PETER INGELS: So what we will do today is have an overview and, at some point, a fairly deep dive look at how we can modify the standard software, which is InfraWorks 360, to accommodate local requirements a little bit better. So there are a couple of learning objectives, which have been announced in the class description as well. So I'm looking at pure InfraWorks 360 functionality within the roadway design module within the drainage module.

So it's not about doing general style things so the road looks like a Belgian or a German road. Now it's really growing a little bit deeper into the configuration of the software. So we will focus and dive into a lot of text files where you have to modify values and some sort of C++ code. So it can get a little bit advanced.

So the handout, which I've written, should give you a lot of explanation on the different steps that I'm doing. I probably won't have enough time to show everything which is written down in the document in full detail. So that's why you have the handout.

So for those who have downloaded the handout sooner than yesterday, there's a new version available on the website. I've updated the presentation this morning. So I would recommend going back to the AU site and download the updated materials. So the reason for that is that a presentation is only finished when it's done. So it's always work in progress.

So design rules is the first part. It will be a big chunk of this session. The second part is looking at Project Kameleon. Who of you is familiar with Project Kameleon? OK, so this is the new way of content altering for InfraWorks, as well as Civil 3D. So we obviously will make the link with Civil 3D as well. And we will focus on the pavement side of things.

So last week, on Tuesday, I believe, there was a new version of Project Kameleon released, which can do much more than what I will cover today. There's also content for bridges and pressure pipes in Civil 3D as well. So I'm also covering that. It was a bit too short notice to take that in this class as well.

And the last part of the session is about the analysis. So you know InfraWorks offers a lot of analysis tools. And one of the things is if you have a pavement drainage network done with a drainage module, then you can expect a performance based on rainfall information.

If there's one thing which I've learned over the years running around in northern Europe is that

every country has different requirements with regards to the amount of rainfall used to test the network against. So I'll show again how we can modify the files in the background of InfraWorks to accommodate these specific requirements.

OK, so before we all do that, I would like to say, give it some consideration before you begin-- do you really want to do this? And if you're not completely sure about it, don't do it. It's fairly simple.

Why? It's quite difficult. We release a lot of new versions of the software every quarter. It might happen that we change something in the back on this configuration file. So there is a risk of having to redo these files.

Do we really need localized standards? And I'll dive a little bit deeper into that later as well. If I look at the AASHTO 2011 metric standards that are available within InfraWorks 360 at the moment, and I look at the local design rules we use in the Benelux, they're fairly similar. And as a roadway designer, I know what minimum radii, radius, I need to use, what my spiral lengths are. So I can modify them manually as well.

So just a little warning-- give it some consideration before you start doing it. Obviously, I see a value. Otherwise I wasn't doing this class, right? So that's fairly simple and clear as well.

So let's talk about the design rules. And as you can see here, there is no user interface whatsoever available to do it. So we will be doing some geeky stuff on copying files, renaming files, modifying formulas in the files. So I will jump from PowerPoint into doing it live. So I will show you live how it works. So that's my challenge for today.

There is no way of debugging the things we do. So when do you know something goes wrong? When it crashes. So if I do something wrong in the session because I forgot something, we'll probably see a crash. So be warned about that. It's trial and error. So that's what we're going to do in this session as well.

So basically what you see is if you look at the design rules for the roadway, which is defining the minimum curve radii, or radius, the minimum spiral length, the vertical curve radius, and that kind of stuff, we need a couple of files. And these files are all located in a specific folder.

So for people who have done some configuration in other Autodesk products will remember, or will recognize, the part locations, the program data, Autodesk, InfraWorks 360. And then we go into Resources, Standards, and Roads.

So let's have a look. So if you look in this folder, you will see that we have a series of files available. And if I look into InfraWorks, and I go to my model properties, you will see that I have these files here, or these design standards here as well.

So as an example, I have added the Dutch standard file here as well. So that resonates with these files we have here. So if I want to create my own localized design rules-- I'm a bit lazy. I'll probably want to take what is existing, copy it, modify the things in there. That's much less work than doing it from scratch.

So saying that, I'm going to take the AASHTO metric 2011 template, very advanced functionality of Windows-- Control C, Control V, very, very high end functionality. Obviously, I want to rename this file to something that's more useful for me. Let's say that we will have an AU 2015 metric design rule now.

I have to rename that. Then I have the other copy here, rename it. Be a little careful. Because it puts the copy after the .template. template So don't make a mistake. Because every little mistake-- and if it's not 100% correct, it won't work, simple as that.

OK, AU 2015 metric-- voila. That's all done, you might think. I'll go back to my InfraWorks environment, Model Properties. It's not there. Damn. What did I do wrong? I'm just fooling around. I know what I did wrong.

So this file is not the only thing you need. So this is kind of the container that you need to have the standards available. But it needs to point out to other files in here as well. So in the Design Standard subfolder of this location, you have all these different files as well.

So I'm going to take the CLP files of the AASHTO metric ones, because that's the base of my standard, do the advanced Control C, Control V again, and rename it as well. So again, be careful about the naming. It needs to be exactly the same-- so I'm making a mistake-- as it is as the files in the previous folder. So it's not at all sensitive in syntax. It's really, really, very sensitive. OK, again, don't forget the copy, and do AU 2015 metric.

This is not the last step. I still need to do one more step going back to my-- let me check if this is right here. OK, going back to the previous folder, go to my AU 2015 metric template file, open it in Notepad, and make the reference to the correct CLP file. AU 2015 metric, File, Save, and now, if everything's gone well--

AUDIENCE: What about [INAUDIBLE]?

PETER INGELS: Sorry?

AUDIENCE: [INAUDIBLE].

