

JOSCHY

Good morning everybody. I think they are coming people in, but we will see that. So, welcome to AU, first session. It's my first AU so it's my first session as well. So that's a bit strange to give the first session, but OK. My name is Joschy Rausch. I'm from the Netherlands. I work at the Royal HaskoningDHV and I'm a big coordinator. I do large scale projects all over the world.

RAUSCH:

Today I'm going to talk about closed loop life cycle management in those projects. I'm going to show you some few simple steps in the software to implement those ideas of CL2M. So yeah, I want to keep it practical. So the first part is-- in the first part I'm going to tell you what CL2M actually is, and why we want to use it, and then what kind of projects we can use it. And after that I will show you in the same time what the importance is of real time data, for example, in the projects, and then I'm going to tell you how you can implement it in the software we all are using now, and with simple steps so we can implement it.

So one of the parts is a part in Civil 3D, so we're going to look at the corridor solids, and then we're going to link all the stuff together in Navisworks, and we're going to link databases to it. So, Closed Loop Lifecycle Management. What is it? Closed loop lifecycle management is a derivative from PDM and PLM. So when PDM started, it was product data management. So it was all about a product and all the information that was in that product. Well, it was really product based, and then they introduced product lifecycle management. So all the lifecycle and the management of it was implemented for your product.

And now we are going a step further and we are going to closed loop life cycle management, where we are adding feedback loops. So all the data we have, we are going through this lifecycle, put in all various steps of those life cycles we have different data we could use. With the old march of the internet of things, we get more data from everywhere, and we want to see that in our whole lifecycle. So we want to have a look back, for example, to our design.

But I can tell you all of this in some boring slides, but I actually made you a whole world. So I make a microworld for you, and here I'm going to show you the principles of CL2M. So we have this nice world, and we have here, we have a road. It goes up to the mountain, but here we have a tunnel and then we have a bridge we have to build, but there is no bridge. So if we are going to see where we start with our lifecycle, we go to our extraction. So we need resources. So here our life cycle starts. So we have an extraction, and these raw materials we have to process.

That is our industry. So our second step is industry, and it's not-- I will tell you in a second, but it's the start of the lifecycle, but maybe not the lifecycle of our designs. I will come back to that. And if we go further, and we go to the design. So here is the design Foreman. Every day I'm sitting here at my desk making awesome drawings and stuff like this. So this is the design part, and then if we look further-- so this is the normal things we always do, and then we come to our construction.

So here we are going to introduce our first internet of things ideas. So here we can get our first actual real time data. So in the building process, while we are building, we are implementing sensors everywhere so you can see if the strains are not overloaded if you build it, or if your crane is at the right position. So your foreman can check it on his iPad if everything is going OK, so the security and safety of your building process can be made better.

And so if we then look at the bigger picture. If we round everything up, we can see that we get a maintenance phase as well. We're going to build a BIM model, and this BIM model, the design boys are making the BIM model, and they are actually getting feed loops, information loops to your factory because they want to know, OK you have to produce this, and we have looked at the construction so the construction guys know what they have to do, and we're sending it in the cloud. And I call it a building hub, but you can call it whatever. You can call it cloud, doesn't matter.

So we have these loops, and here the real closed loop life cycle management kicks in. So this is what we always do now. This is our normal way of working. So we have our BIM model and everybody uses it, but actually CL2M adds sensors everywhere, and we'll go back with all the information to our building hub, and then you get all these different life cycles from design to construction, construction back to design, construction back to factory, and so forth. So this is all those data going back and forth.

And then we have a-- and our microworld is advanced with a bridge. So that's the principle of closed loop life cycle management. And now we know what it is. Why do we need it? Why do we want to use it? So there are a few things, but the biggest thing is we want to-- and it's actually the third one. So maybe I had to put it as first, is to pollute less because we are in our world together and we want to have this will a little bit longer. So it's nice to keep it like it is, or even better.

