CARL SPALDING: OK. Good afternoon, everyone. My name's Carl. I think you've kind of worked that one out. With me is Joseph. I'm based in the UK, but work for Graitec as a group. So on that branch, I'm group product strategy director, and Joseph heads up our engineering and design technology.

So today we're going to cover design-driven 3D rebar in Revit. If you've had a look at the handouts, you'll get an idea of what we're going to show. But of course we want to show that to you live. So we're going to go through a couple of things. Emergency exits, there and there. This is a one-hour session, so we'll try and pack as much as we can in the short space of time we have. But hopefully you enjoy it, and hopefully you see some stuff that either you were expecting to see or weren't expecting to see, which will be even better.

So this is the brief that's in the class handout. Hopefully that's why you're here. We're going to cover a few things, the connected workflows-- this is what we're really trying to push is a workflow that is seamless and intelligent-- and transferring BIM data-- the I we put in the middle, not just the geometry-- from one system to another.

So at the end of this, hopefully you'll come away with some real key objectives, some stuff that you can take away and start to apply in your own practices. We hope that's the case anyway. We're going to show you some stuff around 360 as well. It's a good platform. The Alexandria Project is going to come into fruition next year, so the 360 platform will become a good medium to share your projects and to collaborate. So we're going to try and show some of that.

Quick overview of Graitec, just for those of you who don't know who we are. We are initially a developer in the structural space, so we've been focusing on construction for a very long time. We've been going for over 30 years. Predominantly based in Europe initially, but now we have offices across the US. And Total CAD is a recent acquisition. So platinum partner status we hold across two continents, and we are the only Autodesk platinum partner to have offices across two continents.

So in addition to that, we're also a developer. And we have an ISV contract as well, which allows us to deliver the structural solutions under an ISV branch. That's the Advance Steel and Advance Concrete. So we deliver a full suite of Autodesk technology, but the services and

success services that go with that-- the support training, consultancy, BIM implementations, all of that-- as well as our own technology.

So this is what we're going to try and show you today is a bit of a workflow that is a connected workflow based around the Autodesk technology-- in this case, Revit using Autodesk 360. But of course we can promote the same in Advance Steel, or at least in the structural environment. So that's it. Short, sweet. If you want to know more, please visit our website. I've got a couple of catalogs at the end there, so if you want one of those, grab those. My business card's in there as well, should you need it.

So we'll start with the workflows. To look at the traditional way, just so we kind of paint a picture, and then we know where we can progress from. So the traditional workflow-- you've got your engineers. They use a multitude of software for finite element analysis, or design software with multiple guises. These Revits, the pluses are your add-ons. So there's lots of add-ons available for Revit for doing stuff. Likewise, you could use AutoCAD with add-ons to that. And then, of course, your good old traditional hand cards. And then we share stuff with the designers-- the CAD technicians, designers. We're going to call them designers. It covers a broad spectrum. Add-on reports, drawings, geometry, IFC, you name it-- any multitude of file formats that we exchange. They use Revit or AutoCAD again with bolt-ons.

So that's your workflow. It's a stop-start with sharing ES geometry. We're looking to try and get an environment where you've got a Revit model which has the analytical model, and then have some intelligent data associated with it. So it's not just stored in the engineering platform, but we transfer that data, in either workflow, into a single environment. So that's really what we want to try and do. And there's positives for that.

So for the purpose of this exercise, we're going to show you workflow A, because we're going from a Revit model to an analytical model, back into a Revit model. If we go this way, it's kind of a one-way downstream process. We want to show you the harder one, so we can start here. Of course, you can start in either place. But if we do it this way, it covers all types of workflows. So that's the one we're going to focus on today.

So how do we get FEM results and Revit, and what's the point? Well, the first thing we need to do is connect it. So we have a little app called BIM Connect that allows us to transfer a multitude of file formats, but importantly, our own as well. That also is included in the PowerPack. I don't know if you are aware that we've released a PowerPack for Revit. We'll

show you some of the tools that are available in that. But if you have the PowerPack, you don't need the BIM Connect. The PowerPack is available to purchase, but we give it free to our subscribed customers anyway. And if you want to have a look at the structural analysis data inside Revit, you can download this tool that's free as well. And then you can start to have a look at the analytical data that you've got inside Revit.

So this is where we're going to look at is a workflow. So we're going to show you Advance Design. It's a Graitec product. So you could use Robot-- obviously, because it ours, we're going to show you that one-- or any other engineering software that you can take data out of and is able to deliver that data back into Revit. Then we're going to optimize the structure, produce some calculations and design reports, and take those FEM results and put it back into our Revit environment. Update the Revit model if these are the geometry changes. But more importantly, we want to attach the analytical data-- the FEM results-- in your Revit model. And then we can use the little app from Autodesk to analyze that.

So at this point, I'm going to hand over to Joseph. And we're going to show you how we can achieve that in a live environment.

JOSEPH PAIS: Just switching the screen. So hi, everybody. So something that Carl missed to say is that I'm coming from Paris, so don't be surprised with my English spelling, so that's OK.

