JAKE OLSEN: So my name is Jake Olson, vice president of field engineering for DEWALT. I come from a civil-structural background. I've been doing construction my whole career, consulting engineering to begin with, and then much of the product side after that

I spend a lot of my time, as do our field engineering team, working with structural engineers and working with contractors trying to find solutions, products on both sides there. So a fun place to be in the industry. I think a lot of you guys are on one side of the other and that's always-- getting right in between structural and contractors is always fun. But yes so well talk about what we're doing here.

ALAN ESPINOZA: My name is Alan Espinoza I'M A VDC modeler with MMC contractors. I, also, share a little bit similar background the civil engineering technology degree. I, also, been in construction since the ripe old age of 16, getting dirty in the ditches.

A little bit about MMC contractors we're a large mechanical contractor based out of Kansas City. As you see, we've got different locations spread out across the country. We're an employee owned company. We're, also, a union mechanical contractor, just a little bit about us.

JAKE OLSEN: So Alan and I are here today to introduce a plug-in that we've worked on for Revit. A plug-in that sits inside of Revit called DEWALT HangerWorks and this automates the design and placement of hangers and seismic bracing.

So you guys are there in this room because you're very interested in what that even means or where there's problems in the industry. And I can tell you when we first started working on this a couple of years ago, we went out to contractors and we asked the question. We started saying, hey, you know we're working on improving this workflow, there's problems, we see the problems, we're going to build some software solutions that are going to help with that hanger and bracing

So we got a-- that's a extreme, extreme close up. Whoa! That's not distracting at all.

ALAN ESPINOZA: Although, we got-- can we start over?

JAKE OLSEN: I got a pretty similar response when we first started walking in here. We walked into the contractor's office-- hey, we're building software to help with hangers. And I got almost the same response everywhere I went, DEWALT is building software for hangers. WTF, which of course, stands for well what's the functionality.

So I think it could help if I put it a little bit in context. I'm sure a lot of you guys associate DEWALT as a tool company. And indeed we are, we build great tools we've been probably longer in it than just about anybody building tools. But DEWALT has grown into a lot more than just a tool company.

One of the things that DEWALT has expanded into is hangars and anchors. In 2012, it acquired Powers Fasteners and that's where I came from. I was with Powers for over 10 years, now. And we just announced recently that we're going to wrap the DEWALT brand around that anchor and fastening line, so we've introduced DEWALT engineered by Powers as a brand. Along with that introduced a whole ton of new anchor solutions, products specifically for MEP contractors-- hanging and bracing stuff off the ceiling. So that puts it a little bit more into context of why DEWALT's interested in software and improving that workflow.

But I think it's also interesting to think about it from the contractors standpoint. So the mechanical, electrical, plumbing contractors-- an important customer both for Powers and for DEWALT-- are guys that are working on hanging things off the ceiling these types of systems, a lot of power tools, a lot of anchors, a lot of fasteners going to that application. And we've watched both from an anchoring side and a tool side, that same application has changed quite a bit.

So where we used to hang things with the ceiling, this was our customer up on a ladder hammer drill putting in anchors, today it's much more of this person. Now they're achieving the same thing, they're putting in hangers to suspend MEP systems, but it's a different set of tools. It's a different set of products. So for us as a tool and anchor manufacturer we need to make sure we understand what's going on here and solve the problems that these guys are facing.

Same thing from a layout standpoint. So I go back 10 years and this was very much my customer, this was the guy that was putting in anchors and hangers trying to suspend systems. And today, again, that's changed, this is what that guy looks like today. So guys and gals out using things like robotic total stations. So again same concept hanging, anchoring, bracing-- new tools, new ideas, new technology and, of course, as that being our key

customer whether it's a DEWALT power tool or an anchor. We need to make sure we understand that, we're looking for problems, we're making those workflows better. I mean, that's very much a job site of today. I'm sure those of you in this room are probably in this room because you understand that.

What making that possible? Modelling, creating models of what we're actually going to go out and install allows us to place hangers, to place anchors, to do that stuff in advance. So this modeling has really changed, especially if you talk to mechanical, electrical, plumbing contractors. One of the big benefits you get from modeling is, actually, the ability to place hangers in advance. That's one of the big use cases for creating the model for any of these systems. Certainly something like a PT deck or something, I mean if you're not placing your hangers in advance you're in trouble. You're crossing your fingers drilling or you're scanning, I mean not a lot of solutions.

So, again, from DEWALT 's standpoint understanding what's going on they're trying to look for solutions that's in our DNA to understand our customers, our end users, our contractors and try to build better products and better solutions. Working with them and we want to build products with our contractors, not for our contractors. So when we went out to solve this hanger and bracing problem we made sure we were working with the industry we were very happy to find Alan. I think when we knocked on your door and said we're building software for hangers and bracing I think that was the interest of yours.

ALAN ESPINOZA: Yeah, I was definitely interested and probably a lot of us are CAD MEP users, fabrication. We have the ability to place hangers and it's still a very cumbersome process. We can hit a button have it have in place, but there's no way to truly check to see how they're designed. We have to take into account the load of the pipe that we're supporting, of the conduit, or the duct.

So we're a lot of times going through-- unless you guys have a structural engineer that's going through and looking at every hanger scenario that you have-- you're turning to maybe a B-Line book to your strut And, me personally, just taking structural analysis classes, I don't feel comfortable saying, OK, I looked at this chart, I'm probably supposed to use this. But I would feel more comfortable if I actually knew the point loads on this piece of Unistrut. What's the max deflection of that piece of Unistrut or my lower attachment that I'm using?

So HangerWorks is in the process and is going to help us increase our efficiencies there.

JAKE OLSEN: So I think Alan has been a great person to bounce ideas off of. I can speak, I think, to a lot of

contractors in the room that are having problems with hangers and bracing in BIM, in their models. And I'll tell a couple of stories of stuff that I've seen from what I've done.

So we were involved with the big data center project and this was a highly coordinated project, so everything was modeled. All the contractors had to submit models, lots of coordination process. If you guys have worked in the data center there's a lot of, a lot of stuff that goes into those very, very coordinated project.