So how do we pollute less now? We can manufacture less because we get specific data, and if

we get the feedback from the construction and we know, OK, this steel isn't good enough, or this concrete we have to change. If we know that and we get real time data from that back, then we can look into the design and think, OK, I need different materials so I can manufacture more specifics. So I can say no, I only need this because I know out of my sensor data, this is going to go a lifespan of 100 years or whatever. So that's why we need CL2M.

And the fourth one I put in, it's to create safer environments, and it's more related to the construction building, so that we can monitor everything that happens in a real time way. So we have our iPads or whatever, and we can see what is happening, and where unsafe things are going to happen.

So we saw what CL2M is, why we need it. Yeah, but how do we get the data in our lifecycle? How are we going to do that? And I have put on two methods to get it, and two methods to distribute it. So actually, the first one is RFID, Radio Frequency Identification. Those are simple tags. It's the same as that you go into your building and you log in with your key card, and you get access to your office. Those are cheap. There are practically no costs. The limitation of this method is the range.

So for example, if I was inspecting something on my building site, then I could as a contractor, go somewhere and just scan everything, and see if it's OK or not, but then I would need to be physically there. So for some situations that's really difficult. If you have a bridge of 100 meters high, you can't come everywhere obviously, and you can't always reach all sensors. That's where the second part is coming in.

LoRa is Long Range Low Power Network. It's actually just a Wi-Fi, but really low in power consumption, and it can put data everywhere. And in some countries, like in the Netherlands, we have LoRa all over all our country. So you could actually just put in and go to your AT&T, for example, look in America. And then you can say, oh, I want to make use of the LoRa, and then you can use it. So that's the two ways you could get your data from your site back to the internet, to the cloud.

And then it will be stored in a database. So you could set up your own database, and it could be as simple as an Excel or Access. That's the most simple part, and I'm going to show you how you do that. Or you could use it a SQL database of whatever kind you would like, and you could set it up on your own server or what you want. But the most advanced way now we have, is to make use of a cloud solution. You can buy lots of IoT Hubs, Internet of Thing Hubs,

and then everything is in a cloud. So it's all automated and you get it back, and I will show you how you can do that as well.

So what sensors can we use in a maintenance phase? I'm not going to read all of you all of these, but the list is endless. You can do whatever you want with sensors nowadays. Today I'm going to look at displacement sensors in a tunnel, and we are going to look at steel tension bar in bridge sensors. So why is it important? Now we know what it is, why we need it. We get our data, but why is it important to implement it in the early stage of our projects?

So we need a framework. We want to know where to put our sensors because yeah, you can put sensors everywhere, but if you do that, then all of a sudden you don't know anymore. You get that much data, you don't know what you have to do anymore. Second part is you want to define what to improve. One solution is OK, we are going to do a lot of sensors, and then we get all the data, and then we see what we have to change.

But the other approach is I want to know and I want to see what I have to improve. So I can define, OK, I want to know now which concrete I want to use. So then you can do that. There are cases that we have a lot of sensor data already available. So we could actually learn from that and build from that. So this is actually if it's already implemented.

That's last one is IDs, IDs, IDs. This is in our BIM working ways, we need codes everywhere, or IDs because that's the way stuff will get recognized what it is. So you're in the design stage. We are going to state which idea is where. You want to do it at very flexible, but you want to say now OK, this is your ID, this is your sensor ID, and this is the same everywhere. So it's very important to know that you have to do this in your design phase. You want to do it in your design phase.

So what do we want to do with our BIM model then? What are our BIM goals? We can state a BIM execution plan, what we want to do with our BIM model. I want to see where stuff is. I want to say OK, this sensor will go there. This sensor has these coordinates. It has to be placed there. So the contractor knows where he has to put the sensors in. I want to sort and separate. I want to search in my model, and I want to search for my IDs. I want to know where it is.

The third part is I want to see the real time data. I want to click on something, and I want to see what actually the sensor is measuring, and I want to see those values come up in my BIM model. And the last part is I want to visualize my data. So I want to have easy tools. So I push

a button and I see all right, here it's not going as planned, or here it's not anymore to the requirements I wanted to have. So that's the visual side of our BIM model.