So we'll [INAUDIBLE], just to make the demo. So what I'm going to show you now-- I decided to make the demo on this real project. So it's a model coming from Autodesk, so it's a real user project, quite big. So some parts of the demo, it's slow. There are some processes that can take seconds, 10 seconds. But I think it's important to show you the entire workflow on a real model.

So this is the Revit model we are starting with. So as you can see, it's a 3D model. It has some concrete elements, some steel members. Here we see the organization of the project in the project browser. And of course, as it's the beginning of the workflow, this model has, of course, the analytical model. The purpose of this class is not to go deep in all the possibilities of the analytical model in Revit. So tomorrow, we have a class at 1:00 PM where I will go much more into details. OK, we consider that the analytical model is well done.

So here you see that we have all the elements connected. For example, here we see the steel truss here on the top which is connected. Why, of course, if we just have a look to the 3D model, it's true that it's not really the case. So those connections are managed thanks to this

analytical model. What is important also is that this Revit model, which is our starting point, [INAUDIBLE] also the loads. So here, if I go to the analyze ribbon, I can just see that here we have four load cases created in Revit. OK. So dead loads, live loads, one snow load case and one wind load case, just for the example.

And here, I created some views with the different loads so you can see that the loads are already applied on the model. Just one detail that you can notice onscreen is that here, for example, for the dead loads but also for the live loads here, you can see that the loads are applied directly on the main bars. That's a user choice. OK, the model is done like that. And what is important is that, if we just come back a second to the descriptive model-- to the real model-- here, we have a steel deck. And it's important to notice that in the properties of this Revit object, the analytical model is disabled. So that's an important assumption because when I will transfer the model to the FEM system, it will not consider this element.

OK, so this Revit model embeds, as I showed you, the older loads prepared to be exported with the geometry to the FEM system. So to export this model to Advance Design-- so as Carl said, we will use Advance Design. Again, the workflow we are proposing works also with Robot, for example. It's the same. The objective of this first part of the workflow is to get back the FEM results in Revit.

So to link with Advance Design, here we have the PowerPack. So here I have the PowerPack in my Revit, on top of my Revit. So the BIM Connect is part of the PowerPack. It's here. And we have some different settings. One important setting for this way, from Revit to Advance Design, to the FEM system, is-- for example, here we have an option. So that's options coming with the BIM Connect tool from Graitec. We have an option to export only elements with the analytical model defined. That's why we see that, for example, the steel deck on up will not be exported as a structural element.

So then you can either just export here-- so it will create a transfer file if you want to place it on the server or to share it online-- or you can just use this icon. And it will use the flash connection. So here, now, what the system is doing in fact-- don't be afraid about the black screen. I don't know why. With my laptop, when I'm sharing the screen, I have these effects. It doesn't matter. In fact, what it's doing now is creating, in fact, a transfer file. So browsing the entire model and creating the file.

So this file, I will of course load it in Advance Design automatically. And in a few seconds you

will see that you will get a report telling you how many elements-- that's it. Here you have the report with the date-- so that's today-- then the time, the two files created, and the number of elements exported. OK.

So now, here, because I'm using the flash link, it is running automatically Advance Design and loading the model in Advance Design. That's important to keep in mind, that this link, even if it's a flash link, is used with an external file. That's important because you may have the workflow where you have the Revit user worker on his computer. He wants to share the model with another user or another engineer from his team. So you can share the file. The two softwares, it's not a mess to have both of them on the same computer. That's very important.

So here we arrive in Advance Design and we get this dialog. So that's important. All the communication between Revit, Advance Design, BIM designers, both ways, is based on mapping databases. Sections mapping database, materials database, and so on. And here, for example, that's a good example here. In Revit, we have this material-- steel, S235. This material does not exist in Advance Design. Here you have the material libraries in Advance Design, and if I select the steel family, yes, I see equivalent materials, but the name is different.

So from now, I have two possibilities. First is that you want to map two materials. In this case, this material coming from Revit, you can decide to map it. So to assign it to an existing Advance Design material, either just for the current project or for all the projects. If you say for all projects, it's updating your mapping database, and you will not have to do it again. So it means that this mapping will be done for all coming projects. Another solution, because you have created specific materials for this project, you can just say, OK, just create the new materials with all the data defined in Revit. That's it. And of course you can say, apply this choice for all the unknown materials in this project.

So I [INAUDIBLE] loading the project. OK, done. And here you see that you get exactly the same geometry in Advance Design. Of course that's what Carl said. In this workflow, we are starting from Revit and going to Advance Design. Advance Design is a FEM software that has a kind of CAD system embedded. So you can create this model from scratch in AD-- in Advance Design-- and export it to Revit. It's you to choose where you want to start the workflow.

So here, if we look to the used materials, you will see that we have the steel material coming

from Revit. And you get, of course, all the mechanical properties loaded from the Revit model.

So this model, you see that we get all the elements. We get the steel members with the corresponding sections. So here it's UK sections. You get the concrete columns. You get all the model. In addition, you have here a kind of browser or so. And the organization of this model is the organization of the Revit model. So the levels from Revit are consistent in Advance Design. And it's useful because then you can quickly just-- and that's interesting on big models like that. You can just isolate, for example, a system, isolate another one, and so on.

