RALPH PULLINGER: OK, ladies and gentlemen. Thank you for coming this afternoon. I don't know what I've done to deserve what I call the graveyard shift, because it seems like after the party last night, it's almost been a graveyard day. My name's Ralph Pullinger. The title of this session is Extended Workflows with Autodesk Advance Steel. I'm supposed to put Autodesk almost in front of everything, but occasionally I will lapse, and I will just say Advance Steel, or Revit, or Robot. So please don't report me to the Autodesk police on that one.

I am a solutions engineer for structural fabrication, and I work out of [INAUDIBLE]. My home is a place called Coventry, which is right in the middle of England. So about eight hours time difference from here to there currently. So luckily, everyone's asleep at home, so they're not watching this.

Right, so if you've had a look at the screens, this is what we're going to be doing. I'm not going to go through all of that again, because it's a bit of a long blurb. But essentially what I was asked to do, what I thought would be good is to have a look at Advanced Steel, but have a look at what else we can do with Advanced Steel. And also what else we can interface with, how we integrate effectively. So although my primary focus is Advanced Steel, I firmly believe that on its own, it is one thing. But when you put it into a much bigger work flow perspective, it becomes something else entirely differently. And hopefully that should come out in some of these slides.

So learning objectives. Because we have to have learning, otherwise it's not a university. At the end of this class, you will be able to get a better understanding of our structural offerings. Not just Advanced Steel, but I will also touch on Revit and Robot. Understand work flows, certainly how I perceive them, and how much of the industry perceives them. And have a look at some of the recent enhancements to the portfolio. And I'll come onto that little bit later as we hit those slides.

And it wouldn't be Autodesk University if I don't mention Dynamo at some point. So I am going to have a look at Dynamo. And because of the-- I don't know if this is a verb or not-- the newness of Dynamo for Advanced Steel, it forms about 2/3 to 1/2 of the presentation. It's not in-depth, it's very scratching the surface, but it's a work flow to get you thinking, and something that certainly got me out of a hole earlier on in the year.

So I always like to start these sorts of things with a bit of a loosening up. I'm not going to get you to do any Callanetics or jumping up and down like they will do in some classes. But what is structural engineering? So first of all, how many structural engineers are there in the room? Whoa, OK. How many fabricators stroke detailers? OK, and the rest are hangers-on.

OK, so structural engineering. This is a great quote from an old professor. Engineering is the art of modeling materials we do not wholly understand into shapes we cannot precisely analyze so as to withstand forces we cannot properly assess in such a way that the public has no reason to suspect the extent of our ignorance. Not out, that should be our ignorance. Spellchecker, great.

So what essentially we're saying is, engineers are clever, but they have stuff to work with which sometimes we don't understand. We lose a lot of safety factors, and those safety factors get us out of a big hole most of the time. Why Stonehenge? Any ideas? Apart from it's in England. Well that's quite a good one, yep. Oldest man-made structure in existence today, supposedly. About the same time that the ancient Britons were building this, the ancient Egyptians were building pyramids. So that puts it into context a little bit. But you can also argue the fact that it's also one of the first cases of pre-fabrication. Stones were prefabricated off-site, shipped to site, erected.

How many were in the keynote this morning? The closing keynote. How many of you were still suffering hangovers? I'll put both hands up there. About looking forward. Now, I agree looking forward is good, but sometimes I think looking back is also good, as well. So I quite like looking back into history for some of these things as well, about how things have developed to see patterns, and so on and so forth. Maybe be how we could have done things slightly differently. But I think Stonehenge is a good starting point going forward.

So why an integrated workflow? Usually what you start off with is a bit of a blank canvas. You have a project and you have very limited amount of information. And you have to build on that information. So I'm already using that information word, which is inherent in today's society. Many engineers talk about this as being a concept model, but intent sort of feels more cuddly, almost, in some respects. Because it's what you intend to build. It's what you want to build.

Now at some point, engineers get a little bit scared about using rules such as span over 10, and WL squared on eight, which is all very well and good for presizing. So at some point you need to do a little bit of verification. And that could be an Excel spreadsheet. It could be, dare I say it, an A4 piece of calculation paper. Those of us that can still use pen and paper.

But the results of that verification have to go back to validate and update what you want to build. Now, this cycle, this process has been going on for how many years? Any idea? Thousands. If it doesn't work, but usually way back in history, there was a case of, it breaks, do it again. But now we're looking at doing things slightly differently, slightly more intelligently.

This goes round, and round, and round. And if you want to think about intent, it's almost like a sphere. And it might start off the size of a pea, and by the time you've done all this validation, it grows into about the size of a football. And for those of you in Europe, and not in America, it's a proper football, a round one. Not one of those oval things, that's a rugby ball.

So the information grows, but hopefully you understand and realize maybe that that intent model is not good enough to build to. And at some point you've got to move that on into what I call a realization phase. Because most of us in the room are engineers. I go into engineering because I like to build things. If I can't build it, then I feel let down.

So the realization part is when we start to look at things in greater detail and make sure that what we want to build can actually be built. And that's an important factor. I've seen Revit models where steel columns stop at floor level. There is no way that I can splice another column on top of that through a floor. So it's looking at it slightly differently, slightly in a much greater level of detail to make sure that it can be built.