Now we know what we want to do in our BIM model, and now we are going to look at the steps how to get there. I myself, use a lot of Civil 3D, so I thought I'm going to do it in Civil 3D. And then in Navisworks we're going to see what happens. So I'm going to show you a project, and I'm going to do it real time. If anything goes wrong, it's the computer. So

We have this junction from a freeway, and it's really congested, so we have to change stuff about it. We're going to destroy some. We're going to build some new roads, but we're not going to focus on that. We're going to focus on a modular bridge where we're going to look at the tension from the steel in it, from the pre-stressed parts, and we are going to look at a modular tunnel.

Why modular? All the building blocks we are going to use are prefabricated, and put in. So we have tunnel segments, and we have bridge segments, and it's easy to put in. And in this way, we can easily put in IDs and allocate stuff. So how do we get there? What are steps in Civil? And after all this presentation, I'm going into it real, so don't fall asleep, please.

So first, start a Vault project. We do all our work in Vault to have everything in one location. So we have our document management system, and then there we are going to state everything. It's not entirely true because our databases aren't involved, obviously. They're on the cloud, but all our engineering stuff is actually involved.

So the second thing we are going to do is we are going to create subassemblies. This is the first part, where we already are going to say, OK, here has to be a sensor, and here I'm going to incorporate my ID. So this is actually the very first start, we are going say OK, here is an ID, and this ID is throughout the whole lifecycle.

If we did this, we are going to define-- actually, because this is general subassembly, and then we're going to go to Civil and say OK, we are going to define the IDs actually where it has to be. We want to create corridors, and then we're going to create solids property data. And actually, property data is the nicest thing we had in a long time. So we had that for a little bit, but now it's implemented so you can use it easily, use it out of the box, and can put in some data on where you want it.

So we can put in the metadata, and that's very important because our IDs are getting tracked

throughout the whole life cycle. So is this new? Yes and no. I mean, I think 60% of what we had is the same as we do every time. Maybe 30% is a little bit high, maybe it's lower. It's not really that advanced. And if you look at what we actually have to add to our actual design work, there are three things. So we have our real time ID links we need. We have to have metadata of objects, and we have to have a cloud connection. It's not rocket science actually.

So now I'm going to show you, and I'm going back so I can show you the steps right away. So first, Vault. I have a little bit of a problem with Vault, that I can't reach it from here because I'm overseas and I'm in the Netherlands. Everybody who is only for Vault here, I'm sorry for that. All right.

So our first step is create subassembly. So you could do this in Civil itself, with standard subassemblies, but if you want to go to advanced, then you need to subassembly composer obviously. So I started-- where is it? Here. I started to make a modular bridge. So I have my bridge parts. I added them here, and here I can build everything I want, and here we can see we have steel bars that will be pre-stressed, and hold the old bridge together because it's a modular bridge.

We have to state which IDs we have to do. So actually, here we have a lot of bars and bar codes and everything. And it is already filled in, but there are default values, obviously, and we will fill them in Civil in a different way. So all of these parts then we're going to put into Civil. So if we go back to this. So we have made our subassemblies and now we're going to Civil.

If we go to Civil, you will see a very not sexy model. I mean, this is not really pretty, but I don't care because everything is in 3D, and my BIM model, that's leading. So I'm not wanting to make drawings or anything, I just want to make a 3D model. So we'll all see in Navisworks that it's more pretty than this. But here I didn't focus on anything else than it being a nice 3D model.

So if we look at our assemblies, and we put it here, we can see the same thing we had. Let me change the scale a bit so you can read it more easily, and maybe a little bit more. So here, my IDs are stated. So I put the IDs in. So we select our subassembly and we say, OK. I go to my properties, and here I have all my codes that I want to fill in. So you can choose if I want the tension bar or not, and then I can say, OK, if I have this tension bar, what is my ID? And those ID are all synced to-- so module one is one point, and then the number of the bars it is in.

So if I, for example, would take module 6 and put it here, then you would see this has only one

steel segment, steel bar in it. So for all these modules it's different. We remove these again. So then we are going to build our-- and actually the bridge is under the tunnel. That's strange, right?