PETER INGELS: Yes, the AU 2015 metric one will be my local design rule. So we're also referencing to quite a lot of different files with definitions, for instance, saying that we have speed tables, that we have common definitions for sight, passing, and distance, and that kind of stuff.

So you can go all the way to modifying and creating local copies of this. But one of the things I learned by doing this is that most of the standards used are common base. So in this standard, to accommodate my Benelux design rules, I don't need to modify all these files. But you can if you want. So this is references that we also need for specific parts of the calculation, basically. It's kind of general formulas we use and definitions. That's all, OK?

Having said this, going back to my model properties should give me my AU 2015 metric-- woo hoo, first steps taken. And I'm making some fun about it. But it's very sensitive in what you do and how you do it.

On the naming conventions as well, one of the things you can do is start with a letter going further than the G. Because behind G, you have I. And that's the first letter of "intersection." So we have intersection standards in InfraWorks as well. So they've limited, really, much to all the files starting with an A until a G. You can have small, capital ones. You cannot start with underscore or dollar signs. So it's very, very sensitive. Numbers, although, are allowed.

So what I would try to do is because NL standards-- that's an N. I try to do underscore. It's not working at all. So you need to have-- there's some restrictions, let's say, to make that happen. Good, so now we basically have set the framework. And now we want to deep dive into the actual design rules itself.

So if you look at the standard design road AASHTO metric design rules, then we have, for the collector road, a standard design speed of 60 kilometers an hour and a minimum radius of 135 meters. One of the things that I always use to see what's happening is if you have the design road itself, and you look at the curve properties, it's always telling you what design rule it uses for the minimum radius, and also for the maximum radius.

The maximum radius normally-- as it says there as well, it's probably not very clear. It's using

the maximum possible radius based on the geometry of the two tangents. The minimum radius is defined or derived from the AASHTO design standards. So that's what we want to change in this case.

So looking at the Dutch standard, for instance-- and I've only taken one specific type of road. If we have the collector roads, or the type of road in the Netherlands, then we have also a possible design speed of 60 kilometers an hour. And then we have with a given super elevation of plus 2 a radius of 150. Obviously, if you have a bigger super elevation, you can lower the curve radius, right? So if you drive on a road like this, and a curve, then you need a bigger radius to not get out of the curve. If it's super elevated like this, you can bring the radius down.

At this moment, InfraWorks doesn't support super elevation conceptual design. So we have to make a guess or a decision for what super elevation we will create the design rules. I don't see that as a problem. It's just something we need to decide, which you need to be aware of.

So my minimum radius, what I want to target, is 150 meter radius. And again, this is not that much different from the 60 kilometers an hour and 135 meters, right? So that's why, again, consider before you start doing all the fiddling around with the files and see if it's really necessary.

Good, I found that. So from looking in the design standards, this is how they are built. This is how they look like-- very human, readable language. Not. There are a couple of things. If you look at how a minimum radius is being calculated-- and I'm going technical now. You always need, or you always have, the design speed.

You have something like the super elevation as part of it, as you've seen in the table. And you have probably some factors, a side friction and all that kind of stuff, that determine the calculation or that helps the formula. So I've highlighted in the documentation and in the slide which of the portion of this design file are important, where you have to look at if you want to change that information.

So going to the file itself, I have my design standards. I'm working in the CLP file, not in the template files. I'm in the actual CLP file, which is the design standard as well. So just to run through quickly, we start with some global variables, like, what is the default lane we use when we do calculations? 3.6. What is the driver eye height if you want to check against visibility? These are all kind of standard formulas.

A very good tip I would like to give you-- if you change these values to, for instance, 1.1, which we use in the Netherlands, then also do it as a comment where in the documentation it is so you can always find it in the document itself, in the technical description, what parameter to use, where can I find it. Document your design rules.

Everything you put behind a semi-colon is comment in the CLP files. So it's very easy to add your comment, your descriptions. Please do. Otherwise you will never find back what you have changed compared to the standard AASHTO files. I'm probably a little bit too lazy for this session. And restricted in time, I probably won't do the whole thing. But please pay attention on documenting the changes you make.

Then there are a couple of [INAUDIBLE] definitions in here. The thing that is becoming important is, find the default design speed. So what I like about these files is that they are already well commented. So it's fairly easy to find the sections in the file you need to start modifying. So for the local roads, we have a design speed set at 45. There's a lot of text between it. But basically that's what it says.

And believe me, I can't program C++. I can't understand half of what's in this file. I just tried something, and it seemed to work. I was lucky, I guess.

For a collector road, we have a design speed of 60. You know when you do a road, you can modify it as you go. You can modify the speed as you go. But the default speed is set in here. If you change it to 50, it will be 50 in InfraWorks, simple as that.

The second part that's important-- ahh, minimum radius. That's what we were talking about. [INAUDIBLE]? OK, thank you. So we have the minimum radius. And so if you look at these files, what you have to look at-- the minimum radius. There is the design speed, side friction factor, emax, and minimum curve radius. So these are all the parameters of the variables that are being used in the formula.

And the bottom line, the [INAUDIBLE] question mark [INAUDIBLE] 127.0 plus asterisk 001 emax blah, blah, blah, that's a formula, OK? So now we can start modifying these values to get to where we want to be. So we are using variables-- the side friction factor, the emax. So they must be defined somewhere else. And that's coming back to the question you asked earlier, Tatiana, is that it's probably somewhere in one of the other files where you have to look to these variables.

So the emax, for instance, is in the AASHTO_2011_Definitions.clp. So going back to my design standards, you see that we have the definitions and the common rules CLP file here as well. If you look at the definitions one, you see a couple of slot values. And it says, slot emax is a range between 0 and 12. And the default is 6. So the value of 6 will now be used in the formula in that other file.

