

GAURAV BAGGA: Good afternoon folks. How are you guys doing today? Good. I tell people don't put me in any session after lunch. Unfortunately it happens here. This was the second time that I get-- so it's a tough job to keep you guys awake without videos that you saw in the morning. I like that. This is a very standard thing in every class. The seats in front are always empty. The last ones to enter, poor guys, get these seats.

Anyway, welcome you all guys. My name is Gaurav Bagga. I am a senior application specialist for infrastructure based out of San Francisco, and I'll be taking you through the five tools and tips that I learned from Caltrans employees-- training those guys. And I have a bunch of spies from my company that are making sure that I don't give away more than five tools. They're setting some right here. Only five.

All right, so let's get started. Speaking of Caltrans, Caltrans work with Autodesk and they were a big implementation. I had some very good word for Autodesk, and a lot of bad ones. I can't say them now, I'm being recorded. All right guys, so let's get started.

Five tools and I have four bullet points. But you know, hang in there, maybe there'll be some more. We'll talk about how far I go through. But this is basically it. This is what I brought you guys in for. What I learned from Caltrans and well, there's a whole bunch of stuff, but these four or five things sort of stood out when I was doing this implementation. And I'll talk about me.

The tips and tricks embedded in the DTM services and the routines embedded in database along with services. Tips and tricks with data shortcuts, and some alignment command, and some profile commands. Some are hidden, some may be not, but from my experience I found a lot of people do not use the things that I'm going to talk about today. But they were used big and we implemented them in Civil 3D for Caltrans so I'll talk about those things there.

I just want to make sure that I tell you up front what we will do and what we will not do, so I'm literally going to talk about the Caltrans implementation, how and what the training plan was. I'm going to go through some picks and clicks on data shortcuts. I'll talk about a variable, and some picks and clicks across the service DTM routine. We'll talk about alignment, profile, and intersection frequency.

So, this is what I'll go through. There's not a whole lot of pick and click-- a lot of talking that I will do. I just want to make sure that if you're here that your purpose is good and aligned. If it's not, feel free to walk out and attend something else that'll be better value for your time. I just want to make sure that this is what we'll go through and talk about.

So, having said that, who the heck is Gaurav Bagga? I tell people when I train, the training in my class starts with my name. I'm a senior application specialist. I have worked in the Ideate office, San Francisco, for the last 15 years and I have been helping ENR 500 firms along my area. A lot of public agencies, helping them implement Civil 3D.

In fact, I've been there longer than the software itself. So it was not Desktop and AutoCAD before that. And the last three years I have been deeply involved with the Caltrans implementation and training. So, I have done a lot of training. There were multiple training that they did on various workflows and I have been involved in that. So I'm recapping what I have learned from the last three years during this training with Caltrans.

How many of you attended trainings in general and find that training did not really help you? Right? OK we've got a solution, my colleagues though.

OK so, what I want to talk about is the way Caltrans implemented Civil 3D, and the training went through is very typical and unique to what [? Vegas ?] Caltrans had done. So I want to talk about what makes it unique. So, all of you guys, either you are public sector employees or you work with private. How many users of Civil 3D or AutoCAD do you guys have in your office? 5, 10, 100, maybe 500? This company has 4,000 users. So you can imagine right, somebody has to do this if possible, and that will happen.

So Caltrans when they have so many users, there is a specific support department. They have their own department with 5, 10, 15 employees working to help and customize Civil 3D beyond what our desk does. So they've got a guy there sitting and helping them with support. You can do under the hood and customize things.

That's how the custom Civil 3D launchers would be. They don't just launch Civil 3D from the desktop icon that you have, they have a custom Civil 3D launcher. There is a purpose for that. There's a lot of customization that goes behind the scenes and that's why that happened.

Another thing unique about Civil 3D-- and I'll go through this-- is that Caltrans worked and implemented Civil 3D 2012. The current release of Civil 3D is 2018. I'm sorry, it's '17. A few

months from now I'll be 18. But Caltrans is still using 2012 and they are trying to implement the more current release, 2016. When it's going to happen we don't know. But right now it's '12, so that was important to understand. It's been a long time.