So we have a bridge and we have our tunnel, and actually, it's nothing different than a normal corridor. So if I would select this, and I would look at the properties, and it takes a while, actually. And then you can see here are all my modular parts. So it has a length. My parts are 20 meters in length, so my frequency is set to 20. So I have these modular parts, and everywhere the codes are in place.

So that's actually the stuff we always do, right? We make subassembly, we make the corridor, and then we build it. That's not no biggie, but then we are going to say OK. Go back to our-- we have to define them, we have created the corridor, and now we are going to create solids, and that's the fun part.

So we are going to say OK, I want to create [? solids, ?] and I want all stations. And then it looks like the same as always, but then in our property data we can choose what we want to do. So here we will say, I want my codename because my codename is my ID for my sensor. So this one, our codename, we are going to link in Navisworks so we can see where the ID is, and where the ID in our database is set in.

And for the bridge, I did it like this, and for the tunnel, I will show. I did it a little bit differently because it's easier in the beginning, but it will be very hard if you change stuff in it, and then it's a lot of work. So actually, if you built a corridor like this, and you may make your shape codes all your IDs, and you can take it with you to Navisworks.

So the output is dynamic, so every time you rebuild it's awesome. It works just fine. And you could actually change, if you think oh no, I messed up my codes. So you could change it actually, if you think oh no, I changed this ID, 1-10. It's not modular one, but it has to be a different one. We could just say, oh no, I'm not 1.1, but 1.2, and so forth. But that's not different than we always do. Right?

So if we have this, that's the way you want it to do, but you could actually just state other things. For example, if I made my tunnel and I have this 3D solid, and I don't want to put it in my codename or anything else, I could just add my own property data to it. So that's what I did here. So actually, beneath here, you can see I put in a real time data sensor ID, and here I can just type in the sensor ID.

The dangerous part about this is if you do this, and you rebuild your model, and you change stuff, then it forgets what it is. So this is actually not the most advanced way, but it could be a good way to do things if you have normal solids, or you don't have a corridor, and you know it's not going to change anymore. Or you know where it has to change, and you change it yourself again.

So here you can put in any metadata you want. So actually that's the part of Civil. It's not really that hard, I guess. So let me go through it. So we saw this. We saw that as well. So now we have our model in place. I mean, we have our design model in place. I'm not going to focus on how the other parts in the Navisworks model came.

So we have our tunnel design, and we have our bridge design. We have all our IDs stated. So now we're going to look at how we get the real time data in Navisworks. So we can use IT services, or we can use Excel. I will show you Excel. It's the same principle with SQL databases. I will show you how you do it with SQL, but I can't do that live because then you will see all my credentials for all my SQL databases, and that's not something I want to show you.

If you're crazy like me, maybe you could build your own sensor at home, and then you can put it in front of your window, and then you could count how much cars are coming by, and you could see it in your model. You can you just go to this website, and they will tell you how to build this. You can buy packages there, and you can build everything you want.

So using IoT services. I myself, use Microsoft Azure as-- yes?

AUDIENCE: Can I ask a question?

JOSCHY Yes, sure.

RAUSCH:

AUDIENCE: Could you please [INAUDIBLE] a little bit about what you mean by sensor? I don't think it's a sensor.

JOSCHY OK, the sensor. So the sensor is a device which measures stuff that is happening. So for

RAUSCH: example, if I would make a sensor-- the same as that you walk through a door, and then you walk through the door and it's automatically opening. So that's your sensor. So if I walk there, the sensor will see there is someone coming, and it does something. And you have all those sensors for concrete. You can put sensors in concrete and it measures how much water is still

in the concrete, for example. Stuff like that. So you have sensors everywhere. How hot it is in your thermostat at home, that's your sensor. I mean everything that can be measured, you can put a sensor on.

AUDIENCE: Does it mean the sensor would be information that during the construction would be feeded back to your cloud in the BIM model?

JOSCHY RAUSCH: Exactly. Exactly, yes. So IoT services, Internet of Thing services. This is where our sensory data, which is coming in, is sent to. I use Microsoft Azure, but you could use a lot of different services. And here is my hub, and you can see I have [INAUDIBLE] and it measures the stuff, a lot of stuff. So it's a really easy interface. So here our data is coming in, and then in the same IoT hub, we have our SQL databases.

