DAVE YOUNG: Wonderful. So welcome to the last class of the middle day. Little past the halfway point. This is Georeferenced Point Clouds in Civil 3D. So we're going to be able to take a scanned point cloud from terrestrial scan data, could be from drone, could be from whatever, but we're going to be able to map that to real world coordinates, and bring it into our plans, do some comparisons, bring it into Revit, all sorts of fun things like that.

And great, my clicker doesn't work. Plan B. So, little bit about myself. I am Dave Young, application engineer for Repro Products. We're a reseller out of Atlanta. Been doing this for quite a while now. Started off holding the dumb end of a steel tape for a surveyor. Moved inside doing CAD work, and now training people in how to use it.

About 40 years ago, I guess, sitting around Christmas time. Family had all gathered for Christmas dinner. The aunts and uncles were playing cards, and grandmas are cooking dinner. The kids are playing, and I got a little bored. This lovely aroma's wafting through the house, and I decided to go into the other room where the Christmas tree was. And I discovered that if you take the little plug and unplug it, the lights go out. You plug it back in, the lights come on. You do that really fast and it makes blinky Christmas tree lights.

That was a lot of fun until you touch the two prongs at the same time. That's not fun. Arm turns all tingly. But what I did learn from that, there is the right tool at the right time. At the time, 40 years ago, the little sequencers like this didn't exist. Now they do, and everyone expects their Christmas tree lights to blink.

Point clouds are a tool that's coming into play a lot more these days. We're going to take a look at some of the tools to make those work for you. Instead of just having the raw data that's out there somewhere, we're going to be able to bring that in and actually use it in context of what it should be.

So we're going to learn how to align a 3D laser scan with actual survey control points. We're going to learn how to import that laser scan into Civil 3D and other software, create a Civil 3D surface from this scan data, and be able to calculate some volumes, and do analysis, and that sort of thing. And finally, visualize that into Infraworks, Navisworks, bring it into Revit to help with the site visualization there as well.

So the traditional method of capturing site data has been with a total station. We've been doing that for decades. You go out there and you shoot one point at a time, and shoot a grid, and it takes forever. It's got some advantages. You get accurate positioning across the entire site, even if you're surveying a pile of dirt on one end of a site, and a pond on the other, it's totally in context where it's supposed to be. And it's easy to do that because you can move

between different spots on that site very quickly with a simple traverse.

The drawbacks to it is it's one point at a time. It's low level of detail. You're getting a 25 foot grid of whatever you're shooting, and you get limited output. You get XYZ coordinates, essentially, and you don't have the color or photographic record. Now, I will say right now there's exceptions to everything I'm saying. There's some equipment that does photographs with it. Same with the scanners. There's always exceptions. But it does take forever to do it using the traditional method.

Capturing terrestrial data or capturing site information with a terrestrial laser scanner. Here we see a Faro, Leica, Trimble-- everybody makes one nowadays. You see a dozen of them down there in the exhibit hall. Capturing this, you can go out there and set the scanner in the bottom of a pond and captured the entire volume with one shot. You'll be in and out in 30 minutes.

So we got a couple here we did, mostly with two shots. Two setups to capture all the information you're seeing there. Quick question. See if anybody knows this. I have prizes. Anybody know when the first commercial terrestrial laser scanner was introduced? No? OK.

AUDIENCE: '87

DAVE YOUNG: '87? '96. Yeah. Now, there were prototypes and things like that, but commercially available. So I guess the next question doesn't get an answer or a prize. Anybody know what that first scanner was? Probably not. It's a Cyrax 2,400. It was the size of a microwave, and had two big battery packs, and now you can get the size of a bread box. Because you at least tried.

So the advantages of capturing everything with a terrestrial laser scan is you get a high level of detail. You're capturing millions and millions of points per second. Anything the scanner can see, you can capture, basically. And you get the color images with that, you get a photographic record. The drawbacks to it, it takes a long time to traverse between locations on job sites.

So if you have a pile of dirt on one into the site, and the pond on the other, separated by a thousand feet, you've got to go little bitty leapfrogs to get in between them. And that takes forever to do that. And you have an assumed coordinate system, or a prosumer grade GPS position. Basically a little more accurate than your cell phone. Now, yes there are scanners where you can attach a RTA antenna on top, and get accurate positioning, but that doesn't work indoors or under heavy tree cover.