Another thing-- this is a myth that people don't know-- that Caltrans was using CAiCE before, and they have started using Civil 3D. So their design software is replaced by Civil 3D, but the drafting engine is still Microstation, which adds another extra step at the end of the design. For all things drafting, the Civil 3D design has to convert down to Microstation in the end. And so that means you need to have a specific command, or a specific routine, or something that works and converts Civil 3D into Microstation.

Has anybody here worked with people working in Microstation in AutoCAD world and converted AutoCAD to Microstation? You know how big of a pain that was. They now have a command which is now part of Civil 3D '17 that converts Civil 3D to Microstation.

All right, so now, let's talk about the standards. Civil 3D is very heavy on styles. We all know that. The Civil 3D template works with a bunch of styles. So, the Caltrans template, which I have these screenshots from-- it's actually available online. You can download, use it. But, I want to talk that they have a style for analysis and production. Just like you have object styles, you've got tables styles, label styles. What they have done, is they made styles that are production and analysis.

Production styles are based on what the command that will convert Civil 3D to Microstation is sort of based on. Because you've got layers that will convert to the right levels and that's how the printing is going to happen. So all the production styles, they look plain white, but when they get converted by mapping at the end, they come out right for graphing purposes in Microstation. So they have a whole bunch of production styles.

Problem with production as I said, they're all plain white, so when you were working on some analysis and design you don't see where the PI Point is, or you don't see the PI Extension, or the curves and tangents are the same color on an alignment. So what that does is you can't figure out where the alignment curves started, where the curve ended, unless you see the label.

So you have a different set of styles called analysis so you can see how their styles, there is an RD main line production and then there are only RD main line analysis. What that means is, the analysis is going to show up-- all their tangents, curves, and different color.

Same thing goes with labels. Their labels also show up differently, so you've got analysis and production. And this is a general thing throughout all the implementation. They've got templates, there's a server template, and then there is a design template-- two main templates and they both have analysis and production throughout the software.

OK so having said that, in fact, if I switch back to the software, I have that on my machine. I've copied those styles and so those templates, they're all 2012. So if I were to open up one of the design template, you see it's all 2012. And if I were to make any alignment, which I'll pretty much do soon. You can see how you got different styles, and there's a whole bunch of them.

So you've got analysis and you got production for just about everything. ETW has analysis, production, similarly. Labels sets, the same thing. And that again, goes on to just about every object over there.

How many of you have actually made templates on your own or maybe got them made somewhere and you know how big of a work and task that means and involves? So this was a big task. This was a big task that Civil 3D customization was done, and the templates created. Autodesk worked with Caltrans and they came up with these. There are a few people involved at headquarters who actually made sure that these things work, and work good.

And again, those guys who have been working with the styles, you know this is a work in progress. You make, and you understand it's something, you learn something, and you improve it. So these guys also, it's a continuous process. Every time you do or training you will find that the book has some screenshots. It has already been modified into something different in the template. So whatever you do has already been through it. So it's a moving target at all times, and Caltrans is no different. OK.

Another big thing. Civil 3D comes with over 100 subassemblies. They do a good job for the most part. But Caltrans, there are a few things that they do that are different and are not available as part of those hundreds of assemblies. So Caltrans made their own subassemblies-- dikes, retaining walls, and so on. So they have their own set of subassemblies. Those subassemblies are available only to them. The Caltrans resource that you can download from the website, you only get everything else but subassemblies. So you do not get their subassemblies.

One reason to have their own subassemblies is they don't-- Civil 3D does not have what they

want. Two, is they are very big on extraction and material-quantity calculation, so they want a point code and a line code on their own. Which, a lot of times with Civil 3D is just hard-coded into top and date them.

So they come up with their own code for those subassemblies point, link, and shape. So Calderon subassemblies I want to put this point in there because one, you are not going to get those subassemblies when you download the resource packet. I have a link in my PDF that I gave it to you. Can download that. You are not going to get the subassemblies from that.

If you get a Caltrans file you may even get errors. So this is that location you don't have to note it down. It's the link on their website. You can download the resources and you've got a screenshot of where you get it from on that page. Again, it's there in my PDF. You don't have to do this.