So here I have my database, and all the data that is coming in from the previous slide you saw, it's coming in my database, and then I could use it in Navis. So how is our Navisworks workflow? We need a database. I just showed you we need a database. We'll fill it, that's our first. We need that. The second step is we need all our BIM objects. They have to be added through Vault because we were working with Vault, and then we have everything nice in place.

And if we have that, the BIM objects. We have our IDs on our BIM objects. We know where everything is. We can connect it with SQL connection strings. So we have a dynamic linked to those objects. So if our database is updating in a second interval, or a minute, or 10 minutes, or a day, or a week, that doesn't matter. This data will always be refreshed the same way. So it's a real time link.

The fourth step is actually making the data stand out, and put some visual styles to it, and we can see OK, here is something happening, and here is something going wrong, actually. So now I will show you Navis.

So we have our BIM model in Navis, and I put up a few window docs. We have a full browser so we can see everything is in our Vault. We have a normal selection tree. We have a few points. We have selection sets, and search sets, properties, and our appearance profile. So first of all, we have to put all the data in. So here you can see it's a little bit prettier than in Civil. I mean, it speaks more. We can see what it does. Actually, the existing terrain is from Infracore, and then put in here to Navis, just to make sure that everything is nicely in place. And then we put in the design, just added with our Vault browser in it.

So actually, we have our second step, and our first step is our database. So how does our database actually look like? This is Excel, and this is exactly the same as we would see in an SQL database. It's just a list of all the things we have. Not everything is filled in yet, but here you can see we did two different methods.

So we have one in real time data. So here are my IDs I put it myself, and here we can see our corridor shape information, the other IDs from a corridor, which is the more advanced way to do it. Those are all here. So we can look at those here. But yeah, if you look at this, you think, oh yes, awesome. My ID 2.1 is a tension measurement, and it has this value, and I don't know. I don't know if it's good or not. It's not really pretty to look at those lists.

So we go back to our Navisworks, or actually we're going to look at what our third step is. So the second step we have, all our BIM objects are in place, and then we want to put in our SQL connection. So how do we do that? We can do this globally. So we have here our data tools in Navisworks, and we can set it up for your user profile. Maybe you have stuff you always do, but for my project it's always a little bit different. So actually, what I mostly do is do it in the data tools from this file.

So here, you can see I have three links to databases, and the first is the IT network Azure, which I will show you the selection string in the PowerPoint. It's exactly the same. The SQL string is a little bit different than the Excel one, but the rest is all exactly the same. So I have this IoT Navisworks Excel displacement. This is for our tunnel, and I have this Navisworks Excel tension for our bridge, and it's actually really easy to do.

So if you go to Edit-- I don't know if you can read it, but you can download the PowerPoint after this, and it's in and hand out as well. So what we here are actually saying is OK, you have to search for the excel, where it is. And then you can say OK I, know this excel I want to have, and then you can state in your SQL string what you want to do. So it's relatively straightforward.

Select stuff from where? From my real time. So if we're going to our Microsoft Excel, you can see here my tab is real time. So I have to match that so he knows where to find it, and I will state where. So he has to search at real time data, so you will look at all the data that is in real time data. And then if you read this, go through your Navisworks properties, search for real time data, and match the sensor ID.

So it's going to match what is in the sensor data between this real time data and this real time

data. If we put these up, then we can just put in stuff like this, and what we want to see in our Excel or not. So we can put them all in, or just a few. You can do whatever you want. So now actually, we set it up. Say OK, and if I click now here, and I go all to the right, I have a new tab.

So in here, my tab states what it is in my Excel, or in my SQL, or in my database, wherever it is in my IoT hub. So now you have this data, and it's actually-- actually, I forgot one thing. Let me add that. I now can see which ID it has, and I would like to know right away if my ID is right or not. So let's add that. Displacements, yes.