The purple lines you see here are the loads. Also, of course, the model is coming with those four load cases that we see in Revit. And I can select a load. So let me just display the first dead load case to-- perhaps it's too much confusing onscreen. And then you select-- that's an object, and of course, the intensity is coming from the Revit model. So everything has been defined in Revit.

What is missing from Revit to be able to run the calculation is the combinations. So why I'm doing this, I decided in this workflow to load the combinations in Advance Design and not to create them in Revit. It's because in Revit I have to create them manually, while in Advance Design, I just-- of course, depending on the code. So in Advance Design you can apply the Euro codes, you can apply the Canadian codes, the American codes. It's for you to decide. Then you can load the combinations. So here it's the Euro code combinations. You get them automatically. So it makes no really sense to spend time creating them manually in Revit. What will be interesting is to get them back in Revit.

So now the model is ready to be calculated because I have defined everything in Revit-- the boundary conditions, the support, the loads, the geometry. Everything's done. So I just can create and run the FEM analysis. '90s Of course, again, the purpose of this class is not to make an Advance Design demonstration. So I'm going fast on Advance Design. Advance Design has several possibilities. You can have, for example, seismic analysis to run the dynamic analysis. You can do time [INAUDIBLE] analysis, and so on. But that's not the purpose of this presentation.

OK, so the calculation is almost finished. OK, done. And of course, here, as an FEM system, you can, for example, display graphical results or you can-- let's just select a combination with dead loads and live loads. And then you can display the deformed shapes. For example, here.

OK. You can also display bending moments diagrams. So I can select just a part of the model-- filter. OK. And here, decide to access-- so you see here, you have possibilities to quickly access the main results and to display diagrams. We can put values on diagrams, and so on. And you can post-process all the results that you want.

Now what we want to do from this point-- so we have calculate here. I will put, again, everything on screen, just hide the loads. OK, so I want to export this model back to Revit. So for that I will just here activate-- here I have an option to export the internal forces on nodes. We have another option that I will not use now, which is to export only the elements at extremities and intersections. This option can be useful, for example, to link Advance Design and Advance Steel-- Autodesk Advance Steel. If you want, for example, to get back the FEM results in Advance Steel on elements' extremities to design the connections, for example. That's a workflow that can be useful. But that's not the one we are showing now.

OK, so I will export the results on nodes. And I'll just go to the BIM ribbon. And here I will export and create. So you see the file, this file is the one that has been created a few minutes ago. And now I'm creating a file-- export back revit. Whoops. Create. So it's creating the files. We're exporting all the geometry. You see point supports, linear elements, planar supports, and of course the FEM results. So it's done.

Now I'm back in Revit. Let me just close this status. So back in Revit, what I will do-- I will again go to the PowerPack ribbon. And here in the BIM Connect, I will synchronize. OK, so synchronize. So here, this process is taking a little bit of time to load the synchronization dialogue. Why? Because, in fact, what it's doing now is that is exporting this model-- so the one you have in Advance Design-- it's pushing this model in memory and creating a GTCX file. So the GTCX file is the file format we have developed inside the BIM Connect.

So it's pushing this model in memory. And then it will be able to compare with the Advance Design model. Because that's important to understand that from the time I exported from Revit to Advance Design, the Revit user still continues working in Revit. Another user can work in Advance Design in parallel. And the point is to synchronize all the differences. That's the workflow we want to apply.

So here, what I do, I load this file-- export back revit. OK. And I will see the differences here in the grid. So you can synchronize. Here, the purpose of this presentation is to show you how to get back the FEM results. But we can also synchronize any changes. Of course here, the list is

empty, but I can synchronize section changes, if I move an element, if I delete an element, if I create an element-- any modification done on Advance Design.

So here I will just apply. Apply means that I will get back the FEM results only because I have nothing to synchronize nothing else. So I will apply. And now Revit is just updating the results. So while it's taking maybe a minute to load all the FEM results-- it's a big quantity of results-- I'll just come back a few seconds on AD while it is working to tell you also that what we want to show you in this class is the integrated design in Revit. That's the objective.

But just keep in mind also that Advance Design also has some design capabilities. So it's another possible workflow. In Advance Design, if you select a member, you can see here in the property list that you have some concrete cover values, and you have some assumptions to run a concrete design. It's the same for the steel. Here, of course, our presentation is focused on rebar-- on reinforced concrete design. But if you select a steel member, you can also here access buckling length options, to deflection checks. So it means that you can run a design in AD optimized, for example, steel member sections or reinforced concrete sections, and then synchronize back all those section changes in Revit.

OK, so now let's see if Revit has finished. Not yet, almost.

CARL SPALDING: So [INAUDIBLE] who amongst us are engineers? Just have a show of hands. Are you guys sending analytical data back to Revit? So here's the question-- why? Any answers?

AUDIENCE: Code checking.

CARL SPALDING: Code checking? Are you sending it back to Revit?

AUDIENCE: [INAUDIBLE]

CARL SPALDING: OK. So the reason--

AUDIENCE: --for the last 15 versions, it didn't work like that.

CARL SPALDING: No. And there's no reason to. Really, it's kind of an overhead. So what we want to show you is why that's important, what we can now do. So what we wanted to do is show this live, that it's actual real data coming through into Revit. It's not stuff that we've put in there. And the next stage of that-- back to the presentation, or are you continuing from here?