So through one of the electrical contractors, in this case it was using our anchors to do all their hanging. And throughout the coordination meetings this was a project where there was a lot of coordination and the structural engineer was involved directly in the coordination meetings. And during the course of those coordination meetings, reviewing the model, and then working out clashes, and moving stuff around and the structural engineers sees these massive conduit racks, multi-tier, massive racks. And it's these guys are going through their typical process of working stuff out and says, well, wait. Whoa, whoa, whoa, wait a second that's a big rack I mean, how much load is on that. Those are 4 inch conduits, 3 tier 4 inch conduits what kind of load is going back on the structure? And hold the phone here, I'm not sure we have enough strength in our floor and beam system to support that. So the structural engineer asked the electrical contractor to submit the point loads and this was more or less the scratch on the record. Oh, those point loads.

So again, a highly coordinated project everything was modeled. The electrical contractor had to go out and hire an engineer to calculate point loads. The engineer that was going to do the point loads didn't want a model, they wanted a 2D plan set to do that. And this is not a joke, so we spent all this time coordinating all this and creating this beautiful model. What the electrical contractor gotten back was a set of 2D-- actually a roll of plans with handwritten point loads on it.

ALAN ESPINOZA: I thought it was a PDF. It wasn't a PDF?

JAKE OLSEN: Hand written point loads across the model. So that electrical contractor had to go in and enter all of that back into the model, submit that to the structural to put the point loads where they were in the system, the structural engineer reruns the structural analysis and finds all sorts of problems. So floor, overloaded floor slabs, overloaded beams I think 17% of the structural members were actually overloaded. And hundreds of the hangers were overloaded and that's the same story.

So a big problem. And how many contractors in here have worked on the job that it had a specs section that says something like this, submit to the structural review all support location, point loads, and structural attachment details. How many people took that spec section through it over their shoulder and hoped that nobody ever asked for those. Here's another one. This is a job we just working on. This is a point load limit throughout the floor, so maximum point load on floor slab 600 pounds.

From my standpoint, like I said, I spent a lot of time in structural engineers offices this is increasing from what I've seen. Structural engineers are understanding. I mean, the BIM process for modeling things is great. It allows us to route things more efficiently, it allows us to take what used to be a distributed mess of conduit and pull it together and get it on a rack. And build a multi-tier trapeze. All of those benefits you get out of BIM are great, that's what you want to do you want to build the model and think about routing things smartly in design. However, one of the consequences of that is as we build these big racks and these big systems is that they get heavier. And it can create a problem for the structural side of things and structural engineers like us that are waking up to this. I'm sure that you guys have been involved where you need to submit point loads, so, from our standpoint of sitting in between that, we see a lot of problems with the point load requirements and then actually getting that design done properly.

Alan, I think, from a contractor standpoint you could probably share a similar story.

ALAN ESPINOZA: So we did, we actually had a very similar story. So we were supporting from joists, we were in a penthouse area where the roof was above us. We couldn't support out of the roof deck, so the engineers are sitting in our coordination meetings as well and they're starting to see how much we actually have in the model and they're actually starting to see where those hangars are located. So they're pausing and saying, whoa, just the same way. They are saying, wait a minute, we're not so sure that the design is going to work for this, so can you submit us drawing full of point loads.

And us being a mechanical contractor we're like, hold on a second that wasn't part of our bid that wasn't our scope of work. We really don't want to do that, so we compromised on something we sent them a drawing with line sizes and then pointing out where our hangers were. So now we've done work that we wouldn't normally do. And, I don't know about you guys, but in your CAD budgets you probably don't have to have a ton of time on projects,

you're always behind. On their end they didn't have time in the job either, so we end up sending them to PDF. They get it, they review it, and it's a pretty long process for them to go through because it's not just us it's all the other trades on the project. So one week goes by, hey, did anybody hear about the analysis. Two weeks, three weeks, and I think it ended up being four weeks by the time we had got anything back.

So it turned out that they had to go through and beef up some of the joists to properly support all the MEP systems. So time from us, and time from them wasn't planned out. And that can, potentially, impact schedule.

JAKE OLSEN: So why aren't we doing a better job with this as an industry. Why is this such a black hole? I mean, for me understanding loads, properly designing hangers, anchors, rods is always one of these. I go to the structural engineer-- who's responsible for designing those anchors at the top of those conduit racks. Structural says, that's not my job, [INAUDIBLE], pass it down. Go to the contractor and they say the same thing-- hey, are you guys designing those anchors, oh, no that's a structural thing, we don't design those, it's one of those situations.

Best case scenario somebody might be looking at some table values, perhaps they might be trying to look up and size things for tables. Maybe they've got a strut table or something, where they're trying to get this thing sized properly, but I would say that's a best case scenario. And even that's not easy to do because tables usually don't address all the various conditions we see. I mean it's certainly a multi-tier trapeze gets complicated and how to properly calculate and size that.

I mean, I can tell you from an anchoring standpoint there's definitely a misconception in the market that I've seen. A lot of people I think size anchors based on the size of the rod, so I've got a big rack, half inch rod. What do I put at the top of that, I put a half inch anchor. Why? Well because I have a half inch rod, not looking at really how much the anchor itself can support or can hold. And just to put that in context, if I have a half inch rod and one of these typical cast-in-place anchors, some of you guys are probably used, and I just pull on it the anchor will fail around 4500 pounds. It'll rip out of the concrete where the rod will not fail until 8500 pounds.

So in a lot of cases just sizing things based on the rods is not sufficient, it's not enough. There is a whole building code section on how to properly size those anchors, but it's complicated. I mean, concrete's a squirelly material. There's a lot of work that has to go in the sizing those.

And when you've got a project with tens of thousands of hanger points and anchors it's just not practical, there is not an easy way to do that.

You think that's bad, struts are even worse. So maybe something more that looks like a distributed load we can start looking in our old beam-- any structural guys can look into their beam tables. But getting deflection on a multi-point load across a piece of strut or stress that's not a simple calculation. And this will be different than this. That's a different loading on the strut and on the anchors, which is different again from this if I move the pipe to that side. And maybe you're going to get that figured out, wait until you put a seismic into the mix. Throw all of that out the window because that just makes it more complicated, again.

So this isn't being done today because it's complicated and we see that with seismic. If you guys have ever looked at some of these-- I mean from a structural standpoint recently earthquakes, our buildings are standing up pretty well, but all that stuff inside the buildings are still having a lot of problems. Things are not being hung and braced properly to deal with the seismic loads, again it's complicated. There's a whole chapter in the building code that talks about how to properly hang and brace things, but it is really a lot of calculation that has to go on to do that properly. So it's not something natively that a contractor, in particular, wants to do. Structural engineers don't want to do it. There are a lot of pain points here and getting things properly hung and braced.