We have a choice to change the value here. Or we change it in the formula. So at the moment, we don't have possibility to easily-- it probably is possible if you go much deeper than we go today-- have the different options for the different emax values. So this is where you have to change that emax value.

I'm a bit more lazy. So I'm going to change that value by 2.0. Because that's what I decided to do. Remember that this formula is being used for every type of road for every design speed. So I'm actually limiting the flexibility a little bit. But that's what I want at this point.

And then I look at this formula. And I say, well, there's a parameter of 127 and a couple of other values. If I look at the formula for the Dutch design roads, which are in the documentation, it's the formula, this one here. And that doesn't look at all at that formula in my design rule. And I say, well-- and I tried modifying the formula and writing something like that. And I get the mentioned crash. It was not working.

And then I thought, well, let's have a look. But basically-- and I've checked against a couple of design rules. And they put formulas in different ways. But they all come back to very similar formulas like we've seen in the design rule itself. So there is a way to convert that rule there, and the Dutch design rule, to something that's very similar in the standard file.

So that's kind of the result-- yeah, thank you. That's kind of the result. I have a new co-speaker, which is Richard. So this is the Vo squared divided by 127. It's kind of the transferred or the rearranged formula. So it looks very much like the same formula as we have in the design standard.

So the last thing we need-- I have the formula. I have the design speed. I have my emax. And now the only thing I need is a side friction factor, right? So where can I find that? Well, I can find that in the same file, which is the CLP file we're talking about. Going back to it, this one, at the bottom of this file, you see the speed tables.

So for those who have ever done Civil 3D design rules-- I don't know, are there other people in the room who have done Civil 3D design rules? This is the only thing that's similar, the speed tables. And here you can modify the values to the side friction factor.

And these values, again, come from what you did of what you have in your design handbook and a table. And you just have to modify them. It's simple as that. And again, you can then modify the formulas to accommodate the same values. And then if you use InfraWorks, you get it done.

So let's try, if I can make it work. So I need a side friction factor of 0.69 instead of a 0.15 for my design speed of 60 kilometers an hour. So I'm going to my metric, 60 kilometers. And it's 69. And you probably have different values for all the speed tables. I've done the complete converted tables as class material for this class on the website as well. So I'm just doing bits and pieces now, showing the result. And that's where we go.

And probably in my documentation, I wrote that I want an emax in my formula-- going up-- of 5 instead of 2, File, Save. How do you test it in InfraWorks? Fairly simple-- at the moment, in my model properties, I'm AASHTO metric 2011 if I do a design road.

Again, this only applies on design roads, not on the sketchy roads. So if I do a collector road with a given style, you see in my cursor now I have the design speed of 60. Coming from that file, if I change it to 50, that will be 50. I can modify it and then double click. I have that radius going here, curve radius of 135, as the AASHTO design rules specified.

And again, showing the minimum value comes from the standard. The maximum comes from the geometry. So the only thing I need to do now is go to my model properties again, change to the AU 2015 metric design rule. I can do that on the fly. I don't need to reopen InfraWorks.

In Civil 3D, every time you change something, you have to close it and reopen it. So it's much easier, the process now. You just change the standard, do a new design road, which is a collector road, in this case. I'm going to take the same style.

My design speed is still 60. Because I haven't changed it. Double click-- if I look at my curve, now it's 130. Why is it not 150? Because I changed my emax from 2 to 5. And in my design rule going up here, if it's a 5, I have 130. Yeah, I'm messing around with your minds a little bit.

I changed it to 5. If I do 2-- I'll do a 2 for you guys. 5, File, Save, go to InfraWorks again. This will not recalculate all the existing roads, obviously. Because design roads are only applied

when I create a new road.

So if I delete this one, create a collector road, doing this, doing this, you have 150 now. That's how you do it-- easy as hell. So that's how you see what the impact is of modifying some parameters. Paul, you have a question.

AUDIENCE: What happens to the reverse design problem?

PETER INGELS: Ahh, that's a good question.

AUDIENCE: Does it stick to the clearest definition file?

PETER INGELS: It sticks to the AASHTO 2011 file. So the one that's active at the moment you create the design road will be applied to that. I even think you can modify that design rule at some point. Not here-- I thought there was an option. Or maybe that's something for the future. Probably I'm mixing up future features and existing ones.

AUDIENCE: [INAUDIBLE]

PETER INGELS: It affects all speeds at the same time. So this is conceptual design. That's another thing you need to be very well aware of. It's not going in as much detail as Civil 3D at the moment. So that's why, again, I asked the question, are you really sure you want to do it? Because we will get to a certain level, but not at this point to the level where we are at Civil 3D.

But again, it looks much closer. And these rules are fairly similar. But if there are bigger differences between the design rules, it at least gives you a more local look and feel of how it works. So this is the process you have to go through. You look in the files. You see some parameter. You look in all the files where these parameters are modified values, look at the design standard, rearrange the formula so it fits the formula you have.

If you can't make a match, you probably have to write a new formula. But then you need to know the language a little bit more. I have put some references in the documentation to websites I believe you can find documentation on the language being used in these files if you want to write new formulas, create new valuables, and all that kind of stuff.

So this is the topic on the roadway design rules. In my handouts, I've written down about 20 pages about this describing every single section. So this is a very simple example. If you go into the spiral lengths, it's a whole other discussion. There's much more to it. Because by

default, the spiral lengths are calculated based on super elevation runoff in the AASHTO standards.

What we do in Europe is the runoff length of the super elevation, we make it match with the spiral length. So I had to tweak bits and pieces and change variables in the file to make it happen. But it's all really well documented in the documentation.

If I start explaining that now, I'll probably have no time left for the other topics I want to cover in this session. So there's quite a lot of material available to have a look at. And you probably can get my email address if you have questions about it later on as well. Does it make sense? Useful, not at all useful? Good. I told you, consider before you start. Good.