So, real quick here. Just so everyone's on the same page. A little scanning basics, here. If you're going out there with your laser scanner, you're going to set the laser scanner on this little star over here, and we can capture everything you can see. To move around, we're going to move over to this spot over here and get overlapping coverage. And these little green dots over here are target spheres there help it triangulate. If the scanner can see three different spheres, it can triangulate between those from each scan, and it knows where it is. It's kind of like traversing with a set up and a back site.

We've also got on the side of the building here, some checkerboard targets. A scanner can use those-- the software can use that to process and treat them just like the target spheres. The other way to do it is just do a cloud to cloud registration, and then computer churns away for a while, and it's a lot faster processing if you use those targets. So, we can use that concept to combine the best of terrestrial laser scanning and total station methodologies.

So a couple different ways we can do it. The checkerboards you can tape up to a wall and survey those, or you can drive some stakes into the ground and put a washer on top that fits into the base of these target spheres. Now, by doing that, you're going to actually go out there-- maybe you, maybe the local surveyor. They're going to survey these stakes that we've driven, and they will have exact coordinates at that point.

The spheres have a known height. You add that to whatever the coordinates elevation was for that point, and you have the center of that target that you can then use to calculate where everything is inside the point cloud processing software.

So here we are. This is just a simple XYZ file. It's got elevations, northing, easting, and point numbers over here, and that's going to be brought into your point cloud processing software, whether it's the Faro Scene the Cyclone, Point Sense, they all have the same concept of what this is. It's reference's. You bring those references in, it will align those point clouds to those known reference points.

So let's see if we can do this real quick. So I do mention here, methodology is different for every piece of software out there. I'm using Faro Scene. There are others that do the exact same thing. So here is that little building we're looking at, or same site anyway, and if I look at one of these targets on here just real quick. This is one of those spheres, and it has a position right here. And I'm going to throw that over into something so you can see that a little bit better. It's got assumed zero, zero for the site. Wherever that first scan was zero, zero, zero.

So how can we make that match up with that XYZ file that we had in Excel? It's going to be different for every software, but real quick, I'm just going to come over here. I'm going to import some surveyed points, and there they are, right there, CSV file. So now, in here, I have references. These references, they have the same name as some of the targets we saw earlier.

I think I looked at this one right here. I-0E, and there's an I-0E over here. So when I come through here real quick, and let's do it at top level. This hopefully won't take too long. Come on, wrong button. Want to place those scans and simply tell it to use the target based system. We're going to hit OK, and this should process in about two to three seconds. We get some results.

Now if I go back to where I was earlier, the same exterior I-0E coordinate value. We're going to grab that, copy it over here in Notepad. We see data is now transferred into state plane coordinate values for the state of Georgia. So it's not too hard. That always is very easy to do in the point cloud processing software. You can do this in ReCap, it's just not nearly as easy. So if you're doing the laser scanning yourself, you already have the software to do it. If you're having someone do the laser scan for you, ask them if you can work for the surveyor to get it in state plane coordinates if you need to.

Now, that same concept, it doesn't have to be state plane coordinates. Imagine I've got the pile of dirt on one side of the site and the pond on the other. I can set up a little control cluster of three points, put my spheres on it. Use my total station to traverse between them, set another cluster near the other feature I want to capture, and those will be registered together then. Weird sounds from next door.

Let's go back here real quick. Whoops, wrong one. OK, little productivity tip. Civil 3D and a lot of the software will accept laser scan files directly, depends on what type of scanner it is. Usually it's FLS or something like that. Most of the Autodesk software will read those files. Instead, bring it into ReCap. Instead of having to drag in five to 50 separate FLS files, you can bring it into ReCap. You only have to drag in one RCP file. Makes it a lot faster and easier to use. All Autodesk software reads ReCap files, even Inventor.

So how can we use this scanned data in the infrastructure world? Existing ground conditions. We want to know what's out there. We'll go out and scan it real quick. We can do it for comparison purposes. Is As-Built-- does it match the design? We do it for volume calculations.

Imagine you've got stripped off topsoil or a hazmat reclamation site. How much dirt's being moved on a daily or weekly basis? You can do that with this data. Use for visualization purposes. What's out there now? Instead of just putting in some random tree blocks, you can actually scan and see what's there.