And I can tell you when we talk about modeling, there's a real broken workflow in BIM. And I'm sure some of you guys-- let's see if this resonates, but here's the here's the modeling workflow for seismic that I typically see. So contractors start the job, they're going to model everything. They want to get anchors into the deck ahead of time, they go through their modeling, and they get their first pass gone, set. They start coordination with the other trades, they start working as things start moving around, and they might even start hanging first floor second floor equipment.

Once they've got a pretty dialed in model where they think things aren't going to move any more, we got most of our clashes worked out, then they go out and they hire somebody to start trying to figure out how to hang and how to brace that, and how to add the seismic components to that. And at that point it's usually, hey, I need this in 24 hours or 48 hours. I got to get my seismic. it's a broken process and a lot of that happens completely outside of the model. So we've done all this work to model everything and then for seismic you're asking somebody to come in at the very end of that process and try to figure out how to hang your

brace your system. And by that point a lot of times there's so much junk in the way duct and pipe and other trades in the way, you can't do an efficient job of putting that bracing in.

So we're not thinking about that upfront, we're not modeling it up front. And that's because, like I said, it's complicated I mean, how many times do you get seismic plans back and, I mean, they're just 2D plans. I think mirrors your experience.

ALAN ESPINOZA: So right now we have a project going on and our lead on the project is starting to talk to the seismic consultant. And they're trying to figure out a workflow to use. So what they've done so far is they've gone through and he gave him a contract document, as an example. And he's, OK, here's where all your braces. Well everybody knows a contract document and your coordination model are probably not going to match all that much, depending on your delivery type.

But I just see this kind of unraveling into what I call the ping pong effect. I'll hit the file over to you, hit file back, hit the file back, OK, we got it dialed in. So I just see that as an other broken workflow.

JAKE OLSEN: So one of the big problems by not doing that natively in the model is you lose all the benefits of modeling to begin with. So all the things you want to do with a well coordinated, well detail model. When I've got seismic and living in a completely different place, I can't do that. So what do I want out of that model, I want actionable output. I want to be able to create sheets for my prefab shop, cut lengths for strut and rod. I want to be able to create a bill of materials so that I can do estimating and quoting and purchasing from. I want my points. How many jobs have you been on when all the gravity hangers are set with your total station, but you've got to go back and drill in the seismic points because those weren't coordinated on time in the model.

It's a broken process today. By now getting that bracing in up front you lose all the benefits of modeling that stuff to begin with. And, for me, a big one is the engineering piece, too. We've got all that stuff in our model, but we don't have any real justification in the model that we did it correctly. When somebody stops and says, the record scratch stops and says, hey, where's the point loads? You're completely out of that-- all that beautiful modeling you did you don't have any data in there to solve some of the engineering problems. So in order to do this, in order to create good submittals and good engineering information we need to not just be modeling generic hangers and components. We need to build really product specific hangers, components of seismic bracing. So what we'll show you with HangerWorks is we've built a

database of components, so from a DEWALT standpoint, we do all the anchors, all the upper attachments. But we wanted to make sure that for you guys, for contractors you've got all the components that you need all the typical brands you work with, they assemble, your braces, your hangers, your whether it's wire, or cable, or strut. So what we'll show you here is a program that builds hangers that have real content from all the suppliers you are probably used to working with. And that allows me to do engineering, it allows me to do some middles, it allows me to do all the stuff that you guys like to do. So I think we all understand the problem, let's show you what we did here with the solution. So Alan's going to jump into HangerWorks here and we'll walk you through how this solves some of those workflow problems.

ALAN ESPINOZA: All right, so I just put a demo model together showing, highlighting what you see on a normal project different types of scenarios. Oh, sorry. There we go.

OK, so, like I said, I put together a model. I'm going to go ahead and close this view. So, you guys, how many Fabrication Academy P users do we have? Quite a bit. So is anybody thinking about switching to Revit anytime soon? Using fabrication parts, families? Kyle, what are you going to do?

So. We've we're seeing how Revit is evolving with fabrication parts. And how those are acting more and more native to Revit, being example of families.

Now, let's say your an engineer and you guys have spent a lot of time developing all of your families. And you don't want to just throw that all out the window. Well, Hanger works with both families and fabrication parts. So I'm going to go ahead and select this run. This is fabrication parts I have a couple of the six inch show waterlines, and a couple of heating hot waterlines. Four inch.

So I'm just going to highlight it. I don't have to use a filter. I get my button that pops up. Hit the hangers coming in. So what's going on here which is different from Hanger Tools you guys may have tried is, while these hangers have been built out of those components and placed, the engineering behind them is happening as well. So every piece of strut is being checked for bending, for stress, for deflection. Every anchor is being calculated according to the code requirements. So that's happening as Hangar Works is building those Hangar assemblies.

So what you get in the model, then, is not a generic hanger or generic points. You've got specific products. Those are product-specific built hangars. And what you see is what also gets embedded in the model, is all the information you would like, such as point loads and

calculations. That gets built as those hangars are getting placed.

So, really, the special sauce here is you guys probably know, is when you pull either Fabrication content or native Revit content, when you look at those, they're dimensionally correct but they don't have weights associated with them that you would need. So if Alan grabs one of those, you can see we're not just looking at the pipe in the sense of it being a pipe of this diameter. Hangar Works assigns weights to these pipes, and that allows us to do the calculations that we need.

So take Conduit, for example. I don't want to base my hangar and anchor calcs on the way to the conduit. I'm going to base it on the weight of the filled conduit with the conductors. So Hanger Works looks at every system in there and it assigns the proper weight to it.

Now there's cases certainly where that weight-- we may not want a 100% filled conduit. Or if you're working on a job where you have to fill the conduit with water, if you guys have ever dealt with that. So you also have the ability in here to redefine the weights if you don't like what we assign to it. But I would say for the 99% use case, these are the proper weights. Water-filled pipe, conductor-filled conduit. Those are the weights that we assign to these things that allow us to do the calculations.

And this thing needed to be dynamic in the sense that not every pipe that we draw or install is filled with water. Yes. So this needed to have the ability to go through and assign different material types that way. So you can select all your systems, select the proper material type and then all your fill weights are based off of that.

So let's say we're done with hangers, we're starting to coordinate hangars and get everything dialed in. We're starting to see the light at the end of the tunnel in our trade coordination. So I am just going to go ahead and open up a plan view here.