We might also be looking at things there such as, well, can we get the connections in? Do the connections work? And it would also be very good if we could put the results of that realization stage back into our model so that we can keep our information consistent across the three sorts of categories.

You will find, however, that in that realization stage, you will need additional verification. And it might be that you've suddenly come up with a connection that just does not make sense. And it makes more sense to upgrade the members than it does to create a really complicated connection. That's obviously going to throw off your building analysis and the connection again. So you need to run an outer loop just to make sure that what you want to be built is validated properly. But recognizing that this is the real world, we need to interface with surveys, maybe some visual programming, and also third party plugins.

From an Autodesk perspective, I believe the concept model is Revit. I also believe verification, from my perspective again, is Robot. And if it wasn't for Advanced Steel, I wouldn't be standing here in the room. So the realization part of this is Advanced Steel, and that allows me to complete the picture. Visual programming, Dynamo, laser scanning, recap. And then we have various partnerships from a structural perspective, one of which we will see this afternoon going forward.

Does that make sense with everyone? I'm an engineer, I like to keep things simple, keep it at the base level. And when I started to look at this and mine that pit, it just got totally convoluted. But essentially I'm starting with a model, I'm verifying it, and I'm making sure that I can build it. It's that simple.

So I'm not going to dwell too much on some of the stuff that maybe that you've seen this week already. I used to talk a lot about how models can be made accessible to more people. And quite a few engineers and modelers wanted everything being pulled back into Revit. Now I've got a great question which I'd love to ask those people. And that's, why? Why do you want to bring it back all into Revit?

Now, I know people have got various answers, and I'm sure that they are quite valid. But if we can pull it back into an environment that many people can look at very easily, and get around with the same amount of intelligence and data attached to it, then why not use that?

So one of the extended workflows, which is a really, really simple easy win, just the integration with Navisworks. With its file formats, coordination, clash checking, timelining. The information is still there. We can still look at the elements as they come out of Advanced Steel with regards to members and data. And it's straight out of Advanced Steel.

A customer two weeks ago asked about what we had that was equivalent to an application called Struwalker, which used to be from StruCad, which allowed engineers to mark up and annotate, comment on electronic drawings straight out of the detailing package. And they didn't want to pay for new licenses of Advanced Steel, Navisworks. Can do it all in Navisworks.

How many of you have heard of connections in Revit 2017? Good. So the connections as they stand now in 2017 are the ones that have design codes attached to them in Advanced Steel. So that if I load my Revit model with-- it's built in completely the opposite direction, so I'm going to point to this. My connections that are available in Revit through the extension I load into my project.

When I place members and add connections to, I'm only able to add connections that are applicable to that particular instance. So if I put a connection at the bottom of a column, the only thing that I can put there is a baseplate of some description. So the intelligence is built in.

When I link the Revit model to Advanced Steel, I get exactly the same representation of that baseplate in my Advanced Steel model. And that allows me then to take the information that I've put on in Revit and move it on into the documentation phase of the drawing and produce CNC files possibly out of that.

There's no doubt that you will see more connections coming through as Revit gets bigger, i.e. 2018. Because we're not just going to stop there. Back in 2015, can anybody remember how many connections we had in old Revit? Two. One was a baseplate, and one was a beam to column flange.

It's come on a long way, but the Advanced Steel technology is being embedded into Revit for some of these connections because this dialog box here is quite a good representation of the same dialogue in Advanced Steel.

So that's connections. We also have an Advanced Steel add-in for Revit. And again, this has been talked about in classes this week, so I'm not going to be dwelling on this one in greater detail. But the extension essentially allows us to export, import, and synchronize using a format called SMLX. That's another structural format that you need to know about. But when we pull information back from Revit from an analytical perspective, and if you remember that diagram at the beginning, if Revit has integrated with Robot, then the reactions that come back from Robot into Revit can also go forward in Advanced Steel.

And that means that I can directly use my low cases and combinations to check my connection. And that's an important thing I think, because generally when I've got a connection drawing from an engineer, they've marked up the GA with the reactions, and then they've added X amount of kilonewtons, or kips, or whatever your units are, to those N reactions. So all of a sudden, your N reactions do not resemble anything like your low case combinations.

Advanced Steel will go through these code combinations and check the connection, pass or fail, as it goes through. So we don't need to envelope, and I don't believe we should envelope. Because an envelope is a highly unlikely, if not impossible, load combination.

The same add-in with some different nuances is also available for Robot Structural Analysis.

Which means that I can export, import, and synchronize with Robot directly, bidirectionally using SMLX, and still get those reactions. So it's exactly the same functionality without having to go through Revit in the first place.

So you can think of it as a simplified method of obtaining connections design by the reactions from analysis. That SMLX format is also used to integrate with Plant 3D, as well. So Plant 3D has steelwork. We can take that steelwork, bring that into Advanced Steel or Robot to analyze it directly, and then pull in the results and build it up from there.

Now, there will be a time-- and I can guarantee it, because I see it every day-- when you'll come across a connection that you can't code check. And what used to happen then is textbooks came out, calculators came out, graph paper, and you started to wield it up from first principles.

So I used to call this slide, Houston, we have a problem. But there is a company called Idea Statica which has a solution based on component-based finite element methods which will allow you to take a connection, pull it in, add forces, and check the whole joint.