So here's a project we worked on last year, year before, something like that. I've got three separate pond areas that were scanned. As we can see over here on these plans, those are separated by quite a bit of distance. Now, this project was done not on state plans, just on a project assumed 5,000 5,000 somewhere on the site. But when I bring this into AutoCAD, Civil 3D, or anything else, all I have to do is just drag the ReCap files in, and they plop in the correct location. Doesn't have to be on the state plans if you're working with different spots on the site.

So comparing that to the existing plans, we have here a couple of shots out of Civil 3D Surface, with the pond scan laid underneath it. We can see they matched up really good. We're suspecting that these were built with GPS controlled equipment because everything matches really, really well. And here's a nice pile of dirt, scan around it, you can gather it, and bring that in, do some volume calculations. Stage storage, once you actually get it into Civil 3D and a surface. Visualizations, you can use Navisworks, you can use Infraworks, 3ds Max, anything like that.

OK, so what's the steps to do this? We're going to take our point cloud that we've brought into our coordinate system. We are going to convert that to a ReCap file because it's easier to work with. We're going to attach that point cloud to a drawing, and then we're going to create a surface from that point cloud. Civil 3D has a tool to do that, and then we can compare it, visualize it, do volumes, stage storage, whatever we need to.

So attaching a point cloud in AutoCAD or Civil 3D is just like using an XREF. In fact, if you want to find it and detach it, you can use the XREF tool to do that. So in Civil 3D, there is an insert button, attach point cloud. Whoops, wrong button. Actually, AutoCAD has the exact same thing. Revit has it, all the software does. And when you do that that way it's going to give you an XREF dialog box.

Now you notice here the use geographic location is grayed out. That's because the point cloud did not have an assigned coordinate system to it when it took this capture. So in ReCap you can assign a coordinate system. Georgia 83 West [INAUDIBLE] is what we is. It doesn't have to have one, and in fact, it's probably better if it does not have an assigned coordinate system.

So I'll show you that in a minute.

There is a small glitch that we have discovered, and no one seems to know a way around it yet. So at this point we are not using a coordinate system assigned in ReCap to these point clouds. Now, they are using state plane coordinates, we just don't give it the coordinate system that they're using.

AUDIENCE: What is that glitch that you're talking about?

DAVE YOUNG: I'll show you in a minute.

AUDIENCE: OK.

DAVE YOUNG: Yeah, they don't come in in the right spot.

AUDIENCE: Because I had some issues with that.

DAVE YOUNG: Yeah. I have no answer for that glitch. So if you're looking for an answer, not here.

AUDIENCE: [INAUDIBLE]

DAVE YOUNG: Yes. OK, so to bring a point cloud in-- I'm sorry. Once that point cloud is in we're going to create a surface. There is this horribly long Civil 3D command name, AeccSurfaceFromPointCloud. You can type that in or you can go to the surface, create surface from point cloud. Or you can select the point cloud and it has a little contextual ribbon that has create surface from point cloud already right there for you.

So a couple of things to notice. This is wizard driven when you start creating that surface. There is a number over here, distance between points. You may think hey, it's just showing me that for information purposes. Whatever you do, do not leave that what it is. Change it. I'll explain that. So that value is the distance between points in your point cloud. So it is 0.0153. Just very little, tiny-- that's how close the dots are together in that point out. That's going to vary for every point you use, but it's going to be a very small number.

When you create the surface it's going to create 10 lines that are that long. So I did most of the calculations. If I leave that number alone, the distance of 0.0153, it's going to create a surface with 59000 data points in it, and I have no idea how long it takes. It's about three hours and 45 minutes based upon just a guess, but if I change that number to just a tenth of a foot, we see the total number of points in our surface goes way down, and calculation time is

about 30 minutes on that.

If I set that value to a foot, it gives me 129,000 data points in my surface, which is still a lot, but it only takes 30 seconds to build that surface. So there is going to be a little experimentation in there. Find out what value works best. A foot works pretty good. Sometimes you get way with two feet, but it depends upon what your surface looks like. You might miss some data points in there.

So anyway, back to our creating a surface. There's one more tab on that wizard, and that is the filtering. When in creates the surface, it will filter out points that-- if you use the Kringing Interpolation, which involves math that I don't understand, it will filter out points it thinks aren't on the ground, and it does a very good job of it. In these ponds examples I've got here, I've got dirty manholes sticking up out of there. Got a [INAUDIBLE] in one of them. Those are not included as part of the surface. It does a really nice job of filtering that data out.