And let's say we have to move a hangar for whatever reason. First of all, I want to show you guys something that I think is pretty cool. We've got different loads associated with this hangar. I'm not sure if you guys can see that or not back there, but we've got-- support tension one has a load of, in this instance, 325 pounds. And that's because it's supporting the two 6-inch pipes versus the two 4-inch pipes. Two 4-inch pipes is now supporting in this instance 280 pounds. With a total gravity load of 604 pounds.

So let's say I had to move this hangar, I don't know, 10 inches to avoid something. So now,

that total gravity load is now 584.9 pounds. So all of the hangars in the model are being updated and as we move things around. So if I'm sitting in a coordination meeting and somebody says "Hey, you've got to move, I got a pipe running through there. It gives you, as a detailer, as an engineer, the information you need to move those. I can drag that thing to some point. And as soon as it goes over capacity, as soon as I fail that anchor, it's going to tell you, "Hey, look, you've moved it too far".

So if I'm trying to work out clashes, it gives you-- I mean, you guys have all probably said in there, "Hey, you got to move". And you're nervously saying, "OK, I think I could move and not really know" because you're changing the stresses on the system, you're changing your span distances. You're changing the load on those anchors. So by this thing being dynamic, if you see what Alan just did, he's got a color coding filter set up here, right? So when I've dragged that too far for my strut is now overloaded. It tells him, "Hey, look. That's not a good way to avoid that clash. Don't stretch out that strut or you're going to have to go back and redesign it". So it gives you really intuitive output on how to move things around. How much you can move things around before you get into trouble with the structural side.

ALAN ESPINOZA: So how does all this, what I call magic, happen? When I first started getting involved and seeing how HangerWorks actually worked, there was a need to separate the cable tray from the conduit, the conduit from the duct, and the duct from the pipe. Because they are all hung separately. They all have their own specific standards or specifications. So what I like about this is you can create your settings and you can import and export them. They could be project-specific or they can be specification-based.

So you can go into the [INAUDIBLE] or the MSA 58's or the [INAUDIBLE] rules. You can build those out and import and export. Or if you--

JAKE OLSEN: One of the things working with--

ALAN ESPINOZA: Go ahead.

JAKE OLSEN: One of the things we realized right out of the gate was, we wanted just to hard-code in the [INAUDIBLE] spacing requirements, or NFPA and we realized that even though those are the rules perhaps by NFPA, there's guys who like to hang stuff, you might talk to a person who puts two hangers on every pipe no matter what. Even though you have maybe a six foot piece of pipe they're still going to put two hangers because that's how they like to fit things up. So

rather than making those hard-coded rules out of the codes, we've opened it up for flexibility so you can build templates in as your firm likes to build things.

Now, you're always going to be limited by the codes. It's not going to let you do things that are not code compliant from anchor standpoint or for a stress standpoint. But it allows you to set up your own customizations. I want to hang it within six inches of a union. That type of stuff. You can identify that per system. Per trade.

ALAN ESPINOZA: So I'm not going to go through every one of these tabs and bore you to death. But I'll come back to the engineering. I just want to hit on a couple here. So under the project, this inherits whatever is in Revit.

So right now I have two levels in the project. It's reading what my elevation is. That's dictating and telling the upper attachment where to go. So if you have a metal deck like in the instance here, you can tell, do you want it to go to the upper floor of the deck? And most of the time we want to do that. Another thing is the deck profile.

So if we look at the deck profile, this is going to tell us is it going to be wood-formed or is it going to be metal deck, and what kind of metal deck, how thick is the concrete going to be and how tall is the metal deck going to be.

JAKE OLSEN: Remember we're not just placing generic Hangar content. We're building engineered calculations, so I'm not just sticking point for you to go out and shoot your total station. I need to know what type of fastener that is. So I need to know if I'm going to have a PT slab, a metal deck, so I can do those calculations. So these settings are going to pull from that database of products and put the right products in the model that can be built properly.

Another nice to have there if you could jump back real quick is you can set point load limits per floor. So how many guys have run into a point load limitation on a roof. You get up to the roof level and you've got this really tight point load limit. So I can say on my roof level I've got a 400 pound point load limit. Don't place any hangars in this model that go over 400 pounds. So it lets me identify that per floor, which is a pretty common issue, especially on the lighter gauge stuff when you get up to the top of the building.

ALAN ESPINOZA: So then we're just going to move kind of to show the product-specific items in here. So here we have some dual anchors. If I want to disable, let's say, our firm hardly ever uses quarter inch rod, I could just filter that out and say I don't want to use that. And we're going to use that

3/4 inch rod, or a 3/4 inch in this instance.

JAKE OLSEN: So you can turn on and off libraries, whatever you're used to building your stuff out of. You can turn those on and off and that allows what's left in the library is what Hangar Works solves when it goes in and it builds that content.

ALAN ESPINOZA: Just kind of shown a little bit of Anvil. We look at the clavice hangers here from their catalog. It's pretty robust. And then just some of the I'm going to just go to the pipe type because I'm a little biased. But this is just kind of showing you where you set all your spacing rules based on material types. So you can go in and set all that up.

So next, we got to start producing deliverables out to the field. I'm going to drag this up a little bit here. Yes, sure.

AUDIENCE: Whenever we stretch that out and [INAUDIBLE]

JAKE OLSEN: Right.

AUDIENCE: And pre-run everything and it will update it with a more [INAUDIBLE]

JAKE OLSEN: Even better, you can resize that single. Right.

ALAN ESPINOZA: So I come down here and I could change my lower attachment.

JAKE OLSEN: So it will tell you where-- correct. So it'll tell you where your error is. I've got a bending problem on my strut. I've got an anchor problem. And you can fix those problems. So you can set up your filters to highlight where your errors are. And then you come back and you fix the problems rather than trying to rerun everything again. So very user-friendly in that sense of fixing the problems. Eric.

AUDIENCE: Yeah. When you showed the different libraries, I saw that you had costed that.

JAKE OLSEN: We do. I'll talk about that a little bit later. But there's a lot of obviously opportunity there to look at how do I best hang the system. For example, a question that might come up is, is it smarter to hang everything with three inch rod? Or should it use half inch drive, or should I do a mix of both? I can look at 3 A rod. I might have to pull my spacing in a little bit. And maybe I can get longer spacing. But the components cost more.

So there's installation labor. There's cost in data. That allows me to do those what-if analysis.