JOSEPH PAIS: Yeah, I'm going to continue.

CARL SPALDING: OK. So there's a reason for this. So bear with us. We didn't want this to be smoke and mirrors. It's a real-life workflow.

JOSEPH PAIS: OK. So now the synchronization [INAUDIBLE] of the FEM results is done. So I just need to activate an analytical view. And here-- so that's why, from the analyze ribbon, you need to download the Structural Analysis Toolkit for Revit, available from the Autodesk App Store. And then, when installed, you get those two icons-- other ones, but those two icons are really important. So the resource manager. So here you see the set of FEM results coming from Advance Design. So here you see the date and the time, so it's now. We just did it now.

So you have them loaded in the Revit model. And now we use the results explorer, that's the second icon. Post-process everything I need in Revit. So just to compare, for example, here I can decide to display the vertical actions on supports, apply. So you get the values here. So here you have a legend. You have the values and, of course, if I'm coming back in AD-- in AD, it's the same. So you will here have the possibility to display on point supports the vertical actions, the values. OK.

Of course, just a second. Let me increase the text size. Select the dead load to compare on the same things of course. And you get exactly the same values. And you see, by the way, for example, here the sign convention is different in Advance Design and Revit, so the conversion is done automatically. Because here, it's actions on supports, while in Revit, it's reactions. So the transfer is managing all of this.

So that's for this first part. So from now, what we have, we have the FEM results in Revit. So I'll switch back the screen for Carl.

CARL SPALDING: OK, so the next stage is generating reinforcement. So that's what we want to do. That's the reason for it. So we've seen this. We've seen how we can manually apply loads in Revit. But what we've really emphasized is this intelligent workflow. There is a benefit for that. And thank you for your patience in that part, but now it gets really exciting. So those guys, they just missed out on all the goodies. Anyone else want to go now? Now's the bit you don't want to go.

So creating drawings in Revit. At the moment, this is kind of your workflow. You select an item, create a view. I know some of these tools have improved. You get your view and you start building up your reinforcement using the nice new tools that have come out in the recent

versions. You can start to build up that. That creates a cage, and voila, you can create a drawing. So that's kind of the workflow. Very manual inside of Revit. Yes, there's add-ons as I said. There's other processes. We've got some experts in the room I know that do RC detailing in Revit. So it is becoming more and more of a tool for reinforcement. But there's some new tools in there that are really starting to allow us to start to utilize Revit in a much more efficient way for creating rebar.

The important bit now-- this is what we want to do. So the rebar results are independent of the engineer's design. So if you're creating your rebar inside of Revit without coming from a design-- it's based on a report, it's based on some expertise, but it's not checked. It's not the required reinforcement based on the engineer's design. It still needs to go back to the engineer to get signed off. So that's what we're going to try and avoid.

What we want to introduce is a way that we can, throughout BIM designers, just calculate the reinforcement, have that created automatically, produce the drawings, and have all of that done as a byproduct of just importing FEM results into your Revit model. So now there's a reason to do it. Now there's an absolute reason for that to happen. So now it gets good. I'll hand it over to Joseph.

JOSEPH PAIS: OK.

CARL SPALDING: If you know any of those guys that left, just go, you just missed--

JOSEPH PAIS: Maybe we should call them back now.

CARL SPALDING: No.

JOSEPH PAIS: OK. So we continue with the same model now. We have the FEM results. So that's the 3D view. So I will work on this central part here. So I created a view with just this part. And now I want the 3D rebar cage on this footing. I just select the footing. And here I have a ribbon, so I will go into details just right after. I just push calculate, and then you get the rebar done, as you can see. So that's a real rebar object, obviously. So I can select the object. And here I have the Revit properties with all the information.

So now, of course, nothing is magic. Nothing is coming from the hat. So how'd we get these results? In fact, the BIM Designers-- so when you install the BIM Designers over Revit, you get this ribbon. In this ribbon-- now I have no time to go in all the details. But you have mainly functions to manage the assumptions, to run the calculation, to post-process the results. So

generate reports, see graphical results-- I don't know, an interaction diagram on the column or a bending moment diagram on the beam, and so on-- and to detail. So to create drawings.

Everything is code-depending. So here you have the possibility to apply the Euro codes, the American codes, the Canadian codes. So here, for my demo-- I'm of course used with the Euro codes, so I will apply the Euro codes because I have templates already set for the Euro codes. But just keep in mind that they will be released with Euro codes, American codes, and Canadian codes.

So now how it works. First, if you set a footing-- so this footing has a geometry coming from Revit. In the BIM Designers ribbon, you have a geometry button. So here, then, you have the geometry loaded from Revit. So we can wonder why we have a dialog to set the geometry [INAUDIBLE] if the geometry is already set in the Revit model. That's true. But imagine that you want to change this section. In fact, you have to see that BIM Designers has a way to speed up your workflow in Revit. Not necessarily to change it, but to speed up-- to make it faster.