What that means is that we can also look at-- and again, this is a big topic that I sat in on this morning about connection optimization. How many bolts do we actually need? Can I use fewer bolts? Can we use a different pattern of bolts? Can I mix both sizes? Also welds, as well. Can I reduce my welds? And this is relatively new to the market. And it's quite exciting technology. I know a little bit of answer, but I've got a colleague or a friend here at the front who's going to talk more about it. And that's you, right?

[? URAI: ?] Thanks a lot, Ralph. Hope my mic works. I'm [? Urai ?] from Idea Statica, and I would briefly run you through what we do. We are a technology partner of Autodesk, so it's called solution associate. And we built solutions for problems not covered in the three programs Ralph mentioned in his concept. And the case being steel joins.

And really we are saying to engineers that everybody should be able to deal with any topology of joints, and that really means any. That means standard joints, the ones who are a little bit more complex, but also the freakishly different ones.

Today, a majority of the tools for those steel joint design, they're based on what is called the component method, or component model. That's the backbone of all the design guides, whether you are in the US or in Europe. And this method is sound, and it's widely used, and it's safe. The drawback is that you need to build a model for every specific topology of the joint. So we have the well described examples in design guides which we can rely on. Once you step aside from those pretty fine examples, then you have to, as Ralph pointed out, go back to the first principles.

So we took a different approach. Because we know that you guys are all well aware of using finite elements, you use them in the frame analysis and the whole model analysis. So we said, let's use finite elements for analysis of stress and strain in the joint, and then just apply the standard checks as it is in the component method. So the result is a new method called component based final element model, CBFEM. And by mixing these two approaches, it can analyze and design a joint of any topology.

The science is inside the software itself. It's transformed in a way that you're just putting the joints together using manufacturing operations. Honestly, this is the fun part you get rid of when you use Advanced Steel, right? Because when you import it from Advanced Steel, it's already modeled. So even though we have a great modeler, when you go to get it from Advanced Steel, you have it done.

When we put this to the market two years ago, we knew that we have to prove that it's safe. It's about trust. So together with technical universities, it this way we took tens of those standard joints from these design guides, and we calculated those with our tool and got the same results. Then we spent a lot of time on building analytical models in [? Nostran ?] Umces, those more scientific softwares, to model the complex joints, and also compare the results. Again, similar. And we also did quite a few of life tests. It was three years of work of two technical universities, and it all went down to a conclusion in a documented way that this approach is safe. And it's all published.

And let's now jump into how it actually works with Advanced Steel 2016, 17, 17.1. So easy way to activate a link, and then you simply run a command, it's called cone check, which will activate a selection. And you go for the node of the joint, the related beams, and all the objects around. The bolts, welds. And when you select them, it will automatically create in project in Idea Statica connection with this data imported. That means the geometry.

We do have to input the loads manually here. We'll do that via simple Excel spreadsheet input. Usually these numbers come from other programs the engineer used for analysis. So we just copy it in, and we are going to go. It's modeled, it's loaded. So you can go to check and run a anomaly analysis, taking into account all possible aspects of the code defines. What the code says it's safe or not.

And we get a clear check of all the bolts, welds, plates, and then a quick summary check. It's very clear, pass or fail. We can display the resulting forces. And we have three levels of output reports to display, and to prove to your colleagues, and to construction authorities that it is OK.

It's been around for two years. It's been used on hundreds of projects all around the world. And in these, it's just about stress-strain analysis, but also buckling analysis, stiffness. Pretty much everything that is required for an overall check for joint. A couple of examples, electricity tower mast in Poland. The original design was crazy topology of bolts, quickly rearranged this topology to come up with a safe design.

Steel warehouse in Germany. The joint is OK from the point of stress and strain, but there is huge buckling so the design is unsafe. Simple way, adding a stiffener resolved the problem. Power plant in the Czech Republic. Again, joint OK from the point of stress and strain. But if we understand the joint and have the good tool, we can cut the second tube as well, and get stiffness 10 times higher for the same money. Last project is from the UK, extension of Heathrow Airport. This really specific steel service bridge with specific joints which are not able to be checked by standard tools. So we analyzed it-- actually our customer did-- and the bridge is operating.

And during the whole process, you have the results at hand. This is a visualization how we gradually load the joint, and how the plastification zones developed. It's very simple, green is is OK according to the code, either AIC or Eurocode, and red is fail.

So let me sum it up with, this is a tool that can design and check steel joint of any topology, any loading in minutes. And I encourage you to try it out. Visit either our website, idm-rs.com, or an Autodesk app store. When you go to Autodesk Advanced Steel, applications. And you see Idea Statica connection. It's a 14 day trial, you can dowload it right away. There's all materials attached to it. If you've got any questions, we can get to them at the end or after the class. And now I will hand it over back to Ralph.

RALPH PULLINGER: If there are any questions that you think of as we're going through this, then just butt in and ask them. So next thing that I wanted to touch on-- and this is the new bit, and there are some new new bits as well-- Is computational BIM, otherwise known as Dynamo. So in 2017.1, which came out in September, there is now a Dynamo add-in available. Which means that we can visually program Advanced Steel to create all sorts of weird and wonderful structures, not just relatively simple bridges.