What's the best way to hang this system? Again, that's the type of stuff that's very hard to, intuitively as a modeler, to answer those questions right now.

ALAN ESPINOZA: So I'm just going to show you, guys. This is the schedules that I have in my template right now. I just have three. I'm just going to click on what I like to call-- there is a few easy buttons and don't tell our field we have easy buttons, because they already think everything we do is easy. So this is producing schedules within Revit. It is using native Revit schedules. And it's producing a few different-- these are preloaded when you download. So I'm going to click OK. You notice now that all those schedules populated under the Schedules tab.

So let's say I wanted to look at the bill of materials for the trapeze hangers. It's pretty hard to see all those numbers, but it gives me a count, prefab ID, and I will kind of talk to you a little bit later about what I like about that. Again, it goes into the costing. And if you have your shop and field labor filled out for each component, you can definitely do that. And it's just going to tell you.

It's really just leveraging all the data that you have here, your cut rods of individual lengths, and your cut length of strut. Oh, yeah. Those are all even numbers, too.

AUDIENCE: [INAUDIBLE]

ALAN ESPINOZA: We're coming.

JAKE OLSEN: We will get there. We will get there. That's when we-- I have the balloon drop and everything.

[LAUGHS]

ALAN ESPINOZA: So another deliverable that we would send out. So fabricating. I'm sure a lot of you guys do reports for your hanger's, sending it to the shop if you're fabbing hangers. So I don't know. I like having a little bit more visual effects when I send these out. So I'm just going to generate some sheets here. What this is doing is it's generating schedules for all the different hanger types. So I may have a TPZ 1-14, but there's a hundred of those on the project. So what it's doing is it's combining all those single instances and it's saying, OK, you have a hundred of these So instead of having a long list of, saying, 100 times, having 100 line items, essentially. I really like this functionality here.

JAKE OLSEN: So one of the-- working again, trying to help contractors be more efficient, improve their workflows. Prefabrication of hangers was a big one. That's a lot of-- some guys are really good

at it already but a lot of people are trying to figure out how to get a better prefabrication workflow for hanger's.

So building in this type of sheet that can go straight down to your fab shop makes it very easy to do struck cut lengths, broad cut lengths, build out your hangar assemblies that can be sent straight out to the field.

So you've got one of these sheets here?

ALAN ESPINOZA: I'm going to show this, side by side here. So if I go look at one of these hangers. Let's say that one. That's categorized as a TPZ 1-14. So if I go to click on the sheet and look at a TPZ 1-14 is, it's going to give me just a basic image of what that looks like. And I ran this the other day and if I have a rod that's lower than the other, it's actually going to show that picture. Which I thought was really awesome.

It's also going to associate dimensional data for that hangar. So you don't have to sit there and annotate your hangers. I know you could do it in a report but, again, I'd like to give a visual of as to what the person in the field is actually going to be building.

So these A dimensions, B dimensions that you see are associated with the schedule up on your sheet. Like A, for instance, if I go that's cut-rod length for rod 1. So if I have varying lengths of rod, I'm going to get that in my schedule.

So, just to keep running with this example here. Let's say I have TPZ 1-14, go back into my model. I'm going to bring this over here so I can actually see what's going on. So I have that selected. So let's say in my 3D model, for whatever reason, I've got to change that length of rod. So I'm going to attach it to a beam.

JAKE OLSEN: Right now he's got 16 of this type of hangar assembly, and four of this type of hangar assembly.

ALAN ESPINOZA: Right. So when I do that, it said, "OK, I'm no longer a TPZ 114-002, I'm now a TPZ 114-003. So it's dynamically changing and knowing when changes are occurring. And this right here is like a huge-- this thing is awesome, right here. This, I love this.

JAKE OLSEN: That's right. Speechless.

So we promised these guys seismic.

ALAN ESPINOZA: Yeah, you want to do some seismic?

JAKE OLSEN: Let's do some seismic. Come on. Come on.

AUDIENCE: Real seismic.

JAKE OLSEN: Let's get some seismic.

ALAN ESPINOZA: So we're just going to-- what's up?

AUDIENCE: Whenever it's drawing hangers, does it automatically try to avoid hangers under or above, or does it just go in spacing requirements as needed and then you adjust and--

JAKE OLSEN: Let me-- let me.

ALAN ESPINOZA: Jonathan, what was like one of the first things I said that you should do?

JAKE OLSEN: Avoid. Avoid. So, these will actually attache to, let's say we have a beam, it's going to find that model category of a beam. And it's capable of shortening of one rod and let's say you don't have a beam on the other one. So in my mind, why can't you do the inverse of that? That's on the development team's list.

As of today, if you've got structural steel, it'll be clamps.

ALAN ESPINOZA: But it's not going to self-coordinate.

AUDIENCE: Offside? Accordingly, off the beams, not necessarily--

JAKE OLSEN: Yeah. Because you can't be on the center of the beam, you got to be off to the edge and you set your offset. So that's built in today for beam clamps. The idea of, hey, I only want to do anchors, or I only want to do beam clamps, or make this work. Certainly doable. And I'll talk a little bit about where this whole thing is going. But right now, it's very dynamic in the sense of whatever's above, whatever type of fastener needs to be there, it'll put it in, do the calcs, make sure that it's got the right type of product in place. Yep.

AUDIENCE: Question. When you want to attach [INAUDIBLE]

JAKE OLSEN: Yes. Similar type of question where you want to force it to attach to--

AUDIENCE: [INAUDIBLE]

JAKE OLSEN: Yeah. So same question. Right now, it's going to base that spacing more on what it needs to support the pipe properly and then put the right attachments up above. But I'll talk about our future less than a minute here. But that one where I say, "Hey, look I only want to use beam clamps on this building maybe because concrete's already pouring and we don't have time to do it. That is absolutely doable. Not going to be in the release. And I'll talk about some of the stuff that we're going to build out

AUDIENCE: Does it automatically [INAUDIBLE]

JAKE OLSEN: Yes. So any time you change a hanger assembly, it re-calcs. So I've got the weights associated with the pipes. And the weights on the hanger points are tributary. You know, whatever I've got going off. And when the plug-in sense is a change in the hangar location spacing, it does a recalculation. So if I drag a hanger, if I move a hanger. So it's a dynamic calculation.

ALAN ESPINOZA: Let's say I delete a hanger for whatever reason. Notice how all my pipes turned red and this one turned purple? So based on my filters, this is telling me that these pipes aren't supported right now. And that this hanger is supporting two much weight in that instance.