So once we hit the Go button, it's going to process. 30 seconds to six hours later it's going to give you a surface, and we see that surface sitting there behind the point cloud. So let's actually do that real quick. So back over in Civil 3D. I'm going to just start a new drawing real quick, and I'm going to-- well, there's a couple different ways I can do this. I can to the Insert tab and attach a point cloud. This works pretty easy. Let's go get the one called Ponds1.

Now here we get the little dialog box, just like inserting in XREF. I can give it a full path or a relative. I specify the insertion point I want to be zero, zero, zero. Scale of one, rotation angle is zero. I'm going to zoom into the point cloud and hit OK. It should take five seconds to bring this-- I am running a solid state drive, so it's pretty quick. If you tried doing point cloud work on a spinning drive, hope you enjoy getting cups of coffee. It takes a while.

So that's one way to bring it in. I can use the actual XREF dialog box, and here's that Pond1. I can go say attach a point cloud, bring in Pond2. Same [INAUDIBLE], hit OK. So Pond2 has now been attached. I see both of them in there. They are in the correct location to each other.

And the other way is to simply come up here and grab Pond3, and drag it into your drawing. That's by far the easiest. It's going to ask on the command line, doesn't give me the dialog box. S for insertion point. I specify a zero, zero. Scale factor of one, rotation to zero, and that third pond is brought in there for me. So very easy to bring these in. If we zoom in on one of these, see what it looks like.

If I want to create a surface from this now, real simple. I just grab the point cloud. Create a surface from point cloud. That's the easy way. You could go to home surfaces from point cloud. Either way, brings up this little wizard. Now it's going to want me to select a point cloud, and it's hard to see since I don't have the bounding box. This is why I always do it the other way. Kind of drag the window across, grab my point cloud, then create the surface from it.

Pretty typical surface creation. We just give it a name, Pond1. Now, notice I tried typing Pond space 1. Another weird little glitch. It doesn't like spaces when you're typing. So you had to put Pond1, then you can actually go back in between the D and the 1 and put a space in it. Don't know why that is, but it is.

OK, point cloud selection. I can do one point cloud, I can do multiple point clouds, or I can do part of a point cloud. I don't necessarily want to do the whole thing. I could, but if I only need the surface at a part of this, I'm going to remove what's there, and then use this little button in the middle to attach a selected area of a point cloud. Now, down here in the command line it's asking for the first point. I can just draw a rectangle, I can draw a polygon, or select a polyline. I'm going to go with the polygon option. And I just kind of real quick pick a few points around the outside of this thing, and then see if it close.

So it's going to analyze it, find out how many points were in that area, come back and display some numbers for me. Hopefully it was going faster than that. There we go. So here's that very similar number. So polygon areas-- I'm sorry, that is 65 million points in that. So 65 million points. If I leave this alone, it's going to include all 65 million. We don't want that. I'm going to do a value of just a foot. Type in one. Then we see that number point select, it drops down to 98,000. A lot more manageable.

So click on Next. Definitely go with Kringing Interpolation. I don't know why you'd go any other option, unless you're working with a classified LiDAR file, where you have just the ground data points that you could work with. You might set no filter. But we'll create a surface from that, and it's going to tell me, hey, it's working in the background. Pop up little thing down here, and in about 30 seconds we're going to have a point cloud.

OK, so while it's doing that, I can still work in Civil 3D. That's the great part about that. It may be a little slow while it processes things, but there we go. So now I have surface created from point cloud. We'll zoom in on that, and I can see that point cloud sitting here behind it. I'm sorry, see the surface sitting behind the point cloud. What I'm going to do real quick is grab my

point cloud, and kind of turn the level of detail down a little bit to where I can actually see something behind it. It gives me just a little bit of insight into what's going on.

And I can grab the point cloud on the surface, throw it into object viewer and we'll see what we get. Tip that up on the side. We see or surface looking like that, and realistic, and I guess my point-- darn F1 key. OK, so the point cloud doesn't like this plane object viewer, but I could simply orbit my drawing. And then we can see those two in the context of each other.