Definitely the color of my laptop is a lot better than the color on the screen. It's looking a bit washed out, so I apologize for that. But how many in the room I've heard of Dynamo? That's good, because the marketing is working. How many have used Dynamo? That's also very good. And who's used that with Revit? Dynamo Studio? That's what I expected. Advanced Steel anyone? OK, sure. Good, all right.

So this bit is really easy. And it got me out of a bit of a hole. But what I realized in doing this is that it doesn't apply to just this one solution that I needed. It can apply to many different instances. So Dynamo for Advanced Steel, new for 2017.1, it's an add-in. There are new notes being added to this implementation almost all the time. So over the past eight weeks, we've had almost a node a week being added.

Same sort of interface that you're used to with working with Revit and Dynamo Studio. There is a health warning. This is important. The implementation that shipped in 2017.1 used Dynamo core 1.1. If you automatically upgrade your Revit Dynamo to 1.2, this will stop working. Your Dynamo cores need to be consistent. That said, last week we actually have released more nodes on the 1.2 core, and they have the technology in place now so that if one core updates, our use of that core will update as well. So this warning is a temporary warning, but be aware it can seriously affect your work-life balance. Because you uninstall, reinstall, and even my Dynamo Studios stopped working, as well.

So news nodes that we've added now include a tapered beam, a compound beam with plates, and a compound beam with sections over and above the nodes that were there to begin with. So that means that we can get access to essentially plate girders and compound sections.

The Dynamo nodes, I will warn you, after all of this I'm going to go into Advanced Steel to show you this as well and sort you through this. We have a straight beam which has a start point, and an end point, and an orientation. A bent thing which has a start point and end point, a point on the curve to define the arc, and again, the orientation. And the orientation is important because that tells me what the twist angle is on the beam. If you don't have it, it's just going to go in vertical.

Occasionally we're going to want to rotate that through various degrees. And as I will admit later, my maths sometimes escapes me, and I have to ask my 18-year-old son to help me out a little bit on this. But my 12-year-old daughter can do Dynamo as well, which is most unnerving.

We can also create plates based on a polygon. And we then added the ability to apply beam sections, or sizes, to an element. So the plate is defined by three or more points. We need to add in certainly circular plate. I'm not prepared to put an infinite number of points into polygon to get a circle, so we need to do that one. And the beam section again uses syntax, which I'll come onto to apply the right section to the right member in the right location. Otherwise it comes in as your standard default beam.

Same goes for material. We create something, we push it in, we give it material name, it's applied. There is also user attribute node, which allows us to populate the user attribute part of the Advanced Steel object so that we can do clever things with it in the Advanced Steel model.

So Advanced Steel, we can set up filters. At one point we were using these user attributes to go searching for things, get them into a selection set and do things with them. And we can still do that as well, but I'll come on to other possible uses of these attributes as well. It might be that it could be a function so we embed a function of the member into a user attribute that we can use later. Or model role in Advanced Steel terminology.

The new nodes that were added literally three days before I came away-- so you can imagine my horror at having more nodes to show you and update my class handouts and presentation-- includes the compound beams. Slightly more complicated this, and I will come onto why this is more complicated. But essentially we're looking at the same sort of inputs, points for start and end, orientation vectors. But now we're starting to really get into the bones of Advanced Steel by inputs also for class name and type.

The compound beam with plates is more or less exactly the same, except the section that is produced is defined by plates and not sections. The tapered beam is a little bit more complex, but it doesn't look that way to begin with. Because we just have a point for a start and end, and an orientation vector. But we do need to know what that type of beam wants to look like.

The caveat for these three new nodes is that the sections that we want to use must reside in the relevant Advanced Steel database. If they don't you end up with default members. Recognizing also that we need a beam section string occasionally, and this is documented in the first implementation, those of you that know Advanced Steel, we have catalogs, and we have sections. And each section has to have a unique key in the database.

Formatting that to get the section string, you need a special delimiter set of characters. This node takes that out of the equation. So what you can see here is the section strings, and if I just move it to the other side of the screen, you might be able to read this. But we have the catalog with the delimiter, and the key. We've got to get that right for the section to be applied correctly in Dynamo, and that just needs a little bit of interrogation of the Advanced Steel databases.

How does it work? We can use code blocks, or we can use points. Code blocks are quite simple to use, but they can get a little bit black boxy. And putting values into points makes the data flow look a little bit easier. So I've got examples of both ways of how we do this.

So input, those you that know Dynamo, we've got input and we can output. So input starts of member, end of member, and the orientation vector. And what we get out of it is a straight beam. However, we don't want that to be any old straight beam, we want to be a certain type of beam. So we take the catalog and the key, we pull that into the create the section string, and we pass that into another node that takes two inputs. And that manipulates the data that's already in the model so that it takes on the appearance of an AISC equal angle. Straightforward, yes, no? Makes sense, hopefully.

Similarly with the bent beam, we just need to make sure that we have the relevant point on the arc to define those three points. The tapered beam is very much similar, and the code block is for the assignment of section string. Again, it's very similar. But these here will take on the periods of the default tapered beam in the database. So you need to have a little idea of what that database looks like. Compound beam, again, much the same.

So if we put that all together in a very, very simple sort of Dynamo graph, we can do many things. So I use Robot for my analysis and design. I know other people in the room use something completely different. And I wouldn't mind betting that in this room there's probably six to eight different analysis packages being used.