JAKE OLSEN: Which makes sense. You took out one in between. The two on the outside pickup more load. So, one of the things you'll know if you've got a huge, massive model, it's hard to get every single thing braced and hung properly. So it's important from us from the get go to make sure we're giving you visual clues. Like, hey we got 98% of the hangars but over here it's red. You got to go figure out what to do here because we can't. There's places where sometimes you can't find a solution. Out of that hardware library, you said I'm going to use half inch rod or 3/8 rod. Maybe I can't support that particular place with 3/8 rod. So it gives you the visual clue of where to go back in and do some work.

So turning on seismic. You guys that are in seismic countries should recognize some of this. I got to put my acceleration, pick a seismic design category. Let's go D because that's where I live. And now, when I go and I run hangers, it's going to also do-- so he's picked the conduit here. So this is going to take a little longer. Probably still a little bit shorter than your outside seismic engineer, though.

[AUDIENCE LAUGHS]

But it's actually doing full seismic calculations in the background. So you can see I've got my transverse and longitudinal bracing in there. And one of the things out of the gate here is, you guys don't just want a black box seismic tool, right? If I do this, and you've got to go and submit this or prove to somebody you did it right, and you said, "Oh, I use the Hangar Works". Maybe some day, but I know we're not quite there yet, you need to prove that you did that right. What are the code requirements? How did I size those? How did I sized the stride? How did I sized the bracing?

So we've got a massive calculation engine sitting in the background. And a massive engineering report tool that populates out of that data that's in the model. So ALAN ESPINOZA just ran a full seismic engineering report on that hangar location. And you're going to get blown away at what you get, but you're going to get more engineering than you ever wanted out of that one brace location.

So the way I see this being used is creating a schedule of all the braces. And then running calculations on a few of them to prove that you've done things properly. So all of my force resolutions, how did I get my force to the anchors, was it cable brace, was it rigid bracing, diagrams of how that was sized, strut calculations, how did we do that strut calc. Those are extremely complicated. They take a lot of work, they take a lot of time. There's a lot of fudging that goes on because it's so much work to do them right. And that's the amazing power of building something like this into Revit. You can do full-on optimized seismic counts for any single hangar in that system.

I mean, full submittal. This is an engineering package you could walk down to a seismic engineer and be very close to having a stamped completed project. Yeah? [LAUGHS] It should save you a lot of time.

And I mean, again, in full disclosure, this may not be able to solve all, in fact it probably won't do 100% seismic done stamp, you're out. But this is going to get you 90% home, 95% home in a lot of common projects. And it gives you that visibility while you're modeling of what you should expect for seismic. It allows you in that very first coordination meeting to walk in there with the model with your braces already in place. And say, "Hey look, I got a brace there. You're not running ducts through there." Or I'm not going to-- you can tell them you don't want to redo your seismic even though it's really easy, if you need to. But it allows you to think about seismic upfront while you're modeling. Huge difference from a lot of the workflow we see today.

ALAN ESPINOZA: So we're just going to jump back into modeling. And let's say we do send something to the design team to review, like an engineering calc schedule. So let me find that schedule.

JAKE OLSEN: We talked a lot. Both ALAN ESPINOZA and I have had a lot of problem with point loads over the projects we've been involved in. And like that like that spec I showed you, no point goes over 600 pounds. Well, I can very quickly run this engineering report. I'll put it as just a schedule. Here's every single anchor, seismic brace, in my whole model. And here's the loads that are on them.

So, "Engineer. Here, look. Here's all my bracing. I didn't do anything over 600 pounds. Here's every single load. You guys can check them if you want to, but here it is". That type of output is extremely powerful when you're sitting in that meeting and-- hey. That engineer says, "Hey. Look where are your point loads?" "Oh, they are right here, sir".

AUDIENCE: Drawing that shows all those points--

ALAN ESPINOZA: Funny you ask.

JAKE OLSEN: Did you watch our slide?

ALAN ESPINOZA: So you would want a supplemental drawing for them, right?

JAKE OLSEN: Yes. Perfect example. I've got a corridor. Hey, this is a corridor I'm concerned about as an engineer, I want to see all the loads that are in this area. You know, you see that hatched on a plan, like, "Give me all the loads in this area". So because that data is now native in this model, my loads, all of that, I can very quickly do things like tagging of that.

ALAN ESPINOZA: Yeah. So this is just a native generic model tag. You could bring imports or parameters. You could do parameters within your labels to extract the data out of the hangars. So you'll have a shared parameter file that you're using that goes along with the hangers to make sure that you're able to access the data there.

So I am just going to click OK on those three hangers. And now, all of a sudden, this is just native Revit power right here. So now, I can just go and clean up my drawing a little bit.

JAKE OLSEN: So I can run that on the floor. I can run that on an area. I can run that on the whole thing. I've got that information. It's live, it's dynamic, if things move, my point loads update. So like handwritten rolls of paper, only better.

ALAN ESPINOZA: And these are very customizable. Like I said, if you just wanted to give something-- If you just wanted to call out the name, you can go in and customize a tag for that. You just go in and edit the family and push and pull parameters around as you see fit for whatever your deliverable is.

AUDIENCE: How out of the box deliverable do those annotations come with it?

ALAN ESPINOZA: What's that?

AUDIENCE: The out-of-the-box solution will have at least the starting point of the annotations there.

ALAN ESPINOZA: Right.

JAKE OLSEN: That tagging function is built into Revit. It's just a matter of identifying--

AUDIENCE: The concept behind it, the--

JAKE OLSEN: Yep.

ALAN ESPINOZA: Yeah. That's not a problem.

JAKE OLSEN: Exactly.

AUDIENCE: Are those side beam bars fully adjustable?

JAKE OLSEN: Yes. So I can drag them. Like, you know, I got a clash, let me go to 30 degrees. Oh, error, error. Don't go to 30, go to 60. That same way that we updated those disbands on when we were moving around the hangar, the seismic updates, as well.

AUDIENCE: [INAUDIBLE]

JAKE OLSEN: You mean from a tolerance standpoint? They're all put in at fixed tolerances. You guys got to do what you want to do in the field.

[AUDIENCE LAUGHS]

I can't improve the quality of work in the field. I can't do it all.

ALAN ESPINOZA: So I'm going to-- go ahead.

AUDIENCE: Will these work with multi-trade racks?