So actually, we have to look what it's called. So we want to see our real time data, and then we are going to put it in here, real time data. And you could name it otherwise. So my field name has to be exactly the same as in Excel, because otherwise it won't find it, and then my display name I could name it whatever I want, but I like real time data. So I will just do that. And you saw it already pop up. So now if I select this, I just can see what ID 30 is, real time data 30. And if I go here, my real time tab from the property data I got in from Civil, I can see OK, it's ID 30. So how it works.

So this is actually our connection, and for SQL it's exactly the same with a little bit of a twist with the SQL string. So now we have put it in, and we can look. OK, we have our connection, so now we want to make it visual. So actually, we have it visually sorted off in our properties, but again, it's the same as in Excel. You don't want to go to each thing and click on it, and go to your properties. Maybe your properties aren't open always, and then you have to look at it and think, OK, awesome. OK, this is it.

So one of the first things is, you could make quick properties so that if you hover above it you can see what it actually is, and then you can put in whatever you want. You actually do this in your options and in your interface, click properties and your definitions, and it probably has to think because it's looking at the Excel or at your database.

So here you can state what you want to see if you hover over it, and then you could make it easier. But still, this is the same thing as that you click on it, you have to hover it. In our tunnel, we have stuff underneath it, because if I hide this, there are things here. So I can't actually hover. It won't show, actually. So that's not what we want, and we want a quick visual style of our data, if it's still in requirements or not. So how do we do this?

We can actually do this with the appearance profiler, and I will show you how it looks, and then

I'm going to tell you how to do it. So if we look at our tunnel here, we can go to our appearance profiler. It's not really scripting, it's not really difficult. We can state some stuff. So I'm just going to run this, and then you can see what the effect is, and then I'm going to tell you how to do it.

So now it's looking in our Excel database, it's searching for the data, and it's linking a visual style to it. So now you can see my tunnel is actually colored in, and for this example, I obviously rigged the data. So it is a pretty sort of rainbow. But here you can see, OK, what is actually happening?

So in my list here, I have a displacement below 40 millimeters. That's green because we think it's OK, and then if the displacement is going up, then the color is getting more red. So actually here we probably have a problem. So the displacement is too big. We have to change something, some things, or there is something that's not right anymore. So this is a great way to just show you what the data is. You can obviously see, right away, where it's not good anymore.

And for our bridge it's a little bit different, but the principle is the same. So let's do this now. So we go and load our different appearance profile set. Load. So we say our tension critical values-- and this is actually a bit simpler. Here I say, OK, is my critical value of tension reached? Yes or no? Sort of hide my transparent-- my modular bridge, because otherwise I can't see it.

So if I run this, it's looking again at the Excel so it has to load a bit. And then you can see, OK, all my parts of my tunnel are see through, and then I can see, here is a problem with my tension, and here it is. So you could actually put whatever in what you want here, and then you can see what is critical or what isn't.

So how to do this? Let me reset this. So we can reset this. So actually, it's pretty straightforward. What we have to do is we have to make search sets. So we are going to search all the objects who have a certain value from our data, which we are putting in. So we go into find items, and we go into our category. Let me make that a little bit bigger.

So actually, here you see what you can find in your model. So we are going to look at our Excel displacement because I want to have the values it gets from my Excel, I want to color in. I want to select first, I want to search that. So on here, our property, we can change what we want. So for our displacement, we have a sense of value because we have to color it in. And

our condition is-- or is below. You can do whatever you want. So if you want a value.

And now it's not doing anything. So you think, there is no data in it, but you just have to first load it, and then is reading here as well, the same values it can find in your databases. So here can say OK, all the values of 10 I want to select. So if I now do find all, it will search for all the objects who have that. And if we go below, you can see actually, it's selected all of these. So we are going to say this is a search set, not a selection set, because if we add some stuff with the same value it searches for that as well.

So if we will do a selection set, it's just a relatively stupid selection. If we have that in place we can do it for all the objects, and the only thing we have to do here in our appearance profiler, is actually color them and by sets. So we say OK, I have my corridor shape ID, or I have my displacement. I will give it a color here beneath it, and then I will put it in, and then I can use it. I can save everywhere I want, and you always have this nice visual style you can use.