Now, I could change my style to show contours in a 3D view, but no big deal. And from here it's just Civil 3D. You can do a stage storage analysis, you can create a 10 volume service, you can do whatever you need to. So I've got several other things I want to show you in here, in addition to that. Let's go back to my PowerPoint real quick.

Another trivia question. So what was Infraworks called immediately prior to Infraworks?

AUDIENCE: InfraStructure Modeler.

DAVE YOUNG: InfraStructure Modeler. Yay! I got something for that. It's not worth much, but a little Windows sticker here. So what was InfraStructure Modeler called-- too far away, I guess. What was InfraStructure Modeler called prior to InfraStructure Modeler?

AUDIENCE: Project Galileo.

DAVE YOUNG: Project Galileo. And prior to Galileo, what was it? Yes, I heard the answer back there somewhere.

AUDIENCE: Land Explorer

DAVE YOUNG: Yes, Land Explorer, and I think I typed that wrong. Where was that one? It was a nice throw too.

AUDIENCE: [INAUDIBLE]

DAVE YOUNG: OK, no hecklers. OK, bringing the point cloud into Infraworks, it's almost as easy as bringing it into Civil 3D. Let's just jump out to Infraworks real quick. Here I have a very small site. This is a water treatment plant, and I need to bring that point cloud in here. So let's jump over to a different proposal just to keep these things separate. And once again, we can go the hard way. Come over here to our data sources. We can attach a point cloud this way.

As before, my preferred method is drag and drop. Don't need Google. We can take one of these georeferenced files with real state plane coordinates. Let's grab the exterior RCP and drop it in here. It's going to connect to it. It's going to come in. It's not going to be configured yet. We have to configure it. Now, the exterior point cloud that I brought in here, does not have a coordinate system assigned to it from ReCap.

So real quick-- wrong R. Anyone know why Autodesk made two icons that are almost identical? So here I am in ReCap. This is that point cloud. If I go to my settings, under it real quick, we can see here that it can be assigned a coordinate system. This file does not have one assigned. The coordinate values are in a state plane. So if I look down here on the little coordinate display, those are the state plane coordinates. There's just not an assigned coordinate system to it.

So, all I have to do over here is say this is in GA83-WF. It's all I got to do. Hit close and refresh. And unless I horribly screwed up, this is going to drop in right where it needs to be, almost. So that looks halfway decent. I am seeing a couple of things that are wrong. Half my site is underground. So this was done with Model Builder. We all know that Model Builder's elevations are plus or minus 20, 30, 40 feet sometimes.

In this case, it happens to be off. I have actual real surveyed coordinates where this point cloud is, so I've got two options. I can try to lower my surface, which doesn't work real well, or I can simply apply an offset to that point cloud. So to do that go back my data sources. Let's find that point cloud real quick, configure it, and after a little experimentation, I discovered that was off about 17 feet.

So I just put it is Z offset of 17 in there. Hit Close and refresh, and we'll see that gets moved up just a little bit. So now I have a lot more of my surfaces. There's still a little bit of it underground because the levels of accuracy on the point cloud are much better than what the DEM file was that this was created from. But that's how you bring it in.

Now, I do have also another point cloud in here. Let's go open. This is a georeferenced one. They're actually both-- I had to rebuild a data set this afternoon. I guess I didn't get far enough on that. Hopefully this goes quickly. Yeah, it did. OK. So here's same thing, but if I look at the settings for this one, we find that it already has a coordinate system assigned to it. The only difference between these two clouds is one has a coordinate system assigned, the other does not.

So if I do the same thing back in Infraworks, let's take the [? Geo-xed, ?] drag it into ReCap. The only difference, this is already pre-populated with my coordinate system. It comes in at the same spot. Easy enough to work with at that point. So I should see one pop up 17 feet lower than the other one, and that's kind of what I'm seeing here.

Now, bringing point clouds into Infraworks, it sounds like a great idea, but performance drops way off when you do this. There are a couple of settings you can play with. So you come up here to application options. Go to point cloud, and you can turn the point density down a little bit and that will help. So we do that. A lot fewer points for it to have to calculate, and it works much better.

OK, what about bringing those point clouds into Civil 3D? OK, you saw me drag the ponds in. Those ponds we're on assume 5,000 5,000, did not have a coordinate system. If I bring the point clouds in here-- Let's do it the long way. Let's go to insert, attach point cloud. I'm going to bring in the exterior. This is the one without the coordinate system assigned to it, geographic locations unchecked. I hit OK, and that should pop in right where it needs to be, as expected.