So that's what I meant. If you want to have the minimum spiral length for highways, for instance, that's all written down in the documentation. Project Kameleon-- very excited about that little tool. Well, not so little, actually.

Who of you has ever used Part Builder in Civil 3D? Who loved it? That can't be true. Nobody loved it. It was a nightmare to use. It still is a nightmare. Yeah, it is, obviously.

So this is kind of the next version of Part Builder on steroids. It's the new way of how we will create content. And this class is around InfraWorks 360, mainly. But the content we make in here for the pavement drainage, at least, is usable in Civil 3D as well.

This is very important in the sense that we have that workflow between Civil 3D and InfraWorks 360 at the moment. So there's been quite a couple of sessions this AU explaining how these two work together. For pavement drainage, if you have your custom parts, which we will have a look at later on in the session, then they can be used in InfraWorks.

But what you want, if you bring that information into Civil 3D, that you have the exact same part in Civil 3D and not looking in an existing catalog with other parts and make something up, really. So you want to have the exact same content in the two systems. And that's what Kameleon allows you to do.

So I'll describe the process of how you make a new part. What do you need to do to bring it in InfraWorks? And what do you need to do to bring it in Civil 3D? And that's the part of the documentation that I updated yesterday because of the new release that came available.

So it's a labs project, for those who don't know. I saw a couple of people already knew it. But if

you go to the labs.autodesk.com, then you come to this site, where you find Project Kameleon. You need to join that project. You need to request for approval, or whatever, to get in.

So you use your Autodesk account for that. And then you have the page describing what this-- Project View, you can download the tool. So an important thing to say is, this is version 4 of the Project Kameleon. The ones of you that already used Kameleon before the 15th of November, that one will no longer work.

Because they are labs tools. They're time bombs. And we had the idea to release it half a year ago as a full product. But it didn't happen. So it's not yet graduated from labs.

So you'll need to download the new version from this website to work with it today. And as you can read on the bottom of the page, I believe, it is time bombed March 15 next year. So that probably is the new aim of date where we want to release this as a full available supported product.

What I will do in this session is talk about a basic flow, how you put a part together. I'm not going to touch on creating completely new shapes for difficult and exotic forms. Because that requires you to learn Inventor.

The content building part is based on Inventor OEM. And I thought that might be one step too far for you guys, or actually me, to go through that today. So there's a lot of good videos on the lab side as well explaining how you have to create the content and what you have to take care about with regards to parameters if you want to make it work in InfraWorks.

And another reason why I don't go into the shape modeling is because, if you look at pavement drainage, how many different shapes do you have? And the catalog we have available in Kameleon is quite a lot of elements in there. And it's probably more about part sizes rather than part shapes that we will need to modify.

So the aim is with existing shapes-- rectangular, circular ones, conic, whatever manholes you have-- how can we add dimensions or sizes to these elements that are not available in the standard catalog? If you want to go into shape modeling, that's a whole other story. So if you haven't tried it, that's where you have to be. Then again, as I said, version 4 is available.

So again, this is saying the exact thing what I've already told. So you will see that there are two parts or two icons on the desktop, and you've installed it, which is the shape modeler and a parts editor. If you want to use existing elements and just change the dimension, it's only the

parts editor you will need. That's the only thing you need. And that's very simple to use as well.

So in the handout, I've written kind of an exercise. Do this. Click that. Do that. So you can learn it yourself as well when you get home. But basically what happens is the structure of a pavement drainage part-- and I'm talking about the manhole. I'm not talking about pipes at the moment-- exists of three elements, which is a grate, an inlet frame or a surface frame, we call it, and the underground structure.

You need to take these three elements and then combine them into one combined assembly, assembly coming from the Inventor rule as well, so just picking elements, adding sizes to it, and combining it and so one. It's not much more difficult than that. OK

So what I want to do for this session is look at a rectangular inlet, which specific sizes we use in our region. And again, these are the three elements. You see that a lot of parameters, a lot of variables, we have to add values to, we have to take care of. But again, it looks more complicated than it really is.

So this is the workflow. Assemble the parts. You have to validate the parts. And then you have to do an additional step to publish it into InfraWorks and into Civil 3D. And then we can use it and do some nice things with it, which I will show off as well. This is a part we will create.

And as you see at the section, there's quite some detail in there. The question is, do we need to go to all that fine little detail? I don't believe so. I want to have a rectangular shape with a grate on top of it. And I want it to have the correct dimensions.

I don't need to have that little diffusion in the middle, or that little element separating the waste from the other water. At this point, we're doing conceptual design. That's not necessary. But I like to have standard sizes that are realistic for the region I'm working at. So this is what we're going to do.

I probably won't need that anymore, and that, and that. So as I said, we have the two icons after we installed Kameleon-- the shape modeler and the parts editor. And I'm only using the parts editor. This is how it looks like. And those who have used version 3 of this tool, it look much less. Because we didn't have the pier British abutments and pipe fittings. That's all new for this release.

So it's quite cool. Because we have quite a big library now of pressure pipe content. Civil 3D

normally ships with a fairly limited catalog of pressure pipe content. So we will create the pressure pipe content for Civil 3D in here as well.

So I'm not sure if I am allowed to say it. But we will have a production pack too for Civil 3D coming out at the end of this year, which will contain all these pressure pipe things. So that's why we already put it in Kameleon as well.

But the abutments in InfraWorks, if you have the bridge module, the piers, the foundations, you can all make them here with this tool as well. So if you like very exotic curved piers and abutments, that's perfectly well possible to do in this technology as well. So again, this is the way forward. It's a very common platform for the future to create content. So obviously, I'm going to focus on the pavement drainage in this session.