So you could actually do a lot of stuff with this. So yeah, that is actually the last step. We make our data stand out of visual, so now we can see in our model what is my sensor data? What is value? Is it critical or not? So that's actually pretty straightforward.

So how do we do a link? It's not really good to read, I guess, but you can [INAUDIBLE] at the presentation. So the only thing different to SQL and the cloud, is that this selection string is a little bit different. So there's just like a comma is different. It's like really potato, "potatoh." So that's this actually brings an end to this presentation, and I only have one real recommendation.

So I looked at Civil and Navisworks now, but I mean, there are a lot of different software out there you would want to use this. First, we can think about if we think about BIM is Revit. So you could add the metadata there as well, it's no problem. It's like the same thing we do in Civil. In Infracore we could do that as well.

We can use custom schemes, and we can update those with the SQL database in the same way we do with the Navisworks. So we could actually, when we start at the really, really, really beginning, we could do it in Infracore. We could do it LIVE, actually. So you could go through that in your VR, and you could look at those real time sensors as well. And the last for that last thing, and that's where I'm really [INAUDIBLE] is in FORGE.

So you could put all your BIM models in your FORGE platform, and you could there use it in

the same way we just did it. So just add the SQL databases, but the Autodesk research team is actually doing project Dasher. It's really amazing. You have to Google it and find it. It's really awesome. So they are really putting effort into this.

I showed you some simple steps in Civil, and some simple steps in Navisworks, but we could actually do this through our whole software scheme. So questions? Yes?

AUDIENCE: Do you see this evolving into some [INAUDIBLE] platform where you could do [INAUDIBLE]

JOSCHY Yes and no. I mean, ideally it would be awesome to have that, but I don't think in the near

RAUSCH: future it's going to happen because of all the different things. There is a lot of stuff happening with the common data environment, and FORGE, and in the cloud from Autodesk, and that will be very open and wide. And if you look at those things, really a lot of software are plugging into that. So I don't think there is one solution that will fit all, but in your cloud solution, you would want to do that. So yes and no. That answers your question?

AUDIENCE: Yeah.

JOSCHY Yes. Yes?

RAUSCH:

AUDIENCE: The SQL database [INAUDIBLE] it's linked into the BIM model [INAUDIBLE] and it's filled by different engineering departments [INAUDIBLE]. So how do you manage the linkage between SQL database and the BIM model in term of when the BIM model is updated [INAUDIBLE]

JOSCHY Yes, so that's why I brought in how important it is to have those IDs. So you have to have

RAUSCH: coordination about your IDs. You have you have to have several persons or companies who are willing to adapt to one single ID framework, so that is used. So that's very important. That's difficult to achieve, actually. Yes. But that's not an out of the box solution for now, not yet.

AUDIENCE: Do you guys use large files inside Vault? [INAUDIBLE]

JOSCHY Not a lot of [? point ?] cloud data, but the rest, we use relatively large models, yes.

RAUSCH:

AUDIENCE: So all of that [INAUDIBLE]

JOSCHY Sorry?

RAUSCH:

AUDIENCE: The files that you got inside Vault, if you got say, a single file [INAUDIBLE]

JOSCHY No, it is in compartment. So it's a bunch of relativity-- I mean, our biggest files are like 100 MB

RAUSCH: maybe or something. Not bigger than that, but then it chunks it is in there. So, yeah.

AUDIENCE: What's the purpose of linking BIM objects in the Vault?

JOSCHY In Vault?

RAUSCH:

AUDIENCE: [INAUDIBLE]

JOSCHY Yeah, I mean, you could do everywhere you want. It doesn't matter, but we use Vault because

RAUSCH: there's a great solution to have all your information in Vault. So actually, you could do it wherever you want. So the common data environment, which is coming up and then is building up now, you could use that, or you could just use your c-drive, yes.

AUDIENCE: Vault isn't necessary for this process?

JOSCHY Not really, no. It's nice to have, but it's not exactly needed. Yes, that's true.

RAUSCH:

AUDIENCE: What are some of the most powerful sensor types that you imagine-- in the operation of phase, I'm imagining displacement on a bridge, I'm imagining temperature for a mechanical room. What are some of the ones that you believe are just going to be everywhere?