And for example, if I want to change the dimensions of this footing, either I create a new type, I rename an existing type, I put a new name, I go into parameters, I change the parameters, and then I apply it. OK, let's go faster. I want to change the dimensions of the footing, let's do it. OK, I changed the dimensions of the footing. Press OK, and it's done. And it's done. You see that the BIM Designer module has created a new type. So in the family that you are applying-- so that's a US metric family coming from Revit, and it's not the family coming from Graitec. It has created a new type corresponding to what you just defined. So it's also a way to accelerate how you model your elements in Revit.

Then, if I come back to the geometry dialog, we can see that the BIM Designer is also detecting all the connected elements. The footing is supporting a column, so it's detecting also the geometry of the column. Then, of course, you can also in the BIM Designer define additional parameters that are not inside the Revit model. For example, you can define the blinding concrete below the formation. So all those informations will be stored in the Revit model as BIM Designers' parameters.

So the second step is the assumptions. So here you have design assumptions. So of course, I will not go through all the tabs, but as you can see, you have many assumptions. For example, the concrete quality is loaded from the Revit material. But you can change it here. It's up to

you. Either you change it here, either you change it in the Revit material manager. It's up to you. You decide which workflow you want to apply.

Then you have, for example, the ductility class, the class exposure. Also you have some design assumptions, of course. The concrete cover, it's the same. You can either define the concrete's cover styles in Revit that are loaded in the BIM Designer. Or to not lose time creating new styles, change them directly in this dialog. And many other options that allow you to put a water table to define the bearing pressure capacity of the soil, and so on.

So as soon as you have defined the design assumptions, you can define also the rebar assumptions. So you will get a 3D rebar, but which diameter are we spacing? Which hooks? What are your preferences? So you can define all of them here, and of course save all those design assumptions, all those reinforcement assumptions to be reused on other elements. And then, when you have done this, it's true that--

Sorry. I forgot something before running the calculation. We defined the design assumptions. We defined the reinforcement assumptions. And we have the loads. Now you start to understand why it's important-- why it makes sense to get the FEM results in Revit. Because here you see that I get automatically the four load cases I've defined. And more important, I get all the values. That's the values coming from my FEM analysis.

Of course, it's a workflow that you can work in a different way. For example, we can imagine that you would just want to design a footing. Just open this dialog, enter manually loads that you have estimated roughly, and go to the design. But having the full set of results makes really sense. So thanks to all this information, we can again get these final results.

What is interesting also to know is that this rebar is parametric. Again, I'm in Revit. So we are not changing your Revit workflow. So that's Revit objects. And as you are doing manually, you can change everything you want in the Revit properties. But let's consolidate what we are doing. If I want to change this footing, I go there. And I can directly access this dialog to set the parametric definition of my 3D rebar cage.

So here, what is interesting is that you have the values on each direction-- bottom x, bottom y. And here you have the theoretical value, you see, because the footing has been designed. So I can change the values. And if I put, for example, here 15. It's automatically recalculating and it's telling me, hey, that's not enough. So of course I can decide to increase the diameter to fit the requirements and validate, and the 3D rebar cage is automatically updated.

Also, what you can get-- you can get a report. And that's important because as soon as we are speaking about design, about analysis for the engineer, it's really important to be able to trust what the software is doing-- how I get this reinforcement quantity. So here I can generate a report. Or you can have more or less details depending on what you want. And you will get a design report including all the details.

What I'm showing you, for the moment, it's a better version. So don't be surprised if in some places, we have some fine tuning to do. It will be released in two or three months. And here, for example, we can just see the report. And what is important in the report is that you will have the articles references to the code. So everywhere you have the formulas, the article applied. So really, you can really go in the details and see everything according to design.

So what I have done on an element, I can do it on several elements. So for example, I can just hide the floors. I can select several footings. For example, go there, go to the design, go to the concrete cover. Just change a value here-- for example, top face and bottom face. Validate. Just push calculate, and the footings are calculated. And each footing is calculated with his FEM results-- so with the results coming from the FEM analysis. Here you have a project status saying that some elements have been designed with errors or with warnings. So then you have to go in the reports to see what's happening.

Also, another interesting functionality is that when you have some identical elements-- so for example, let me check. This is a section of this footing. This one has the same section. With the PowerPack, we have a functionality that is very interesting. So the PowerPack is coming with a set of tools dedicated to reinforcement. And here, a tool which is a really interesting is the copy function. For example, I can select this footing, go there, rebar in element, copy rebar. I can exclude-- or not-- some rebar. So by default it's taking all rebars in the element. I apply. I just select this element. Finished. And the copy is done.

What is interesting in this copy-- first, just think how many times you need to do it by hand. Maybe a few seconds more. But what is interesting also is that those bars have the rebar number 17 and those ones have the rebar number 17. So that's really identical elements. So if your schedule [INAUDIBLE], you will have the total quantity for identical elements. So that can really be interesting.

So now what I'm showing you on footings, we can do the same on columns. It's the same. Just select the column. So again, I will not go through all the dialogs. But this column, for example,

has loads also coming from the FEM results. So that's it. Just push the button, calculate. Of course, now I'm going fast or else I will spend three hours showing you all the possibilities. But then you get, you see, the rebar inside the element. And again, you have several columns to do. Square columns here. I have some circular columns also. So select all of them, push the button, calculate, and get them. You see, it's calculating the elements.