But the lowest common denominator that I realized in talking about this is Excel. Most packages can push data out to Excel, either by copy and paste or by direct output. And it got me thinking, if we can manipulate that data in Excel, we can create an Advanced Steel model from any analysis and design application. So in theory I can go from xyz to a steel model without having to use any sort of data translation files, or anything like that.

So I'm going to use, in this example, Microsoft Excel, which I used to hate but have come to love again. And this particular Excel workbook is formatted so that I have a front page which accumulates all the data. I have a Node tab, which has my nodes numbered xyz. I have a Members tab which is numbered, and I have nodal connectivity. Begin node, end node. I also need to be able to look at material mapping that my sort of analysis application might call steel, and what I want that to go to from an Advanced Steel perspective. And I also need to be able to manipulate and map those sections.

From an Excel perspective, I'm just using the look-up. And I'm pulling data in from different sheets. I'm organizing it, and I'm making it so that I only look at one sheet in my Dynamo graph. I don't go messing around different sheets. So VLOOKUP, very easy to use. I gave up using actual rows, and I use named ranges instead. Much easier to work with. So the Dynamo sheet is where it all comes together. The nodes are organized in xy and z. The members are node to node, material mapping, and section mapping.

Advanced Steel knowledge. Material mapping comes out of a database. Those of you that are using Advanced Steel, you will know that there are several databases. Some of the sizes of those databases are quite small, and one of them is absolutely humongous. Which is very big. Or rather than using access, we can use the management tools.

So what we're looking for here in the Materials table is the unique key that we need to use in the node to assign the material to the member. You can't get away without looking at least one table to assign material. The same goes for section mapping. Again, as the profiles or the management tools. Here we need to look at the master profile table first to get the catalog. It's a bit blurry, so I do apologize, but it is in my handout I've produced as well. This presentation is also online. And if you get really stuck, I'll send you the actual PowerPoint presentation as well, so you can see the slide builds. But I will correct my spelling mistakes.

So this will have the catalog, and then the table name that you need to look at to get the unique key for the member that you want to place. So this involves two tables. Currently investigating easy ways to get at this. But what you've got to have right in the syntax to assign a section is word for word, case for case for the catalog, and word for word or letter for letter, case for case for the section key. Because it's a database, if it's a small x, it's different to a big x. If U, B, or whatever is at the front, or the rear, that's where it's going to be, otherwise the key's not going to work.

That graph-- and I'm not very organized, it does look a bit like spaghetti-- will take output from an analysis application and pull it into Advanced Steel member for member, material for material. So the Dynamo graph. It's got to start somewhere. This particular example starts with the Excel spreadsheet. I grab it, and I tell Dynamo to read the Dynamo tab. That's the one that I want to look at, that's the one that I want to pass the data of.

Also became apparent when I was doing this that I needed to take into account a header. Because I read strings in initially, and it all fell over. So if I have a header, it reads from row one. If I don't have a header, it reads from the first line. So a bit of redundancy, a bit of an option to make things a little bit easier on me going forward. It also means that I can still organize my data, and it's always nice to read in my Excel spreadsheet.

So what I do then is essentially slice my Excel data into a series of lists. And that allows me to get almost a list of lists of the columns and rows out of the Excel sheet. Once I've got that, I can start to build up the information again from that sort of list of lists, or from that array, if you want to talk about programming parley.

Because of where I come from, we have SR units. But we have SR units, and we have SR units. One can be in meters, and one can be in millimeters. And there's 1,000 times difference between the two. So this I added in because my very first structure that I created was about this small, whereas in fact it should have been this big.

If we're looking at feet and inches, slightly different approach, I guess. But units are important. If you get the units wrong, or you get the suffix wrong, you're going to end up with something totally unexpected. So again, a bit of redundancy allows me to work with my data little bit easier.

I want to look at-- because I'm going to create a series of straight beams in this example, so I need to look at grabbing points. So I look at grabbing points from columns xy and z, multiplying them by the scale factor, and pulling them into a point node. That point node I can use then to create my straight beam. I do that for both my start point and end point.

In theory, this bit here can be condensed into a custom node so it just takes four inputs and one output a point comes out of. That would clean up the graph no end. But it would also mean that I'm going to be the only one in the audience that understands what is going on in that black box.

This is where my 18-year-old son came in. Because in my Excel spreadsheet, I have an angle for the twist of the member. And I was trying to get that angle into a directional vector that I could pull into my structure. Turned out to be quite simple maths. Which left me a little bit embarrassed. But this sort of code block, or this little bit of code essentially takes an angle and creates a direction vector from it.

The material is using that V lookup and that mapping table to pull the relevant material out of the spreadsheet and assign it to the member in question. And that also applies to my user attributes. So I'm pulling out the function of the member and putting it into the actual member itself using the user attribute node.

The original code block for setting the member looked like this. So I'm taking my catalog, I'm taking my section name. I'm adding a delimiter to my section catalog, and then I'm adding my section to the other string, and I'm putting it into my member. That's what it looks like now. So it's simplified dramatically so that I can see the flow of information as it goes through using the new create section string node that came out last week. And that means it's just a lot easier to read, and it gives me the same results as you can see in that watch window.