All right, so let's start talking about how many of you use data shortcuts here in using Civil 3D. OK, that's big. Data shortcuts, I'll start with this. I just wanted to refresh. You guys were very good on that, but basically it's four steps. And this is-- I brought this up and I wrote it down because this is how I teach people who don't understand how data shortcuts work. Really you're answering two questions. Where are projects? And that's what you mean by set the working folder. And which project am I talking about? And that's what the set data shortcuts project folder is. So those

Two steps are main. Once you've figure out where are the projects and which project am I working with, then you can create data shortcuts. The one thing that was a problem in 2012 is you had to save the drawing and be very careful with that. Because if Civil 3D thinks a drawing file is not saved, it will not let you create a data shortcut, which has been improved now. It does not happen in '17. And then finally, in the target drawing, you refer to that shortcut, you bring it in.

One challenge that I had with all the Caltrans employees on this was making sure that on the prospector tab, you know this is drawing on the top and data shortcuts are at the bottom. So that was one very important thing for them to understand. That am I browsing the drawing, or my browsing the project? So it was a big thing to harp that here, this is your drawing, this is what you see in the drawing, and this is what is available. Maybe you do not create, somebody else do, but it's available for you to bring it in.

So having said that, this is their folder structure. So this is the tip and the trick that revealed

right here. And look at this. I'll talk about this in a second, once you've been through it. That screenshot that you see there, the image, what you will notice-- and I don't highlight that-- is you see there are to underscore shortcuts folders, and that was the trick, and that specifically happens within the service.

So here's the problem. Imagine this. This is very specific to how they're working on the survey department. But the survey department works and creates multiple services that are their own. They don't want to share it to anybody. For example, they have an area to pull down and that's a service And then-- which are full of geometry-- then they do a real survey which is more accurate. They mesh it together. That's the final deliverable. They want to give the final deliverable, but you cannot get to that point unless you create shortcuts. If you create a shortcut while both those inaccurate services are also available to everybody on the project.

So what do you do? You go down to a second level, two tier, and say this folder will have permissions only for my department. And so you've got to level of shortcuts. You can create your subset of whatever you want in there. Whenever you are ready to export the final deliverable to, let's say in this case design, then you come up to the top layer, top tier of the shortcuts and you deliver your final stuff. So that was the trick right there.

So this was done on the service side of it. You can see how there is an underscore shortcuts here. And everything here is very specific to survey. Then every department will have their own folder and they could create shortcuts. But this is the shortcut available at the project level, which will be shared across the whole project team wherever they are-- in one office or multiple offices. OK. And that's my take number one.

The other one, it's revealed right there. Has anybody heard of this variable? There's some people who have written a blog on this. This variable is very important. This variable is a very less documented variable. Not a lot of people know about it. There has been very less talk on the web also, on what this does. But this is a very big thing. Caltrans has implemented this big. OK.

I have written down why you would use it right there. You all know the difference between absolute path and relative path, right? All data shortcuts are absolute path. This variable makes that path relative. That's the crux and the bottom line of it. OK?

How and where you set it, it's actually done outside of Civil 3D. So if I were to go and take environment variable-- I just search. This is Windows. I am outside of Civil 3D and AutoCAD.

What I'm doing right now is outside into the Windows environment variables, and you can see how I have a variable set on the top called the data shortcut system variable. That DSS var is basically telling Civil 3D this is where I'm going to have my projects. OK, this helps big time.

The way the Caltrans works on this is, that you may have a project that started on a district level. Caltrans has multiple districts and then there are headquarters. So districts, some are big, some set small. Big districts have all the resources in them within the districts. Some districts are smaller. Then they have to go and refer to resources in headquarters. So at that time they have to start sharing data across different offices.

So then, let's say a project was created in some other folder-- which, just kind of making a fictitious case here-- and then it goes to headquarters and they have a different folder structure. Well, same concept as relative paths. The DSS var can change. Without the DSS var right now, that you see-- this is the XML file, the data shortcut file of alignment. That would be the full path as that shows up on the top. And the DSS var this path will become relative.

So if you see right here, this would be the actual path. This is where the file, and then within that, which drawing and the object. DSS var now-- if I were to go and show you this thing on my hard drive, this is that path right there. So you can see how-- and by the way guys, I'm showing this to you. I'm not sure if you can read that part on the top somewhere. There is a very small line that says in green, and bold. I hope it could be bold but, please do not edit this file. OK, I'm telling you. I'm out of this now.