CARL SPALDING: And those are calculated based on the results that are stored in the Revit model. It's not just placing reinforcement based on a configuration. It's basing it on the design.

JOSEPH PAIS: Yeah. That's an important remark you made. Carl, thanks. You can also use the BIM Designers just to place rebar much faster than doing it by hand. For example, let's take another footing. Let's take this one. OK, I don't want to design it. So what I can do is just go into this dialog. So here, of course, I didn't run the design, so everything is empty, obviously. Here I have 0 for required reinforcement. That's no matter. I can say I just want 10 bars, diameter of 12. The spacing is automatic. OK. 12 bars on the other side. Push OK, and you get it. You want to add some hooks? OK, no problem. Get back into the dialog. Just put a 90 degree hook, define the length of the hook, and it's done.

So it's also a way to use the BIM Designers-- not to design, because you have no idea about the loads or you don't want to spend time on the whole workflow. Just put in a few parameters and you get the 3D rebar cage. And then continue to use your usual manual workflow in Revit or continue with what I will show you now. It is the possibility to get drawings automatically. But before going to the drawings, we can also say a few words for the beams. I don't know what's about the time. OK, I think it's OK.

I will just isolate those two elements. That's important. Why those two beams? Because this is an isostatic beam. Just a second, if I go back to my Revit model, this is isostatic beams-- one-span beams-- because the wear model has single beams from a column to a column. That's the way the BIM Designers are working. This one is a continuous beam because the model is over the three columns.

Now you'll remember I told you that you can also use-- sorry, I don't want to hide those elements. I want to isolate them. I told you that those BIM Designers can be used also to speed up your modeling in Revit, giving you new possibilities. For example, imagine that you want to place an opening in this first span. It's possible with Revit, of course. You have the possibility to create openings here, but you have to draw to enter the [INAUDIBLE], but it's a

bit long.

So here, just select the beam. Go to the geometry dialog from BIM Designers. You see that we start to have a lot of possibilities. By the way, the BIM Designer is detecting automatically the T-sections. Because here you see the flange is detected automatically depending on the slab. But here you have a tab, span opening. So I can create rectangular or circular openings for the moment. I just defined the position of the opening. What's the height-- 700, OK. So let's put 250. The dimensions of the opening. OK. And then it's done.

So you can use this tool just to place an opening. That's much faster than placing it manually. And for example, on this span, I can do something else, which is creating-- whoops, sorry. That's the design assumptions. I can define a depression here, put the length, put the height of the depression, and done. And you get it.

Of course now, if I select those two beams and run the calculation again, I can do it. And it makes sense because I loaded all the FEM results in the Revit model. Don't worry, the light will come back. So you will get the 3D cages, you see. I have a small problem here on this one, I will see what's happening. So here you see that you have all the 3D rebar inside. And it's a continuous span, so here you have, for example, the bars over intermediate supports. So you get the three-span reinforced.

So this one, I don't know what's happening. Just let me--

CARL SPALDING: Is that good? Different from what you've seen?

[APPLAUSE]

Oh, thank you. That's cool.

JEREMY PAIS: So maybe I can just increase it a little bit, maybe. OK. Math. I have an initialization problem. OK, anyway.

So now, that's the capabilities to generate the 3D rebar. And as the name of the class, it's design-driven 3D rebar cages in Revit. Now it's missing the second part of the class name, which is the drawings. So now if you want to generate the drawings-- I will come back to my model. How I do-- I select an element. And here in the functions, you have detailing settings. So basically I'm going fast because the time is passing. We can select templates for the views, for the title blocks, for beams, columns, and footings.

CARL SPALDING: Revit templates.

JEREMY PAIS: Revit templates, that's right. And then I can select this column and this footing and just generate the detail. So now what it's doing in fact is creating all the 2D views-- so iteration views, section views-- placing the annotations. You see, that's the section view. And it's purely automatic, you see. OK, I will not enter in the Revit functionalities, but that's an annotation. That's a Revit annotation, so you can do whatever you want. You can set the styles, you can move it, you can-- it's your usual Revit system. But you see the amount of time you save just to get this right from the model. So here, for example, I see that.

Of course it's difficult to get something perfect all the time. So you are in your CAD system and you can adjust the position of the tags. For example, here you can select those bars, say that you just want to see the beginning and the end bar. You are in Revit. I forgot to activate an option, because I see that here I have no sheets. So maybe what I can do, I can select another one. OK, this one-- no, this one. And we also have an option to automatically generate a sheet per structural element. And if you do that you will get--

So of course, on all of those elements, you can apply the Revit's schedules, obviously, because it's rebar Revit objects. But what is interesting also is that here, you see that our [INAUDIBLE] title block. It's a title block coming from the Revit user. So just a second, let me change it because it's written in Revit 2014. It's a bit older. Let's take this one, yeah. OK. So you can move all the views. You can change the view scale. You can do whatever you want, as you usually do in Revit. And what is interesting is that here, you see that you have the BIM Designers schedule. We still have a few adjustments to do, but you see, including the bending details, for example.

So that's how the BIM Designers are working in Revit. So I'll let you continue, maybe.