So what else can I do? So beam nodes. Straight, bent, compound. So straight and bent are really easy, compound and tapered, a lot more thought. And we needed to be able to distinguish between the different types of modeling purposes, and that's because of what I want to use them for. Because ultimately, yes, I'm creating a model, but I wouldn't be creating a model unless I wanted to document from that model, create my fabrication details or my in-depth views of my connections.

So how am I going to do that? So again, we go back to this AstorProfiles database, or Management Tools. And for a compound section, we can use that to filter to look at what's available in compound. Group the necessary information to pull that into the Advanced Steel node.

The tapered section, there are two approaches to this. One is quite simple, and the other one is slightly harder. In fact, that's a lie. It's a lot harder. The Advanced Steel way of doing it is, in the model in question that you want to pull all this data into, you create a series of tapered beams. So a tapered beam you can set up using different components. So a number of sections with different plate configurations, different weld configurations, different treatments on how you join from one to the other. Different depths-- start depth, end depth, start width, end width for your flanges.

There's a lot of information going into that. And rather than say it is a default tapered member, you say that is something that you actually recognize. So it might be 12 by 18 by 1 by 2. However you want to do it. But so long as you give it a name-- mid 20 mil flange-- that can be accessed by the node to manipulate the data for a tapered beam that you just placed using Dynamo.

If you go and have a look at the AstorProfiles database, or through Management Tools again, this is where it gets really complicated. Because you start off in one table, it directs you to another table, and then you've got to go to another table. So it's not an easy thing to program tapered beams, but it can be done if you understand the data structure of the databases, or through Management Tools.

Essentially you end up with a key for your tapered beam, and then you end up with keys for your sections within that tapered beam that all relate back to that key. So, so long as you keep your keys consistent, it will work. But you need to understand the structure.

The interesting thing that I did find out diving into this was that the column which specified the plates that the flanges and webs are cut from is not required at all. It is totally ignored. There is a way that you can create these entries using Excel that you need to understand exactly how to correct that data so that you can pass it, pull it together, and push it into the database. So it can be done. If you have a list of, say, tapered beams that you are going to be using, you can create that, format it, and push it into the database before you start to import your model.

So where are we going next with all of this? More connections, certainly in Revit. Tighter integration with Revit and Robot, and other applications. Definitely more nodes in Dynamo. And Yeah, we have a saying in the UK, the future is bright. Do you have that one? Anybody heard that? Yeah, the future is bright. The future is definitely not orange, though.

So in Advanced Steel, here's that graph put together. So again, graph starts at the left and moves to the right. Very, very simple thing to read an Excel sheet and pass the data, push it into beams, and assign attributes. So when you first run this-- that is not the wheel of death. That is not the wheel of death. So I've seen lots of people do live stuff and it hasn't fallen over. Although it has missed a member off, which is clever.

So that is what is produced by-- several members off. Not very clear, I'm afraid. It's a simple bridge structure. And it just reads the data and creates the model directly from it. From here, we are able to add connections to the members themselves. And some of these have gone way off target. Don't you love it when a plan comes together? Let's come off, let's go around here.

I can have a connection to these the ends of these members. So if the geometry changes in my Excel spreadsheet and I update this model, my connections will change as well. So the connection to the spreadsheet is recognized, which means that if I start to play around with truss steps, the connections that I've already put in will adapt to suit. Obviously maybe the loads will have changed a little bit as well, but we can reach at the connections if we want to.

So from a bridge perspective, all of a sudden this starts to get slightly exciting. Because if I can manipulate my model using tables, I can actually start to create different profiles for my bridge. So I can create a cambered profile, which is required for fabrication, as opposed to my finished profile, which is what it's going to look like when it's all assembled and on site.

I also want, however, to make that work, a new node, which is going to give me something called twisted folded plate. And again, that's one of the ones that's currently under development. So what am I saying? Essentially, with a pragmatic, organized approach, we can create a steel work model from any analysis application in the world by pushing that data through Excel.

So if you want to create a Stuart model, then we don't have to rely on a link to an analysis application to make that work. I guess you could also argue that the same would also apply for Revit. Because rather than creating steel beams in Advanced Steel, we could also create steel beams in Revit directly from Excel.

In this particular example, the data has come and it organized exactly as I described earlier. And these are just simple VLOOKUPs. And it just pours in and does exactly what it says on the tin. One member to one point to another point.

AUDIENCE: Can I ask you a quick question? That first line [INAUDIBLE]

RALPH PULLINGER: We don't currently have the ability to format to the alignment points, so it's going to come in on center line. But once I manipulate my beams down to, let's say for instance, top of steel, the next time they come in they will obey where they were set to. Because that has a link indirectly back to that line in the spreadsheet. If I update it, then that will obey.

That said, however, Graham, a node to set that would be advantageous, definitely. It is on the shopping list.

AUDIENCE: Can I ask you a question?

RALPH PULLINGER: Yep.

AUDIENCE: That total analysis back to the point where the [INAUDIBLE]

RALPH PULLINGER: So if we pull in faceted members, then we can actually-- and again, we can miter between the facets. But that's sort of a manual way of doing it. So you have to facet or miter between one member and another member for it to slice. Some analysis applications will take in as an arc. They will facet it for the analysis, and they will report it back as an arc. So that's what Robot does.