So this, the data shortcut variable-- this is relative. If you had a project that you were not using data shortcut variable. So just to make some cases, I have a folder which does not have it. So it's an older project. If I were to pick up something old then you realize that path is still-- pick up something. This guy maybe. You can see how that path is hardcoded in it.

Now you may never need to know this, or you may never need to open this, but this path, which is full, becomes relative. All you have to do is go to the environment variable and specify the path to where your projects are. So this is big at Caltrans. In fact, they don't make the users go and change this environment variable on their machine, because with 4,000 users it's not easy to train everybody go and change the windows variable, and render your computer useless.

So instead of doing that, that custom Caltrans launcher has the thing set in it. You specify this

path right in there and that custom routine then changes and add that variable where it should go. So that was one use of that custom launcher.

The other use of that custom launcher is to set profiles. Have you ever heard of ARG files? Anybody? Profile, AutoCAD profile? Right? AutoCAD profile and desktop shortcut, there is a slash P and you all know about that. But the custom Caltrans Civil 3D launcher sets a profile.

Apart from other things, it does one very important thing. If you are in survey department it will set your QNEW variable. You are aware that. The quick new command-- anybody not know QNEW? It sets the profile ARG which will set the QNEW to survey template, or design template. Plus there are other custom things, but two main things. All right, DS Sys var is an important thing. And Caltrans is using big DSS var.

All right so now, let's go on to the surfaces, which will be my tip number two. How many of you have made a surface and see in the event viewer that you've got to break lines that are crossing? Right? How do you resolve it? Well there are multitude ways to resolve. But what I'm going to show you, is one little trick. If you've been through the hand that I give you know it. If you're not using it you should. There is one routine that I'm going to show you that does that.

So what I will do is I'm going to show you within the software. This is based on survey or design template, I forgot. So I'm going to go and search. This is our debut. That's good, but that's point. What about alignment? So this is their design template. Let me open up the survey template just so I can show you what they have done.

So there the survey template. And yes, I know it's old. I can check this box but I wanted to make sure that you know it, and that I remember that this is not the right thing to do. But point is yeah, we have it.

All right, so this is a survey template and what I will do is, I have a survey database. I'm pointing to it. I'll just open it up and I can create a surface from these figures. Very easy, straightforward, I would go and say create break lines. So this database, I'm not going into the detail of it.

But you can see how the server database, you got figures and some figures are break lines, yes. Some figures are no. There's an automated way as you import points in the Caltrans format. It automatically figures out from the coding that they have done on the files, that some point which are going to be break lines, automatically become break lines, though that are not

have a no on it.

So now I'm just going to say create a surface. Let's call this guy EG. And it's being displayed as border only, that's fine. I'm going to add OK. And that important reason all that data, I'll say a survey. Survey data and that's about it. You guys know what the supplementing factors are? Good orderly distance, anybody? Right? I won't get into that. Let's move on. I had one yes, so I have figured others are on the same line.

So it makes the surface for me and I have a surface in my drawing now, EG. He was created from these break lines. But, maybe there are some feature lines, some break lines crossing each other. You will literally have to manually go and solve that because you don't want that. But, there is this button that is all crossing break lines that is part of the surface routine. It has already been-- has anybody used that? I hear a few yeses, good. If not all it does is it'll try and find where those clashes are.

So in this case, it asks you, how did you make the Surface so what break lines are we talking about editing? So that figures into drawing from surface database, I'm going to pick the database because these figures, which are now feature lines. Came from a survey database. So I'm going to pick the survey database and it comes up with this. There are only three, but there will be more.

Point is, if I pick one by one, each one of them, it automatically zooms to it. It takes you right there. Oh, by the way, you see how it's going to get dark? If you don't want that palette too dock, press and hold the Control key and move it away. It would not dock.

So in this case, this is where the problem is-- the red and the blue. One of them is a high elevation. One of them is lower elevation. Elevation difference between them on the top corner tells you point 04. So this is the reason why these break lines are crossing.

Now you know about it. You fix it in whatever way you want, OK? This software gives you few options. You've got resolve, you've got trim, you've got a gap. OK? And so you can use those buttons and fix, right? But I want to highlight one point and that was very important at Caltrans. And that is-- actually, I wrote down the PowerPoint. Let me take you back to that guy. Talk about that. OK? It flows in sequence.