AUDIENCE: [INAUDIBLE]

PETER INGELS: I have no idea. It will be a standalone installation, obviously. But how it will be offered to the customers I have no idea at all. I don't know if we know. So that's why it's still labs. We have to wait for that. I don't know, honestly don't know. If I would know, I'd tell you. But I don't know.

So one of the things, again, when you do modify catalogs-- there are two ways of modifying or adding content-- is by modifying an existing catalog or creating a new one. For those who used version 3 and 2 of Kameleon, there was only one option-- adding to the existing generic catalog, which I don't like. Because when you mess it up, then it's broken. And you have to make backup files.

From this version, we can create a new catalog, just publish it to a model, and it works as well. So it's a bit more safe. So we don't have to save or back up files from the generic catalog. Because I don't want to touch that at all. So what I'm going to do is I'm going to create a new catalog. And you see we can do drainage, piping, bridge. But stick to drainage, Create, and give that catalog a name.

Very obvious AU 2015 name-- we can do a description. And very important-- choose the units. If you start in imperial, you have to continue in imperial. So I'll definitely want to have my metric ones. That's just because of me.

And basically here you come into the part assembler, or whatever. So you see that there are a couple of things here on the top and a couple of things here on the bottom. For those who

have seen the drainage module in InfraWorks, if you want to have the culverts for the, how do you call it, watershed areas, then you can create new geometry in here as well. All the other stuff, the structure and the assembly part, is for the manholes we are working in.

So basically it's fairly simple. I have the three elements I mentioned. Surface structure and the ground structure and the grates are covered. And I'll create a new one. New, I give it a name, AU 2015, Next. It's just a wizard. And this is all the shapes that we have defined for you.

And I can pick one. I like this. But if you want another one, you can do that as well. If you want to have a new shape template, this will then open that shape modeler. And you have to do a lot of difficult stuff in Inventor to make it happen. So this is already very complete with regards to the different shapes you might need.

Next, then you have to say, OK, which is the form, some metadata, really, some documentation on the part. It's a rectangular one. It's a curb inlet. That's an important part if you want to do inlets.

If you do channel manholes, you don't have to do it as a manhole. But this will define in InfraWorks where it comes. You have the inlets and the manholes as two separate items in the catalog. So it will define where they come.

You can add a description, materials, whatever you want, really, if you want to. I'm lazy, as I told you. So I'm not doing it. And here is the part where all the work comes in where you have to create the different dimensions. So I'm adding a row. And my mouse died again. OK, there we go.

And what I'm doing here, I think I'm doing a 450 by 300 and a depth of 60, or 600. So it's fairly manual typing. So there's not much automatic going on. So this is what you will see in the catalog. If you have it in InfraWorks, this is kind of the name that will pop up.

And I'll do it again for 50, 300. If you have information on the weight, on the weight unit, on all these parameters, you can add it to the catalog. But it's not required. The fields that are required are indicated with an asterisk. So this is really the values that you need. Because that defines the geometry and the dimensions.

So I'll start with the girder slope. In this case, it's full flat, so 0 slope. The cross slope is 0. The SS length-- and basically if you want to know what this very cryptic variable name is, just go over it with your cursor. And it explains you a little bit what it is. It's the length of the inlet. In my

case, it's 450.

The width of the inlet is 300. The height-- and it's the height of that little frame. In my case, the height of the frame is 25. And these are all values in millimeters. What's the wall thickness of that frame? In my case, 20 millimeters.

And then you have other lengths and widths. And then you have other lengths and widths. So I was a little bit confused the first time I used it and said, well, what the hell is this all about? Again, if you go with your cursor over the top of the column, it gives you a little bit explanation. So the initial value should be entered with the lengths, the exterior lengths. Now we're adding the lengths and the widths of the opening.

AUDIENCE: [INAUDIBLE]

PETER INGELS: I completely agree. It's Thursday morning, day three or four, or whatever it is, of AU. And I have to calculate what 450 minus 2 times the wall thickness, I guess. Thank you very much. That's 410. Same with the width-- 300 minus 2 times the wall thickness. And I'm very lazy. I'm going to make it 25. That's much easier in calculation. That's 250. The height is the same.

And basically what it says-- here it is. It's another property that will be calculated. But my testing experience from yesterday learned me that if I don't fill in this value, we will have the name crash, which I was mentioning earlier. So I probably want to add it in here. And it's the same as the SS length, as the external values. Don't ask me why we have to get at it like this. But that's the way it works. And I know if I do this, it will work.

And now I can add as many rows, as many sizes, that I want. Done this, Next, and then you see the visualization of that element. If you have the different sizes or dimensions, then you will get a list. If you click on an item and list, the visualization will--

AUDIENCE: [INAUDIBLE]

PETER INGELS: The corners and the centroids, I have no idea. Well, there's no group editing allowed in these kind of--

AUDIENCE: [INAUDIBLE]

PETER INGELS: So this is the surface structure. So that's one third down. Now we have to look at the underground structure. And we have to look at the grate itself as well. I kind of like to do a

Save at this point. And the ground structure is the exact same process-- New. I call it AU 2015. And you probably want to give it some proper names, but just as an example.

And again, you have these different predefined underground structure shapes. Again, if you want to have a new one-- but I'm more than happy with this rectangular one. And then it's all the same, which is the base form, rectangular. I can add materials. I can add descriptions, and so forth and so forth. Next, and I have the same exact thing as I had in the previous kind of wizard, where I have to add dimensions.

And I'm repeating myself now-- 450 x 300, 450 x 300. And then we go all the way to the parameters with the asterisks. Because that's the one we need. What is the total length of the structures?