CARL SPALDING: OK, cool. So yeah, we used that. It was slightly more entertaining, being in Vegas, [INAUDIBLE]. So hopefully you can see where we're going with that. So just a quick summary of [INAUDIBLE]. So we're trying to integrate some of the design capabilities-- some of the stuff that the engineers are doing-- trying to bring that through into the workflow. Why? Because we can use that data to generate-- the true meaning of BIM is to be able to reuse data to automate downstream processes. And that's exactly what we're trying to do with our BIM Designers.

Of course, you can automate that-- automate not only the creation of the 3D, but also the documentation, schedules, and so on. But schedules that are usable-- as opposed to schedules which are not-- inside of Revit. Schedules that contain your bar shapes. And they are customizable. They're just Revit templates. Everything we've shown you today-- nothing's hosted outside of Revit. It's all Revit families, it's all Revit templates. So once you get hold of it, you can customize it to your own environment.

In addition to that, what we've shown you today is inside Revit. But what we'll be showing in some of the other classes is those same BIM Designers can work, as you've seen, in Revit. They can also be embedded in Advance Design. They can work as a standalone platform. And where it's relevant-- we have some steel ones as well. So what does that mean? It means that you can take the BIM Designer as a separate standalone entity and do exactly what we've just shown you in Revit, where you can apply the reinforcements, you apply the loads, you can apply everything. Not even in the FEM software. This is independent, on its own.

So you can export an element-- a beam, a column-- from Revit, send that to your engineers, say, just check that. It needs an opening. He can do that, apply the opening, apply the results, send that back. The guy loads it in Revit, and then he's got his 3D cage created with the elements designed and checked. So it doesn't have to be based in Revit. You can have a workflow. And the reason we've done that is because we want to support multiple workflows. Not everyone is designing everything. Not everyone is detailing everything. So we want to support multiple design workflows.

So here we have the BIM Designers working on an independent platform. So it's a very simple interface, very graphical. You've got different views. We've got the one we've seen in Revit. We have a steel one. They should start automatically. Just wiggle over them or something. Something always has to go slightly awry. So we've got the BIM Designers working in Advance Design, which you'll see here. And we have the steel one working there. Well, it's creating a steel-frame building-- multiple levels. You can create any shape steel building.

But they're designed to be multi-platform. So work independently as well as be embedded on a Revit platform or in your analytical environment if you're using Advance Design. It's the same. You don't purchase different versions. If you have a version of it, it will work on a multi-platform environment. That's just how they're designed. So it is unique. There's nothing else like that on the market. So really trying to embrace a BIM workflow that is unrestricted-- or if I use the word connected, which seems to be quite an interesting buzzword at the moment. So

if you'd like to know more about that, we will be showing some of those in--

JEREMY PAIS: Tomorrow at 1:00 PM, we are showing the workflow with the BIM Designers working in standalone outside Revit. But always with the 3D rebar cage back in Revit.

CARL SPALDING: We're centering everything around Revit. You know, Revit is definitely the design platform. We just want to make it more useful. No one from Autodesk in the room, huh? All right, cool. OK. Oh, it is being recorded. Dang it.

So really, this is the point. Why have this information if you can't reuse it and reuse it intelligently to generate some additional content. So A360.

JEREMY PAIS: OK. Just in a few words. In A360, you have basically two things-- the viewer, and you have the drive where you can share information. So the added value comparing to Google Drive or something like that is that you have dedicated viewers. So you can access the data that you publish on the drive. And then you have the A360 Team which is something for collaboration based on the model in the cloud. So here, this is just a picture that illustrates A360 Team where there's several people working on the shared project.

CARL SPALDING: I think we're out of time.

JEREMY PAIS: Yes, we're out of time. But I'm just showing you that, in fact, when you publish a Revit model-- it's really taking one minute. What is important to know-- maybe you already know, but-- in Revit, what is really interesting is that in the collaborate ribbon here, you have a dialog, views for A360, where you can decide which view you want to publish. So you can publish views of the model-- so the 3D view and analytical view or part of the model. You can create section views and also drawing sheets. And that's very interesting because as soon as you save this-- you save that. You drag and drop it in your A360 project.

And then when you go-- so here, that's the same model I uploaded this afternoon. In fact, you will get it like that. You see? So you will get all the drawing sheets that you have published. You will get all the views. And you can just, for example, go to the viewer. And what is interesting is that, speaking about the rebar-- because that's the subject of the class. In fact, you can-- just if I select this column and I hide the column. Where is my-- OK, the rebar is coming. So you see the 3D rebar. And if you select the bars, you have here all the properties.

So that's really interesting because here, you see that you can start to share the [INAUDIBLE], including the bar lengths, the total bar lengths, the bar diameters, the bending diameter, and

so on. So you can really share intelligent information, not just a view.

CARL SPALDING: So yeah. It's worth looking at A360, certainly with the Alexandria Project coming through. Why? Because this is the vision that we have. This is the vision that Autodesk have. And this is what we see happening in the future. So at the moment, what we're showing you is files going from there to there, from there to BIM Designers being placed there. Really, what we want to find is a central storage that you can suck in the data or connect the data when you need it, so that it's readily available. So you can have multiple design teams working anywhere in the world working off a central database, and then just be able to publish the FEM results and push them back into your model. So you'll be able to take control of that. That's a really connected workflow. We're ready for that. We've already got tools in place. Just waiting for Autodesk to come with the platform that'll deliver that. And we'll be able to implement a workflow that can go right through to the fabrication and bar bending as well.