JAKE OLSEN: Will these work with multi-trade racks? They will work with multi-trade things next to each other that will fit on a rack. But if you're thinking of like a Skanska monster uni-strut thing, that's a different process altogether. But if I've got docked-in conduit sitting next to each other, sure. I mean, very, very simple to inspect. Correct. Correct. Yep. Yes?

AUDIENCE: I don't know if it does this or not. Does it-- when you're working with a joist system, does it work with panel points on your joist? So if you've got to be 6 inches away from the panel point on a joist, does it do that?

JAKE OLSEN: Right. I think this is still an extension of the same question. So, what I'm doing now is I'm optimizing how to best hang that system and then attach it to whatever's above those points. I think there's a real opportunity and this is one of those things that we keep hearing. It's, well, let's not optimize the system, lets force points up above and then figure out what to do to attach. Today, no. If you're at that point, it'll put the rod. You can drag the rods to that point. It'll up update and do all that stuff. But I can't say, hey, look here's where I want this thing to go. It kind of works the other way at the moment. But I will talk about phase two here in a moment. And there's a lot going on. Yep.

AUDIENCE: So, I was working for a large design build contractor, so oftentimes, we already constructing work and building before the entire piping design is finished.

JAKE OLSEN: Yep.

AUDIENCE: So, what happens when piping changes? How does your system react? If a pipe moves, what happens?

JAKE OLSEN: So you would probably rerun your hanger calculator.

ALAN ESPINOZA: Are you saying if you move your pipe, do your hangers go with it? That would be nice, right?

AUDIENCE: Yeah, if you take a-- let's say that we ship that whole run of pipe in the corridor. What's going to happen?

ALAN ESPINOZA: So right now I think that's being worked on to do that. So if I move that pipe, we were testing it earlier. It wasn't flawless, but it's going to be a function. Everything goes with it. So you're saying, this pipe right here, if I have to drop elevation?

AUDIENCE: Sure.

ALAN ESPINOZA: Let's see if it works. I hope you don't mind me going rogue here.

JAKE OLSEN: Oh, man.

ALAN ESPINOZA: I like breaking stuff.

JAKE OLSEN: I told this guy, "Don't go rogue in the presentation".

ALAN ESPINOZA: I got it.

[AUDIENCE LAUGHS]

JAKE OLSEN: Every time. "I'm going to break it. I'm going to break it".

ALAN ESPINOZA: That's confidence in the product. So there's your question.

JAKE OLSEN: In the back, there.

AUDIENCE: I notice the anchors are built in the generic model category. What was the thought process in choosing that category, [INAUDIBLE]

ALAN ESPINOZA: I think Jonathan could get that one.

AUDIENCE: So because we're servicing multiples trades, [INAUDIBLE]

ALAN ESPINOZA: I think you can control it through work sets.

AUDIENCE: [INAUDIBLE]

ALAN ESPINOZA: Maybe work sets, maybe something else. I don't know.

AUDIENCE: [INAUDIBLE]

JAKE OLSEN: And that's--

AUDIENCE: In the real world, these [INAUDIBLE]

JAKE OLSEN: But that would be like an easy button. That would be potentially useful to build. Is having that-- because the functionality is there, we can build the button and that can do that. So you don't have to go through the clicks of--

ALAN ESPINOZA: The young lady.

JAKE OLSEN: I'm sorry, where?

ALAN ESPINOZA: The young lady in the back.

AUDIENCE: Can the structure model slant and not worry that there is a problem?

ALAN ESPINOZA: It recognizes it. I've only done a demo with the beam. So I didn't-- OK. I drew a beam in here and I re-ran it, so it's awesome. Links work.

AUDIENCE: [INAUDIBLE]

JAKE OLSEN: Yeah. That's a brilliant question. So he said, how do we brace the spacing? And I think a lot of spacing for braces is just 40, 80, right? I mean, how many people just put 40, 80, I got seismic, I'm done. This is very different from that. This is actual calculations based on the capacities of the anchor, of the arm, of the system. Checking back every time against ASCE 7. Making sure that I follow the score requirements. Because if I show up and I've get a job or somebody is actually going to look at how did I hang and braced that system, 40, 80 doesn't cut it. I have to show the calculations I did to do that. So these are real calculations happening. Not blanket rules that sometimes they work, sometimes they don't.

AUDIENCE: [INAUDIBLE]

JAKE OLSEN: Checks everything in the system. I mean, sometimes the upper attachment limits. Sometimes the seismic fitting itself limits. What is nice here, though, is when I run that, it's looking through that whole catalog of components trying to find the most efficient way to build that brace. So if there's a solution possible, it'll throw it in the market.

AUDIENCE: But it will recognize the material and apply that.

JAKE OLSEN: Yep. So it's pretty robust on inspecting fabrication and Revit components. If he clicks on the different types of pipes here. And we also built in a tool, in case you pulled in some crazy stuff that we can't natively recognize, we can identify that and assign weights to it, as well. But I would say we're capturing 99% of duct pipe cable tray and conduit that comes into these models.

AUDIENCE: What if it gives you an error-- [INAUDIBLE]

JAKE OLSEN: Yes so you'll see that where we lined it up, and you'll see a list of stuff that we couldn't identify. But you'll see. Here's what we saw, here's what we assigned it as. And if there there's an error there, you have to go in and fix that. And say, no, no, no, that's actually plastic, it's not steel. Sorry. In the back. Right here?

What does it do to the size of your model? The beautiful thing here is all of that engineering stuff isn't running all the time unless you update stuff. So it's not a lot different than if you ran a hanger assembly. I mean, the size of the models is as big as the content that you put into the model. We've tried to keep very consciously our concept light. So you're not getting a beautiful looking dual tanker, you're getting more or less a reference enough to model from.

So we were conscious in that sense, because you end up-- but it's no more damaging than if you placed hangers any other way. Because it's not-- all that engineering and you just have it in there as a module. It doesn't have a whole bunch of volume for the model.

AUDIENCE: Would the software recognize my installation method as far as [INAUDIBLE]

JAKE OLSEN: Yep. Yeah. That one's not done yet and that is absolutely one of the ones that has been-- as we've gone out and field tested, that's one-- I promise you that will be very soon. That's been such a request that we will sort that one out. But as of today, you're going to get two-tier rack.

Now, the nice thing is the weights are the same. Right? So I use the same weight. it's a little bit more work, but you can come back.