But others don't. Others have to facet it from scratch. But because Advanced Steel also has an API, we could also in theory select a whole load of members and essentially glue them together with a faceted approach if we want to. Just by creating a new add-in to do that.

Same would apply, although the angle here we're already setting using the directional vector when we put the member in place. The user attributes might say here, for instance, main or just ordinary beam. If my members are being described in user attributes, I can do a model query. I can isolate those members, and I can work with those members such that I then set there model role to beam. Again, it would be very useful if I could set that as I place my member. So there's another node on my shopping list, the member role.

Everything that you can see in this dialog box you can get at through the API. So if you can get at it through the API, you can create a node, you can embed it into the Dynamo package. Once I have my beam, that means that from a documentation perspective, when I create my fabrication details on that, the connections that join onto it, I'm going to get exactly the sort of output I want. That's just going to make things a lot simpler for me. But again, positioning top of still, yes, I agree. Good node. And also I believe that this model role node is also a requirement.

AUDIENCE: Could the position actually be had to like a straight beam?

RALPH PULLINGER: If you were to let's say for instance, the algorithm to do top of steel could be a simple yes or no. Which means that you can still specify the centerline nodal connectivity out of your analysis, and then it would drop it by half the depth of the beam. So if you knew the depth of the beam, you could drop it just by manipulating the start and end points of the coordinates.

From an Advanced Steel perspective, however, that's not what we want to achieve. We want to have the system line were where we recognize the system line should be-- top of steel generally-- and manipulate things from that perspective. So as much as I like to say yes, it can be done, it's a work around, and I would much prefer to be able to set the position of the steel member through a node just by extending that straight beam and having a position code come into it to drop it down. That, I believe, is the best way of doing it.

So here, for instance, where I'm setting the section, this is English text which basically says the catalog that I'm going to and the section that I want to use. So I don't need to know the actual catalog name, and I don't need to know the key. It's all been taken care of for me through this dialogue.

So when I take a beam, for instance, I'll show you what this looks like while I've got Advanced Steel open. So tapered beam comes in by default with three sections. I did apologize for the poor projector. Terribly sorry. I can break it down into different segments, different heights, different web thicknesses. Same with the flanges. All of this is being built up into and is stored in those three tables. So this is an easier way, honestly, to define a plated beam. Once I have all this set, I do a Save As and I can reuse it. I can change it back to any of the ones that are stored in my database already. Not much is happening because the beam is too long.

So once I have them in that database, I can use them across multiple projects. What I would say is that if you go for it and add in as many combinations of type of beam or plated girder that you can think of, you will create an awful lot of entries into the database, most of which you won't need. So my advice would be that if you wants to use that node, build the beams first, get them into the database, and then reuse them on the projects as they come in.

This one, however, generally comes in at top of steel. The node that creates a tapered beam uses the top of steel unless told otherwise by the code within here. Just got to remember where this is now. Here we go, alignment, top web or bottom web. And again, it depends where you're tapering from and to.

It doesn't have to have multiple segments, it can just have one segment, which essentially means that it's a plated girder with constant widths and constant depth, if that's what you want. And in which case that might make sense to have it on the bottom web, or even in the middle. But by default, that comes in at top of steel.

So there will be more nodes. The ones that were released or in production as of last week will find their way onto general release. They're going through a tester at the moment, so what you saw there was a bit of a preview with regards to what those nodes can do. And because of how Dynamo is organized, you can get at the source code for these nodes via Github. So if any of you in the room can actually program C# or .net, you can actually get at the code and write your own nodes, or different nodes based on our nodes, and extend the functionality.

So any more questions? Yes, John?

AUDIENCE: For the tapered beams, can you [INAUDIBLE] get the size of the beam from the inside of [INAUDIBLE] when it comes from an external program? Like there's obviously loads in the North American market that have been taken like a [INAUDIBLE]

RALPH PULLINGER: So one of the drivers for that node was pre-fabricated buildings, or pre-engineered buildings. And there is no reason why given the fact that access can be programmed. You could poke data from an analysis application straight into the relevant database tables within Advanced Steel to correct the entries that are required to manipulate that steel beam node, tapered beam node to be exactly the same. So long as you can actually program that link.

AUDIENCE: [INAUDIBLE] to the point where most people obviously would like to [INAUDIBLE] for every building [INAUDIBLE]. You were saying that you would have to get all your data and input your data into the database.

RALPH PULLINGER: For every new type of tapered beam, yes. Because the node requires the entry in the database first unless you assign it manually afterwards. And for section is called in the Dynamo graph that doesn't exist in any database, you will get the usual triangular solid, which basically says, I've got no idea what you are.

That's the white flag section. Which again, is quite good, because you can look at those and you can think you've messed up somewhere, and you can go and find out why you've messed up. And generally it's a little bit of syntax that you've got wrong. It could be a small x as opposed to a big X in the serial size field section. That's why you need to be able to look at one table, find the entry, look down another table, get the relevant key, pull that together to drive your section shape.

AUDIENCE: The beam [INAUDIBLE] or the tapered beam, one of the reason that you can't do it is because it's basically depending upon the main to get--

RALPH PULLINGER: It uses-- sorry.

AUDIENCE: Is there a way the API could be changed to accept a series of point [INAUDIBLE] and dimensions?