JOSCHY Seismic sensors. Then you could predict what is happening, and you can see, OK, this is the

RAUSCH: actual limit, and then stuff breaks, and then you can design better bridge, for example. So I think that's a really big thing we would want to have. What you said, safety in building construction. If the crane is holding it or not, stuff like that. So more of the safety. We want to do better, and we want to pollute less and stuff like that, but I think the safety is the quick win we can achieve right now, so that our buildings are safer. Yeah.

AUDIENCE: Just thinking these two questions, based on the analytics phase and during the construction phase, what was the best solution in terms of [INAUDIBLE]

JOSCHY Actually, no. We put up this workflow, and we didn't implemented it until now.

RAUSCH:

AUDIENCE: So even during construction now, and even during the pre-commissioning and after the [INAUDIBLE].

JOSCHY
RAUSCH: We just implemented this in our workflow. So we have to see what will happen if we actually implemented outside. So there are companies in the Netherlands who did this in the construction phase, and they were very positive about it, but we didn't do it ourselves yet. So that's coming.

AUDIENCE: When you're sending data to Azure, I'm assuming you're sending that from Vault? Is that correct? I'm not real sure how you involve metadata into the actual database.

JOSCHY
RAUSCH: Actually, I'm not putting metadata from our BIM to the Azure as of right now, but only the other way around, but you would want to do that, yes. So that's not actually now the workflow that we have, but that is what you want. So now it's only a one link to Navis, and not back to Azure, but you could do that. I mean, you could export a CSV, and then upload it, and then make it a time frame of uploading. So that could be.

AUDIENCE: What are your thoughts on actually below that lifecycle data, going forward?

JOSCHY
RAUSCH: Sorry?

AUDIENCE: What are your thoughts on actually owning that lifecycle data moving forward?

JOSCHY
RAUSCH: That's a difficult one. The owner?

AUDIENCE: Well, again [INAUDIBLE] I'm interested in actually thinking of it more of that as a business.

JOSCHY
RAUSCH: Yes, sure. Ideally, the owner, because it's his building and it's his data. But we are not there yet. So that's a really difficult part. Yes. The owner?

AUDIENCE: It seems like the [INAUDIBLE] owner is thinking about making sure that in the contract I want the data. But maybe that's in all of our industries, the owner is a little bit behind.

JOSCHY
RAUSCH: Obviously. Yes. Yes, sure. So we have a long way to go. That's true. But we're getting there.

AUDIENCE: Are you providing owner in your company when you say I want to be your engineer, I want to

be your partner, and we will arrange the language so that you get all the data?

JOSCHY Yes, obviously.

RAUSCH:

AUDIENCE: So you're not really [INAUDIBLE] value of your contractors, or differentiates you from your competitors.

JOSCHY Obviously, that is one plus. I mean, the whole idea of it is that the whole life cycle is better

RAUSCH: about that. If you can do it better than yourself, that's always a plus, obviously.

AUDIENCE: Do you know any owners that are really savvy and thinking about this?

JOSCHY There are some construction companies who are doing it, but then only in construction. But

RAUSCH: the owner's not really yet, no.

AUDIENCE: [INAUDIBLE] challenging issues that the [INAUDIBLE] are facing is the final interface that management data-- we don't have any [? mature ?] one that they can manage the whole process.

JOSCHY That's true.

RAUSCH:

AUDIENCE: The process that we describe, it's very good. It's amazing. But in term of the [INAUDIBLE] process the [INAUDIBLE] project. He would not have-- or do you command in the interface like in terms of [INAUDIBLE] or data management interface?

JOSCHY Yes, that is something you would want have. And as I said before, [? the ?] common data

RAUSCH: environment we are getting is actually doing that. So you get your visual side of it, and then you get your database. So you could look at them and you can see what is happening.

So that is actually something we are working on. So you saw the last bullet, the FORGE one. There you can actually send it to your clients. There you could state where you have to look. So, yeah, we are actually working on that. So it's five minutes I just heard. If there aren't any questions anymore, I thank you for your time, and have a great AU.

[APPLAUSE]