If I bring in the other one, attach the georeferenced one with the coordinate system assigned to it, and say use geographic location, changing my coordinate values here. I hit OK, and it throws it way off in space somewhere. This is that little weird glitch I was talking about earlier. And let's just do a Zoom Extents. We'll see they're nowhere near each other. OK.

AUDIENCE: [INAUDIBLE]

DAVE YOUNG: Huh, interesting. We'll pretend it works.

AUDIENCE: Make another tab--

DAVE YOUNG: OK, another tab and back?

AUDIENCE: Yeah, go back.

DAVE YOUNG: That's OK. OK, cool. I wasn't aware of that one. I'm trying to tell you about another problem.

AUDIENCE: [INAUDIBLE]

DAVE YOUNG: In another tab. Interesting. OK, so yes?

AUDIENCE: Question. I noticed that [INAUDIBLE] ReCap file, that file was [INAUDIBLE]

DAVE YOUNG: No, that's only going to be off a few feet, if it was. I can go change that real quick. I forgot how to run ReCap. Change that to US. It really doesn't change the coordinate values that much. It may be off. Depends upon which coordinate system you're in and where you are in the state. It may be off up to 10 feet or so. We're off a lot.

So one thing I did notice. Let's go back to ReCap real quick. Back into my settings. I'm going to change this value to meters, hit OK. Now, I just changed the display. Everything's always stored in meters. But hovering over the x and y values down over here, I don't know if you can see them, but I'm running-- the first two numbers are six, four for the x, and a four, six for the y. If I go back to Civil 3D-- no, not that one. Site plan, and now I have no idea. I'm going to just undo this time too.

So this point cloud, notice my coordinate values down here are the six, five, and the four, six. So it's basically inserting that at the meters location, but in a feet drawing, and it just doesn't work. Don't know why. There's no way around it, so that's why I don't assign a coordinate system in ReCap. It's a weird little glitch. If anybody knows way around it, please let me know.

OK, what else in Civil? So that's it for that right now. Let's go back. Import that cloud in Infraworks, in Navisworks. I'm going to skip that one. It's the same thing. You just drag it in and it puts it in there, no problem. I'm actually going to come back. Oh, I'm not ready for closing remarks yet.

Did add something with Revit. So here we have a Revit building, Revit project. If we try to bring that point cloud in-- I don't know if everyone's used Revit, it's going to say no, it can't do it, and it's going to put the point cloud way, way, way far away. OK, just not a good thing. We can use a Civil 3D Revit tool called the shared reference point. That's the easiest way to do this, to create a new site in Revit.

So from here I want to export out a floor plan. Easy way to do that like, I go to say, the foundation level. I'm going to come up to exports, ADWG of this view. I'm actually going to do-- it doesn't take too long. So I hit Next. Save it somewhere. And it's going to make a DWG file of that for me.

AUDIENCE: [INAUDIBLE]

DAVE YOUNG: [INAUDIBLE] DWF? Same concept. So once I get that DWF out, it's going to create-- well, DWF would work. Got me thinking that way. Get that DWG out, I can go back to my site plan

drawing. Here's a site plan. I got that wrong point cloud. Let's just an XREF and detach that one. To get rid of a point cloud, just detach it. XREF Manager, great little tool. Go back up here, and there we are. There's my point cloud.

I've already sketched over my point cloud. I know where all the features are that I have to avoid. So I'm going to-- if it ever catches up-- grab that point cloud, go to the Point Cloud manager. I don't want to detach it, I just want to turn it Off I can do that real quick. OK, my point cloud's not being displayed. It's kind of like turning off a layer. The other thing I could do, didn't think about this, go to XREF, go to exterior, and simply unload it. It's gone now. I can just simply reload it when I'm done or need it back.

But anyway, I got that building I want to drop in right here on this site plan. Let me close this, free of some memory. So I'm going to insert that drawing I created earlier out of Revit. So I want to drop it in here. I know after some experimentation, it needs to go right there, and we'll put it perpendicular to this other wall, there. So that's where my building's going to go. That's my floor plan from Revit.