RALPH PULLINGER: Essentially what is in the table. So there's a table for the beam, which defines the beam definition. In that says there's three sections that make up this beam. So in the next table, each section is defined with start width, end width, web sizes, flange sizes, and so on and so forth. And then the other table then describes how those sections are joined together.

As long as the syntax is correct and the keys of the tapered beam and the sections of the tapered beam are all related to each other, then you can program without API for Advanced Steel. You can just program access to create the necessary input, which means that you could write almost like a table almost in access that pushes the data into those relevant tables.

AUDIENCE: Right, and then could you temporarily put it in while you're instantiating, well you have to leave it in the table, but can you dynamically build that table in Advanced Steel and give it a name, and then run it through your node?

RALPH PULLINGER: You can do that as well, yeah. The simplest way of doing is to just draw a very quick tapered beam, change all the necessary values that you want to change, give it the right name, it's in the database. But sometimes it's easier, particularly say, for instance, does anybody use STAAD in the room? STAAD Pro? So STAAD Pro for plate girders will give you part of a table, which tells you exactly how those plate girders are made up.

So you can take that data, read it into Excel, format it in Excel, and you can literally copy and paste the relevant row with the correct number of columns straight into access. And I think a lot more people in the room can program straightfoward cell manipulation in Excel than VVA or .NET within Excel or Access itself. So there are ways of doing it without really complicated programming techniques. You can actually use straightforward cell manipulation in Excel to do it, and again, copy and paste the data from one into the other. It's relatively straightforward to do.

But it's understanding where the data's come from, what it looks like, and what you need to do with it. And the best way of doing that is just by example. Just find out what's going on in the databases, and you literally almost have three tables open, and you can literally take a piece of string and go from one to the other and see how it all fits together. Another question? Is this going to be one of your one, two, three?

AUDIENCE: [INAUDIBLE] In Revit, if I want to do a pulse into a false parameter, in my Dynamo, it does a conversion of [INAUDIBLE] Does that happen to [INAUDIBLE]?

RALPH PULLINGER: Currently we cannot get forces in to Advanced Steel through Dynamo. Again, node on the shopping list. Because that is literally the missing link between going from analysis and the design output into Advanced Steel, where we can do the connection design. So if we had that node, then that would be quite clever.

Essentially, the force that you put into that input would be the force that goes into the node in Dynamo. So if you decide to miss off gravity, lower gravity, reverse gravity, that's the force that will go in.

AUDIENCE: Whereas maybe it recognizes units, and Dynamo has [INAUDIBLE], and so you [INAUDIBLE] It's just a number.

RALPH PULLINGER: It's just a number. You can think of it almost as a piece of text that just contains numbers, a decimal point, and maybe a minus sign. It's got to have the direction in, though. So negative or positive. But ultimately, yeah. Because in my Excel spreadsheet, I've got 14.5, which I multiply it by 1000 to get 14 and 1/2 meters, or 14,500 millimeters.

So it's a number at the end of the day. And it relies on the units that you've set, therefore, in your Advanced Steel template that you start the project. So if you start the project in an imperial template, that's what you've got to push in. If you start it in a metric, you've got to put SI units into it. And again, that also goes into your forces and moment configuration for that template, too. So if the template is thinking kips and it sees kilonewtons, it'll just treat it as kips. Any more questions? One at the back?

AUDIENCE: This goes back to the one [INAUDIBLE] again, sorry. I don't know if the question [INAUDIBLE]. If you were to continue the thing we made [INAUDIBLE] If you were to build Dynamo based on a standard in this table for about three sessions [INAUDIBLE] If you then change the section inside [INAUDIBLE]

RALPH PULLINGER: If you didn't change the Dynamo graph to use the section that you've just changed, it would overwrite it.

AUDIENCE: Right. So change it to use it when [INAUDIBLE] your Dynamo graph, [INAUDIBLE] get a generic model [INAUDIBLE]

RALPH PULLINGER: Yeah, and then you can literally--

AUDIENCE: Put it in place, except one of the beams [INAUDIBLE]

RALPH PULLINGER: Yeah, that's one way of doing it. Or you can literally, once you've got a type of beam in place, because the important thing is that it's the right sort of object, and it's not straight beam. So when you've got a tapered beam in place going from A to B, you can just obviously just flip the orientation, cross the window, and change them all to one type or another type, and you might not necessarily have to go back and update the Dynamo graph. Because without a name, it puts it in as that the default type of beam, which is three sections.

AUDIENCE: So the default is [INAUDIBLE]

RALPH PULLINGER: But obviously you want to--

AUDIENCE: [INAUDIBLE]

RALPH PULLINGER: Yeah, but default is a name which doesn't really convey what it's--

AUDIENCE: I'd give it [INAUDIBLE]

RALPH PULLINGER: Yeah, which not what it's on about. So just rename it properly. So I'd like to say thank you for coming this afternoon. Because I realize it's 29 minutes into the happy hour. Yeah. Graham did promise to bring beers in for everybody, but he unfortunately hasn't done that, so that's good. Again, thank you very much for coming. I hope you've enjoyed AU. And if you do get a chance, although I totally understand if you want to get off, get to happy hour. But it would be good if you would say what you thought of this presentation. I'm not even going to go there.

But you can fill this survey online, either today this afternoon, or when you get back to the office. But yeah, I'd like to say big thank you for coming this afternoon.