AUDIENCE: [INAUDIBLE]

PETER INGELS: You have to add it here. Otherwise you see a dash 1. So that's not calculating automatically. So it's a fairly manual process at the moment, adding the things you want it to look like in the software. So the advantage is that you can completely control how it looks like.

And it's not what you had in Civil, for instance, when you create a part with Part Builder. The name of that part was kind of a very cryptic, very long, automatically generated thing. So now it's a little bit more easy to just have it the way we want it to be.

So going back to this one, the width is 300. What's the height? I had two options-- 600 and 800. So I'll do 600 for this. What's the base thickness? So the floor, what's the thickness of the floor? 50. What's the thickness of the wall? 50 in this case.

So the wall of this underground structure is thicker than the wall thickness of the grate. And again, what's the length here? It will be the port. Structure port length is 450, I believe, and 300.

So these are the values I need. Next-- and it will be visualized like this. Part two of three done. Grates and covers-- guess what? Right mouse click, New. Guess what? AU 2015, and so on. Again, different types of grates we have.

So we also have a grate or cover type. So apparently the industry has defined different types of grates. I'm using a parallel bar grate, as you saw in my image. Again, I can say it's a

rectangular one. I can add some manufacturing information. And then, again, I can add my information again.

So I guess half of you can now do the next part of this session talking of adding these values again. OK, and then it's, again, the length. So the length of the grate is not the 450. But it's minus the wall thickness. Otherwise, it will not fit in that surface structure. So that will be a 400 to 250. And the 25 is fine. Next, and that's the representation of my grate.

So now we have actually all the components. The only thing I need to do now is go to my assembly. And then you can make a choice, again, if you want to have an inlet access structure or just a culvert. Go to my right mouse click, New. And then it will detect all the surface structures you've done.

If you have added multiple different surface structures, they will show up here. Because that's always the reference for your part. OK, next, and then you have, from the underground structures and the grate covers, to drag elements into the other two components.

If there are components in here with sizes that do not fit, then you will have a big warning exclamation mark saying that that part size doesn't fit. And you won't be able to do this-- drag it into the combination. And the first time I did it, I never read the documentation and do trial and error and then give the 450, 300 to all elements.

Now the grate needs to fit into the structure. The structure needs to fit on top of the underground structure. So they need to match very well before you can make it happen. But that's fine. I think that's not a problem at all.

Next you can define, again, is this an inlet? Does it have sump, if you have it structured? Does it have a depth below the invert level of the pipe? You can define if that's allowed or not in here. So you if you don't check it here, and if you use it in Civil or in InfraWorks, there will be no option to have a sump value.

AUDIENCE: [INAUDIBLE]

PETER INGELS: Well, some inlets don't have a sump at all. So it's not going lower than the invert level of the pipe. And definitely in Europe that's quite often used, I think. But I'll check it here. Because you will see some use of that later on.

And then save it again. And then you're done. That's the steps you have to do. If I want to go

back, I can just go to the element, double click, and go through that process again. And for some reason, in this build, the 3D view is not building up correctly the first time. So that's why I came back. And now you see the underground structure, the surface structure, and the grate all assembled together. So it's kind of a visual validation.

OK, so this is how we assemble all these things. It's not rocket science. You just have to do it. Yes, question?

AUDIENCE: [INAUDIBLE]

PETER INGELS: Yes, yes, definitely. So that's kind of one of the flexible parameters, is the actual height of the structure, which will be based on the invert level of the pipe. And then you have the sump going under it. So you'll see that in InfraWorks and in Civil 3D later on, exactly.

So now I have done my catalog. So it's now saved on my machine. So now probably I want to make it available in the different solutions, like InfraWorks, like Civil 3D. So I can go to the Publish part. And then you see the two different options.

So the previous version of this tool didn't have the Export to Civil 3D. There was kind of looking for an executable somewhere in the folder structure, running that executable, and doing a couple of things with it. Now it's a bit easier. It's available in the UI.

But before I do that, I will need to validate a couple of things. So that's where it goes. Save again-- oh boy. Luckily I already had my catalog, right? That's not working. So basically, what you get-- and that's why we have handouts as well, isn't it? So basically what you have is the option-- and I'll show it in here if you don't see it live.

So when you publish it, you have the option to just publish the catalog and have the file. But you can also add the catalog to an existing InfraWorks model. Because you know when you create a new InfraWorks model, it takes all the base information from some folders there.

And if you generate a new catalog, then you probably need to add that to that existing model. So that's the way you do it. You can choose any model. You can publish it to multiple models at the same time. But you have to select the model.

So if I click on the Validate button, that's what should pop up. And then you get the different options. When you hit OK, then you will get a report saying that it successfully [INAUDIBLE] and published yes or no.

AUDIENCE: [INAUDIBLE]

PETER INGELS: That's a very good question. And the answer is, not an automated way. So what actually happens is that validation of that export generates two files. And if you want them to be part of every new model you create in InfraWorks, you need to copy these two files in a specific folder under the C program data, Autodesk, InfraWorks 360, and so on, and so on.

So I have that written down, that process, in the handout as well. Because very correct, very clear-- if you're publishing it to a specific model, it will not be in every single model from now on. It's just publishing it to a specific model, OK?

So when you've done that-- and let's have a look. So I have my design road. You know if you have a design road, you can add pavement drainage. There are some people in the room that have had difficulties with not being able to add pavement drainage to a design road. Yes or no? No? That's easy.

One of the requirements to do pavement drainage in InfraWorks is that your road style needs to have a curb defined in it. Otherwise, you can't do the pavement drainage. So if it's not working, that's the reason why. So what I like to do-- because pavement drainage is below ground. And even if I make my surface transparent, I can't look through my road, right?