And I also need to know what my finished floor elevation is going to be. So in this case, it's going to be 766 feet where that corner of the building. From Civil 3D, go to your tool box. If you're on subscription, you get this tool, Subscription Extension Manager. It's a shared reference point. This is not intuitive and easy to find out there on the Autodesk world. If you download the handout, I give you some links and instructions to go find it towards the back of the handout.

But we run this. It's going to simply ask for an origin point. It doesn't matter where I pick on the building, I just had to pick the same point back in Revit. I'm going to grab the front corner up here. It's asking for an orientation. Pick another point along that wall right there. It's going to show me my x, and y, and z elevations. I know that z is wrong, but that's OK. I'm going to change it later, but I do need to set the drawing units to feet.

And it's going to export it out as MySharedReferencePoint.xml. Hit OK. Save. Now, I said I was going to change that later. Let's go find that file. Wrong one. Let's go to edit that. This is an XML file. I can simply find the origin z, and change that to the proper elevation. It's all I've got to do. Close that back up. Then we go back to Revit.

Easier to work in the 3D view up here. Zoom in so I can see what I'm doing. The same tool, the corresponding tool has to be installed in Revit, and it shows up under add-ins. Import

shared coordinates from XML file. You can do this manually, but it's a long drawn out process. This was much easier. I pick the same two points. My orientation, it's going to create a new coordinate system for my site. Easy enough.

I still have to do one more thing. Go to the managed tab-- and this is all spelled out in the handout-- locations, and I need to go to my site. Looks like I've done this a couple of times. I'm going to save my shared point, I'm going to make that one current, and I could delete the internal, or delete all the others if I wanted to. That way I have one site coordinate system to work with.

So the next thing is actually bring that point cloud in. Since my point cloud is in state plane coordinates with really big, big numbers, it won't come into it unless I do that thing I just did. Go to a point cloud, I'm going to grab my exterior. Down here, the positioning, by default, is set auto centered to center. This is not a good thing, but I'm going to do it anyway, and we'll see that it comes in, just not where you would expect it to.

Let's go back to manage. Easy way to do this, just take my point clouds and remove it. Let's bring one in again. Exact same thing. Exterior, but this time my positioning is going to be auto by shared coordinates. I do that, I pick my coordinates correctly, comes in where it needs to be. Finished floor elevation is where it needs to be, and you can now start designing in-context. If you need to make sure you clear some other structure, or your ground matches, or whatever you need to. And then from here, you can start cutting sections, and elevations, and whatever you need to do.

So I think that is about it for the software demo side. Let's see what we've got. Closing remarks, I guess we're ready for that. Cool. So what have we learned? Or hopefully learned. Georeferenced scan data, It doesn't necessarily have to be state plane coordinates. You can be just an assumed site coordinate system that you apply to various pieces and parts to these data clouds.

You're going to go out there and survey the control points, just like you would control points on a traditional traverse, you're going to set a little cluster of three points and scan them, or at least three checkerboard targets and scan those. The software will then process that and align it with the scanned data. Importing that scanned data is very much like bringing in an XREF.

Create Civil 3D surface. It is wizard driven, very quick and easy to do. Do not use the default

distance between points. The first time I did it a couple years ago when that wizard came out, I thought OK, great. I just locked up and broke-- this tool is broken. It doesn't work. Found out later that hey, 95 billion points in your surface takes a while.

Analyzing that, we can do it ten volume, we can do stage storage, we can do elevation analysis, all sorts of Civil 3D tools that we have. And then visualizing that into Infraworks and Navisworks. I forgot to show you that. In our Revit model, after I set that new site, that Revit model will drop into Navisworks in the correct location, right on top of my point clouds and Civil 3D drawings. So that reference point is a great little tool if you have Civil 3D, or know someone that can create that for you, and give you that XML file. Or you could probably just type it out yourself if you wanted to.

Last few things. Session feedback, if you fill out your surveys, Autodesk is giving away a free pass every day. So you get a chance to come here for free next year. This class is LD20728. Go ahead and fill that out. We like seeing that. Let us know how we're doing.

How many people in here are in the education side? Anybody? Got a few, good. So you do know, or should know, Autodesk gives you free software. So instead of spending $10,000 to buy the software you need, Autodesk gives it to you for free. It's a great program. If you're an educator, you can get there for your entire classroom. Get your kids running up on the Autodesk software.

