where they have it because they don't have that information in it. If the architect puts that information, or if you can coordinate with the architects to have that information in the fixture, then you can just copy monitor them and it will populate it for you. Yes.

AUDIENCE: Are pipe fittings inherently bidirectional or does it matter where you actually start drawing your pipe? Does it assign that as one end or the other, or does it necessarily matter?

DEREK MAIN: Pipe fittings are bi-directional. Most accessories are. You'll notice that connector settings may not be set correctly. If you're grabbing manufacturer's content, that's where you'll notice that there's issues. So any time you grab something from a manufacturer, you want to open it up, check everything and make sure it's how you need it to be set.

AUDIENCE: So when some of those piping fitting in [INAUDIBLE] files you see online. I think [INAUDIBLE]. Do you have any that you'd recommend or any that you know of that are good fittings? Or are you saying across the board [INAUDIBLE]?

DEREK MAIN: So for fittings, I use the Autodesk out of the box fittings. Whether it's the DWV, or the generic, whatever it may be, I'm not using manufacturer's content for fitting a pipe. Most of our projects are design intent. We have some where we're getting more towards a actual construction document that a contractor would use, but for the most part they're design intent. So I'm not too worried about that. The out of the box stuff that Autodesk has, it's close enough that it works, and you can get your coordination where you need it. Yes.

AUDIENCE: [INAUDIBLE] fixtures where depending on how you [INAUDIBLE] they each have a different fixture count?

DEREK MAIN: So if you had a different fixture count for different water closet that would be a different type in the family.

AUDIENCE: So there's no way Revit will know [INAUDIBLE] go in and tell it this water closet [INAUDIBLE]. And so on and so forth. Would I automate that somehow so that Revit knows, hey I have so many water closets. The first one should be X, the next one should be Y, the next one should be [INAUDIBLE]?

DEREK MAIN: OK, so for that, when I'm doing designs, I'm not doing that. It's this water closet is this many fixture units. It's that GPM value that changes. I think that gets into where a lot of people see issues with the sizing calculator in Revit. That it's not always accurate, and that's because, well it's oversizing this pipe that has a half GPM going through it, or many instances like that.

AUDIENCE: [INAUDIBLE]

DEREK MAIN: That would be a different type. For my work process, I don't run into that.

AUDIENCE: And unfortunately [INAUDIBLE]

DEREK MAIN: Gotcha. So different guidelines for sizing. Yes.

AUDIENCE: You also said that you generally set the connector to be hydronic supply for several instances you had pointed out. Does that impact let's say, plumbing template you can have several different piping systems defined in that template. Will that connector being set to hydronic supply matter if I'm doing domestic cold water, hot water, gas, or some other random, let's say filtered water system I have that helps me with graphics and you showing [INAUDIBLE]. Does that impact that?

DEREK MAIN: So you can duplicate the system types, but it's still going to be set to that other system classification. So you could duplicate the hydronic supply, and you could call it natural gas. That connector still needs to use hydronic supply for the system classification. So if you click on a pipe, you might see where the system type it will say the natural gas. But your classification, it's still going to be hydronic supply. Any other questions?

AUDIENCE: The fact that you might use Dynamo to do some of these things to increase your workflow. I guess you would just grab the [INAUDIBLE] on your architectural model. That would give you your roof drains that are [INAUDIBLE]?

DEREK MAIN: So with Dynamo, you'd have your spaces that are in your family. So you would have your space separators, or whatever you make. Most of the time when architects, they create their roofs, they're not doing it based on each area with that drain. They're doing it however they want.

So they use space separators to create that space, and then in Dynamo you would get the area information from the space, and then you would set that to the parameters in your roof drain that it finds in that space.

AUDIENCE: So you still have the drawing space [INAUDIBLE]?

DEREK MAIN: Yes, I'm drawing spaces in the roof. But it's easier than printing it out and measuring it and everything. Dynamo-- I'm still learning it. I'm using it for some items, but still learning that one.

AUDIENCE: There's a lot of power in that program [INAUDIBLE].

DEREK MAIN: Yes.

AUDIENCE: On the gas [INAUDIBLE] you have. Just my other question is if I were to-- I have a linking mechanical model that has [INAUDIBLE]. Shared parameters that are linked to [INAUDIBLE] schedules. So we have a parameter that shows, this is the gas flow. Will that still talk to my model and tell me what the flow would be in that pipe, or is that [INAUDIBLE] schedule. It won't actually be added into the pipe system to control gas flow?

DEREK MAIN: Well, first you have to make sure that that parameter is what will work for you. That it will work properly, and they're not using a project parameter or something. And the other thing is you have to be able to connect to it. If you can't connect to it, Revit's going to think it's an open ended pipe.

All right. Thank you.