So what we'll be showing in some of the other classes is lots of other geometry-- beams, openings, all sorts of things-- in a standalone environment as well. So it's not just restricted to the shape of your column being a rectangle. We can do multiple geometries as well. I'm going to go through that as quickly as possible. So that's the kind of round-trip workflow that we're trying to do. Just trying to smooth that curve out. And hopefully the disruptive changes we bring will add a lot of productivity to the overall workflow.

So I know we've cut it very fine. Does anyone have any questions?

JEREMY PAIS: We have five minutes for questions.

CARL SPALDING: Yes, please. Fire away.

AUDIENCE: [INAUDIBLE]

JEREMY PAIS: In fact, when you change the type of foundation, it's automatically redesigning, and updating the 3D rebar cage. That was your question? Another important thing-- it's the last slide we saw, and we'll explain it during our class tomorrow at 1:00PM-- is that the BIM Designers, they cannot design any kind of geometry, obviously. So in fact, we have a mapping system. We have several types of footings-- footings with [INAUDIBLE], footings with-- you know, different kinds of footings. So those footings have some parameters that you can map with your own family. I mean it's not a must to use the Graitec families. You can use your own families. You just map it. You just map the parameters once, at the beginning when you install the software.

And then that's it. So as soon as the parameters are mapped, if you change a parameter, the BIM Designer knows what you are changing and can just redo the design and update the 3D rebar cage.

CARL SPALDING: Any other questions?

AUDIENCE: We looked at the rebar generator. How does it work with more complex geometry? [INAUDIBLE]

CARL SPALDING: So the designers we've created at the moment-- so the ones you've seen-- is a footing, column, and beam, because there's a lot of engineering behind that. We do have mind to create generators just for any reinforcement. But really, I think, there are tools out there and Revit's got some really cool tools in it now that you can create reinforcement. And if you want to see more of that, go to those classes tomorrow.

JEREMY PAIS: And also the PowerPack.

CARL SPALDING: But we have introduced a PowerPack that has a lot of Rebar detailing tools in it. So for laying down reinforcement, you saw copying reinforcements and doing all sorts of things. So we're really trying to encourage the adoption of Revit for reinforcement. What we're trying to do with the BIM Designers is actually design it, so it's the required reinforcement rather than an intent. Yes?

AUDIENCE: A couple questions. Does it work for walls and slabs? And also, is there an option that wasn't shown that would-- [INAUDIBLE]

CARL SPALDING: So the three we've got available are the footings, columns, and beams. But we have around 30 that are in work. So it will come with other elements as well-- slabs, retaining, walls, piles.

JEREMY PAIS: Slabs is really the next one. So as soon as we release those three first ones, then we will [INAUDIBLE] slabs.

CARL SPALDING: And the copy was just to show off a tool in the PowerPack. So you can do it without-- if you created your own reinforcement, you can use some of those tools if you don't have the BIM Designers. So it's just showing some of the detailing tools that come in the PowerPack. You don't have to copy it. It'll design it. Yeah, so if you don't select anything and it calculates, it will detect all of the footings, all of the columns, all of the beams, and it'll just do all the reinforcement for you if the design elements-- you know, the FEM results-- are in your model.

Any other questions? Nothing from this side. We thought we were going to get really hard questions. Those are too easy. No difficult questions? There we go. Go for it.

AUDIENCE: [INAUDIBLE]

CARL SPALDING: Yes.

AUDIENCE: How do you [INAUDIBLE]

CARL SPALDING: Well, it depends on your workflow. So if you've got a technician creating a model in the first place, and he creates it based on a rough idea and sends that through to your engineer to optimize and analyze, then your FEM software will determine the best working section size for that particular environment. And if we bring that through into your Revit model, we can update that geometry with the load supplied and it'll work with that. So it's a design choice. We're not forcing that. We'll take the size that's there and, providing it's been calculated, it will [INAUDIBLE].

JEREMY PAIS: And even more, because here, the class is to show the design inside Revit. But a workflow that can also make sense is that you send your Revit model to the 3D FEM system. Here, the engineers drive the 3D FEM system, which can optimize, change to sections, calculate the rebar inside an element. And here you can use the BIM Designer module inside the FEM system. So it means that the engineer can do the entire process in his tool-- his analysis tool-- and then send back everything to Revit.

CARL SPALDING: Including the rebar.

JEREMY PAIS: Including the 3D rebar cage, of course the sections, and all the design assumptions. That's important because, if we are sending back to Revit only the 3D rebar cage, as soon as you do a change in Revit, you're stuck because you cannot update anything. We are sending back to Revit all the assumptions. And then if you make a change, we can update.

CARL SPALDING: We cannot automatically update.

JEREMY PAIS: Yes, we cannot automatically update. Yes, sure.

CARL SPALDING: Any other questions? Great. Thank you.

JEREMY PAIS: Thank you very much.