Autodesk certification, there's certification lab running almost every day this week. I haven't made it yet, I need to. You can go take your certification test for free instead of spending $250. Yes?

AUDIENCE: They just [INAUDIBLE] an updated change in the certification test [INAUDIBLE] You are only allowed one certification testing, one chance. That's it. You are not allowed to do two [INAUDIBLE]. You are not allowed to do [INAUDIBLE]. You only get one shot, [INAUDIBLE] Just an FYI. Make sure it's something you're really good at. It took me 30 minutes. So it's timed.

DAVE YOUNG: That's my coworker up here, not just some random stranger talking to you. [INAUDIBLE] certification lab, you can take one test, otherwise you've got to find a testing center near you and go pay money. It's kind of not good. The Autodesk Knowledge Network. The Knowledge Network folks have a booth down in the exhibit hall. They're giving good talks.

How to make use of the Knowledge Network. If you're in any of the Autodesk products, and you hit help, it's actually probably linking to that Knowledge Network for extra content, besides just the straight up documentation. You can also get little videos and fun things like that. If you use Civil 3D, or any of the Autodesk software, you can contribute to that Knowledge Network. Everyone's allowed to do that.

Use the program called Screencast, it's free from Autodesk. Record a little five minute tip and trick, or problem solving, post it up there, and you'll maybe see it real soon in the solutions to something. What else have we got? That's it. So any questions at this-- yes, I've got a couple of questions. Hold on a sec. You get to talk loud for everybody.

AUDIENCE: My question is what is the best approach when you have a survey data you get that is you not Geo located and you have a lot of information surrounding the property that you need to compile the two information? We use a lot of ReCap, and we're using it to get more information with a survey. So they combined those two, but we're also using Infraworks, and all the information is out there. It's geo located. So now it's combining those two together.

DAVE YOUNG: Right, if you have the survey data, if they survey controlled points before you scan it, you're great. If you have a scan that is separate from that survey control data, it becomes a little more problematic. You can go out there and pick corners of buildings, obvious reference points, and try to fake something in there, but it's not going to be nearly as accurate.

It depends upon what level of accuracy you want. If you want true survey grade accuracy, you have to survey those control clusters first. But you can go through in ReCap or the point cloud processing software, and just pick some random points and say this is this coordinate, based upon my drawing. But much less accurate. Yeah, another question back here.

AUDIENCE: So I just started recently doing the point cloud to Civil 3D. I'm not a Civil 3D user, I'm a Revit piping drawing, but I'm just trying to get something going in our company. I found it looks great and it works great when you've got a lot of gradient, but when the terrain starts to go flat, and you have such a detailed surface with so many triangles, you get really messy contours. About 1,000 islands where the terrain is flat. Is there a way to dumb it down a bit?

DAVE YOUNG: Yes, there is. So when we're running through that wizard, I told you not to go with the 0.015, but to use a foot value. That will help. You're going to end up with a lot less triangles. You can go through there again and smooth the surface. You can simplify the surface. Those will all help.

AUDIENCE: I've tried simplifying the surface a bit, I'm just wondering if that's-- am I becoming inaccurate? Or is it just--

DAVE YOUNG: It should not be becoming inaccurate. Simplifying--

AUDIENCE: I don't mind simple, I just don't want it to be inaccurate.

DAVE YOUNG: Simple, there's some parameters in there. When you simplify the surface. It asks don't change it if the elevation is more than 100 or something that, it's the default value. It's going to take out a lot of points.

AUDIENCE: Couldn't you just make two surfaces? The area that's got a lot of elevation [INAUDIBLE] if you do like a 0.1 or--

[INTERPOSING VOICES]

AUDIENCE: You can simplify with an area and [INAUDIBLE] like.

AUDIENCE: Yeah, so you can do multiple surfaces for days.

DAVE YOUNG: Yes. His suggestion was to do two or three surfaces, one for the overall site, with a big value in there for the distance between points. Maybe three or four feet, where you don't really need to know what's in there. And then where you are concerned about it, for a building or intersection, or something like that, do it with a much smaller value. Say at 0.5, and then just paste those two together. Draw a polyline to separate them out when you create the surfaces from the point cloud. OK, any other questions? OK, wonderful. Am I getting you out of here a few minutes early? I think so.

[APPLAUSE]