So one of the things I like to do is, before I add my pavement drainage, I go to my standard style palette. And under my road style, I have created a transparent style. If I drag and drop it on the road, you actually look through the surface-- a little tip, very simple, transparent material.

Now if I click the road, and I say, add pavement drainage, you have the options on the inlets. And that's my AU 2015 catalog. Just by publishing it to that model, it becomes available. It doesn't look like two different catalogs or just one long list of all the elements you have. But it is available. So that's my part [INAUDIBLE].

Default some of that old standard stuff in here, and you see in this part, you don't see the AU 2015, right? Because I've defined it as an inlet. If I hadn't defined it as an inlet, it would come into the manhole kind of part instead of the inlet part. So every check box in that editor has a specific reason to be there.

OK, and then obviously pipelines-- add pavement drainage. And there you go. And here you

see that the elevation-- to answer your question, again, the elevation is changing with the depth of the pipes. [SPEAKING DUTCH]. Sorry, he said a comment in Dutch. And I was replying in Dutch. Sorry for that. So the sizes of these pipes are fairly big. Because what happened, I defined the standard diameter of 500 mill as well.

So what we haven't done yet is dimension or size the pipe network based on design rules for rainfall. So one of the things I always forget is that I need to size my pipe network as well. So not sure if you know, but in the drainage functionality, you have the option to inspect performance.

AUDIENCE: [INAUDIBLE]

PETER INGELS: That's local. So the Watershed Analysis is cloud-based. But the Inspect Performance is local. So if I now select an element, then I can select a couple of other elements, this one, Enter. And it will do some analysis. It gives me, in my view, some ideas about my energy grade line, my hydrology grade line, and so on.

And by default, if you don't do anything, it's red. And so this can't be. By default, it's not good, right? So how do we solve it? Very quickly, select the designer road. And that's also a little tip. Don't select the pipe, but select the design road. Because the pipe network is attached to the design road. And there's an [INAUDIBLE] sized pavement drainage.

And it will modify my network, having different pipes. If I now do Inspect Performance, then do this, Enter, it will look blue, will give me different values. That's quite nice, I believe-- very nice functionality.

AUDIENCE: [INAUDIBLE]

PETER INGELS: Yeah, so it does it for a pipe run, basically. So it doesn't do it for all the arms coming in. It's kind of a quick inspection, too. But you can do it over the whole length. It's just a matter that I didn't want to zoom out and zoom in too much for the presentation, so very nice function in this case.

But one of the things I always wonder is, where does that value come from? I'm an engineer by education. And I don't believe what I see until I have checked that everything is correct and the way I want it. So one of the things, if you select the inlet, for instance, you see a couple of properties here.

And basically what happens in the calculation is that we use a couple of formulas. And we use the rainfall intensity, which is, in this case, set to 217.53 millimeters per hour. That's not really a value that I'm used to seeing. It's quite wrong.

So that's why we do this session. So what I want to do now is I want to change this value. I want it to be local accepted. But to give a little bit more background, again, so what happens is that that blue rectangle you see is basically to spread. All the water falling on that area will drain into that inlet.

It doesn't take care of super elevation, obviously. Because we don't have super elevation. It doesn't take care of real girders. It doesn't take care of a lot of things. It's kind of an initial, again, conceptual design. That's what we're looking at.

But that area, combined with the intensity, using some formulas, will give you the result. I'm going to first finish this workflow showing how we can modify the rainfall intensity. And then I'll show you how you can get that pipe in Civil 3D as well.

Good, so where does that rainfall information come from? Guess what? It's a file that looks like this. And it's not--

AUDIENCE: How do you find it?

PETER INGELS: I have a good network within Autodesk that can help me. If somebody doesn't tell you, you will never find that file. Because my first guess was, again, go to C program data, and then the design rules, and all that stuff. No, it's not there.

Well, it's under the Autodesk InfraWorks 360 in Program Data under Resources but under the Local Library, Rules, Drainage Design, Rainfall, and IDF. So it's actually, in this version of InfraWorks, using IDF curve information. So it's not using rain gauges and so on.

Actually, initially I skipped this part of the presentation. Because I've seen what's coming in the next release of InfraWorks. And then there will be user interface to do it. And I thought we would release it now. Because it's Q4 now. But it's somewhere in February, I believe, that we will release the new version. So I think until then, we can still use this approach.

So if you find the file, it's an AC item file and not kind of a text or template or whatever files we've been using so far. So it's a different type of file. But it's a textual file, again. And at the moment, to calculate the rainfall intensity, we use one type of formula, which is the BDE

equation. I never heard about it. I'm from Europe. I'm from Belgium. We never used BDE equations.

So I went to Google, Mr. Google. And Mr. Google gave me this and said, well, this is basically what the full formula actually is. And the intensity, i, is the parameter B, which you will see the B coefficient in the table, divided by tc. And tc is the time of concentration, plus the parameter D with an exponent E. And that was it.

So I said, that doesn't resonate with what I need. But actually, I don't care. Because I only need an intensity. So I looked at, and I added these values to the formula. And I found that 217.53 millimeters. And I said, well, to make it work for me, I just changed the parameters so I get the value I want. That's what we call reverse engineering to make something happen.

But it works. Now if I do a pipe network inspection, it has the correct values. And it's realistic for my area. So sometimes that's what we have to do, do some reverse engineering. And again, the BDE equation, if the value is too big, then you probably want to lower the value on the top, above the line. So I changed the B from 41 to, what was it, 8.7 or something, to come close to what I wanted to have. That's what we do.

I just have a number. And I wanted to have 20 millimeters or something, just to do something. I don't know if that's realistic or not actually, but just to do something. But that's the process you have to go through. Very simple, again-- you can modify it. And you can then have more realistic values.