ALAN ESPINOZA: I think that would be pretty easy to achieve. Because you're going to model it based off of your hanger. Right? You're going to keep--

AUDIENCE: It's going to be different.

JAKE OLSEN: Yeah. Your strut. You've got to use a back to back strut in different clamps. Yep. That one is a huge request so we're working on that one. We definitely got to get that one implemented. No doubt.

AUDIENCE: [INAUDIBLE]

JAKE OLSEN: Just perfect. Just perfect, leading us in. So All of this modeling work, we show the output to prefabrication, right? We've got that dialed-in. We've got the engineering output. But the final step really of this model is getting that out to the field. So I can do something with it. So we've

kind of built this to be very agnostic. Any type of system you're using, we've built a point output system. So yeah, that's a hot question.

AUDIENCE: [INAUDIBLE]

JAKE OLSEN: Got it. So any type of anchors that gets dropped in the model gets associated with a zone of influence and that will show up as an heir if those intersect each other. That will be key, yeah. But, listen you can take that to--

AUDIENCE: [INAUDIBLE]

[LAUGHS]

JAKE OLSEN: But that zone of influence carries over to Navis. So if I was just going to go in Clash and Navis. As long as they've built zones of influences on their anchors, you'll see that clash as well. I like your style, man. I like--

[AUDIENCE LAUGHS]

JAKE OLSEN: So like we said, this outputs stuff, you're using a Topcon, Sokkia, Trimble. We've got the output straight to whatever raw batch you're using. There you go.

ALAN ESPINOZA: And based on your northing, eastings, you see elevation. We left this pretty customizable for however you output because not everybody outputs the same way for whatever reason. So I'm just going to run northing, easting. Don't blink. I'm going to generate the report. Over at my file. Now you have a CSV file with a unique point name. And this is just pulling from the mark. Native Revit parameter, which you always want to try to use what's there. So you get your northing, easting, and then your description of what you're using. In that instance, and in this case the wall 75, 40.

AUDIENCE: Would those be customizable if you had your own command that you wanted to use?

JAKE OLSEN: On the points themselves?

AUDIENCE: On the points. Yes.

JAKE OLSEN: Yep. Yep.

AUDIENCE: Can you put abbreviations on your points?

JAKE OLSEN: You mean as a subscript or a prefix on the points?

AUDIENCE: In Trimble, right, you can put abbreviations on your spots.

JAKE OLSEN: I was told not to talk about Trimble this week, but--

[LAUGHS]

I actually had to sign a waiver when we got our class approved.

ALAN ESPINOZA: Last year he was hamming it up.

JAKE OLSEN: Yeah. I mean, this is very easy to customize, the output on those.

So we're out of time. We got a couple more slides to wrap it up, ALAN ESPINOZA. ALAN ESPINOZA and I will hang around-- all right, one more question. One more question.

AUDIENCE: Real quick, [INAUDIBLE]

JAKE OLSEN: That's how we're going to--

AUDIENCE: [INAUDIBLE]

JAKE OLSEN: I will close this out talking a little bit about that. And then ALAN ESPINOZA and I can stick around and answer any questions afterwards.

ALAN ESPINOZA: I don't know why it didn't go there. There we go.

AUDIENCE: So what is this? Like $2,000 a year or something?

JAKE OLSEN: I gotcha. I gotcha. All right.

Closing it up. Closing it up. It's beer time, right? I'm ready. So just like we had here today, one of the most exciting things has been going on and talking with you all about building the new tool and it seems to be useful. One of the most frustrating things is every time, especially with this guy, ALAN ESPINOZA, every time we release a new build of this and say, "All right, man, this is really good." the first question out a lot of people's mouths are "Well, that's great. But what about? I mean, what about this? What about output? And all this type of stuff". What about bottom-mounted conduit. And driving me nuts. I mean, I got to the point I'd hear "What about" and I would say, "Come on man, WTF. Right?" Which, of course, means We're

Thinking Future, here.

[AUDIENCE LAUGHS]

So I've got a-- at some point, when you're building software, you've got to draw a line and say, look, this is a ton of useful features. We've got most of our beta testers have said, "I want it right now. Stop trying to fix it. I need this stuff right now". So we drew a line. And we said, we've got to get a version out. I've got an awesome phase two that we're building right now as we speak.

We're launching this first version. I think there's so much useful information in here, point loads, analysis, that type of stuff that I don't want to wait any longer to give this to you, guys. I want to give you what we've got now. And it's a very robust product, what we've built.

If you're interested in getting started, I've got some flyers up here, if you want to write that down. You can also grab one. But send an email to DWGTP@GOGTP.COM. As long as your email address doesn't end in @Hilty.com, you'll get a reply from us.

[AUDIENCE LAUGHS]

And anybody who sends us an email, you're going to get a free trial. So the month of December will be free. So we're going to start installs in December. After that, next year, we're going to go to our licensing, so it'll be out of the gate $500 a seat. So that will start in for next year, for this. Annual license of $500. Yep. So--

AUDIENCE: Do you have an online demo of [INAUDIBLE]

ALAN ESPINOZA: We will.

JAKE OLSEN: Probably. Yeah. That's a good question. Yeah.

ALAN ESPINOZA: 21st. November 21st, we're done one.

JAKE OLSEN: I will tell you. I think for anybody who has gone out and paid for point loads, or paid for engineering or seismic, I think that puts you in a pretty good value proposition. I've talked to-- we were just working with a guy who came down to the booth and he paid $17,000 on his last shop for two floors of point load calculations. We said. "Come on."

A good software couldn't have been built without a great team. And like I said, we wanted to build things with our end user, not for end users. GTP did all the programming on this. Absolutely fantastic. I couldn't speak higher of Todd and his team. Jonathan is sitting here. Did a lot of the heavy lifting.

We have a crack engineering firm. One of the best seismic engineering firms I know. And he's sitting here from Tobolski Watkins Engineering. Did a lot of the heavy lifting on building all the seismic calcs that go behind this. A lot smarter than I am. So that was key. MMC, I don't know how many nights and weekends Alan gave up South Park to work on this instead. And that's a sacrifice, if you know Alan.

ALAN ESPINOZA: It was family guy.

JAKE OLSEN: And I see a lot of you guys. I've got some of your beta testers that were in the room that helped us as well. So I can't thank you enough for all the feedback along the way. I can tell you it's a start. I think we've got a huge feature set that's going to give you a lot of functionality, and it'll keep getting better. So that's all, thank you.

[AUDIENCE CLAPS]