Maybe one thing to mention as well-- and I have to check. When we do the performance inspection, I didn't mention anything at all on the analysis settings. I'm not sure if you've seen it in the file itself. But there is a parameter saying, it's a once in a year, a once in a five year, a once in a 10 year occurring storm. Obviously, these values get bigger when you have the term getting longer.

So in the file, in that AC item file, you have also the list with what for a 10 year, a one year, a five year, whatever, so you can change the values in there. And then in the user interface, you can choose what return period you want to have in there.

What else can you do there? We can do some settings on the tailwater conditions. I'm not sure what you use in different countries. But the formula for the DC plus D divided by 2 is kind of a normal accepted one. But you can set a user defined value as well, which is an elevation.

So one of the things we do with the pavement drainage is we create an outlet. So we have not shown it. But I can. So if I make that thing a little bit transparent as well-- surface opacity, OK. So basically what happens as well-- and I have to search a little bit.

At the lowest point of your network, wherever that may be, we create an additional pipe. Because that's your outlet. That's where, when you have a gravity system, your system discharges into nature, or a pond or whatever it is.

If you want to do analysis on a gravity pipe network, you need a discharge point. And the tailwater condition is actually the constraint at the end of this discharge point. Is it underwater? Is it free flow? That's making a big difference in how the water gets out of your system.

So that is what I mean with the tailwater conditions. And that's where the very simple to use InfraWorks solution becomes a little bit more industry specific and very, very detailed for specific things. But that's where it comes from, if you were wondering where that tailwater condition comes from. That's because if we add a pipe-- which is leading to a discharge point, right? Good.

Is this all clear to everybody? Again, in the documentation, I have the files. So it's all well documented. So you can redo it at home as well. The only thing maybe to add is that there is a second file, a common rules file, which define which is the standard return period. So by default, it's once every 10 years. If you want it to be every 50 years, you can set it in that other file as well what the standard return period is.

AUDIENCE: [INAUDIBLE]

PETER INGELS: That's a good question.

AUDIENCE: [INAUDIBLE]

PETER INGELS: Well, that's a very good question, which I probably am not allowed to answer. But I guess we will. So what I've seen is that we will be able to add any type of source date, not only IDF curves. But that's future stuff. So at the moment, that's what we have. We will extended over time. But that's probably something that Matthew Anderson needs to talk to you about.

AUDIENCE: [INAUDIBLE]

PETER INGELS: Mh-hm, that's true.

AUDIENCE: [INAUDIBLE]

PETER INGELS: I haven't told it was easy. So I know. And there's a lot of questions around it. So that's what we have for the moment. And that's how I modify things to make it work for me. But it's correct what you say. If I have to do a job for another state, then I'll probably have to change that value again to make it work for that state. And if I do a model for another state, I have to do it again as well.

So we're definitely making changes to that. It will be much easier in the future-- not in the past, in the future. The way we can add information on the rainfall definitely is moving forward. But at the moment, that's what we get. So that's what we have to deal with.

Good, this probably won't work, either. Because my catalog is not there, right. So last step I wanted to show-- and I'll just talk about the process. We have 15 minutes, I believe. We can export the information to Civil 3D as well. So basically it's not a fully automated process.

The result of that tool, Export to Civil 3D, is basically a series of files, which is under my C users, my user name, my documents, Autodesk, Kameleon. And then you have the Output folders as well, and the Kameleon-- no, Kameleon Export, sorry.

And that generates actually a couple of files. There's no clicking to do in subfolders and subfolders and subfolders. But again, it's well documented. It's generating a JPEG and an XML file, which you actually did. These are the two files you have to take.

And go to C, Program Data, Autodesk, Civil 3D 2016, ENU, because I'm using the English version, pipe catalog. These are the same catalogs, or the shared InfraWorks catalogs, the generic drainage catalog, inlet. And I have to copy these files into here-- simple as that. Again, it's not rocket science. You just have to know where it is.

So these files from that export just need to be copied in here. And then you can-- well, one important thing, one important thing. Let me see if I have done it here. No, so this, Control C, Control V-- well OK, that's done. Go to Civil 3D. Any template-- it doesn't matter too much.

What I have to do is to set pipe network catalog. That's what you always have to do. You can define it in your template as well. And for the structure catalog, I'm using the generic drainage catalog metric. That's the one I added these two files to, generic and drainage catalog metric,

OK.

If I would now create a parts list, it wouldn't show the AU content I've created. I need to do one little thing more, which is a very hidden command. Re-- what was it again? Pipe-- I always forget it, so that's why. Is it Part Catalog Region?

AUDIENCE: [INAUDIBLE]

PETER INGELS: Part Catalog Region-- yes, that's the one. I always forget it. Part Catalog Region, go for the structured one. It will update the catalog. And then if you now want to create a parts list, create network parts list, for the structures, add part family, it should form my inlets, add my AU one, very simple process, again.

Good it's 10 minutes ahead of schedule. That's what I wanted to tell you. So there's quite a lot of steps to take. I can imagine there are quite a lot of things we can improve.

That's the current state we have. That's how we can do it. That's how we can make people happy, to have local design rules, local content, some local validation stuff. So thank you very much for attending this session, staying until the end.

[APPLAUSE]

And if there's questions--

AUDIENCE: I've got one.

PETER INGELS: Yes.

AUDIENCE: Do you have any documentation on [INAUDIBLE]?

PETER INGELS: Sorry?

AUDIENCE: Do you have any documentation on [INAUDIBLE]?

PETER INGELS: So if you go to that Kameleon website, there's quite a lot of documentation available, quite a lot of videos telling how you have to do stuff and details.

AUDIENCE: [INAUDIBLE]

PETER INGELS: Yeah, yeah, definitely. There is a lot of information available online. So thank you very much.