That diagram that I have-- the figures that I have-- what do you have to know is I made a surface using the break lines that were part of a survey database. So survey figures got

inserted in the drawing and from that I'm making a surface. So what you have to understand, I've got survey figures. Survey figures first got inserted into the drawing, became feature lines and survey figures in the drawing. From that I created a surface. That's an important point. And for Caltrans it's very important because when you try and use any of those buttons, or whenever you resolve, whatever you resolve in the drawing, it stays in the drawing.

Next time, the same figures get inserted in another drawing, somebody else is trying to use that data, they are going to get the old, stale data. And that's a very important point for Caltrans, because they are big and that survey person over there is very strict. In terms of everybody that served with her, they're all fearful of her.

So you have to remember that figures, feature, surface. If you fix the feature line on the drawing, next time it's not going to be fixed for somebody else so you've got to go back and fix it in the database first. And then reinsert in the drawing, and then make a surface from that. Anyway, so this is the whole saga of resolve crossing break lines. And this was the important point. I wanted to bring to your notice. If you are doing it, know this is how.

And Caltrans is very big on being or making the data very sacrosanct, specifically the database. So what they would do is they would do everything needed to actually fix the database using the drawing in whatever way. The database is the holy grail for all things survey, specifically. So when you do that you've got to make sure that the database is most current, up to date. All right so that was that point.

Now, let's come to the alignment. And everything I'm going to talk on the alignment is also very specific. It's very logical flow of how it was done over there. So I want to talk about-- this is a project that is the main highway here. There is an exit ramp. This is an on-ramp. And the on-ramp, it has a lot of constraints on it. So, how many of you make alignments and work on a subdivision if at all, or even transportation, and you pick PI points and create the alignment? Right? There are other ways on it.

How many of you are using the other ways, the other options the other commands available within the alignment creation routine? There's a lot of them. If you're using it, you're good. If not, I'm going to talk about a few of those things right now. I highlighted the crux of it. There is one command that I'm going to use, but it's a whole series of constraints applied to this ramp. And I'll show you by designing and creating the whole ramp alignment.

So it basically has four pieces to it. There is a ramp here at the south-end corner of it. That

ramp exits from the highway and what we are doing is redesigning, realigning, realigning the ramp that I'm going to talk about-- this horseshoe ramp in the middle. So it has criteria, it has constraints, from the highway design manual from Caltrans at every point.

So based on the typical section that will be on these two highways, these two ramps, the distance between the ramps at the start of this is about 22 feet. You've got a lane, you've got a shoulder, and there's a distance between them. Based on those two the ramp-- so my criteria is that I need to start the alignment 22 feet away from the known ramp that I already have. So that red line that I show there in the south end, that is my first tangent for the alignment I'm going to create, and my criteria has to be 22 feet away. Pretty straight forward. OK?

Then, you don't see it on the top but point number two, I've got another ramp exit criteria. In fact the point of tangency on where that line is going to be is known because there's a bridge over there, and based on highway design manual, Caltrans design standard, it has to be a certain distance behind that. So you know exactly where that point is going to be. OK? I'm telling you these criteria because they're going to be important when I start doing the actual alignment.

Then, those two are good. When I get the two tangents, what do I typically do? I make a curve between them. You guys know the difference between free floating and fixed curves? Everybody yes? I won't get into that. You don't tell me, I'll talk about that.

Anyway, so if I could just put a curve, free curve, that's fair enough. I can do it. But I've got a criteria on that. The criteria for the gold area is that I need to have a curve over there with a very specific delta. And so I need to have a floating curve on this side and that creates a problem, because I can't just put a curve in there. So I have a curve three, which is floating. Then I need to put a curve four that would be tangent on both the sides. So what do I do for that? And that's what I'll go through. So this is what the crux of what I'm going to show you now is for alignments.

I'll go back and switch to the software. I'll close this drawing. To make it easy, what I did, I brought in the other alignments that are here. I've got the highway. I've got ramp one. I've got another ramp. And then my area, the area I'm going to work on, is right here. We need to make this ramp.

So I'll start to work-- alignment, creation tools. We'll call this guy ramp. It's the center line. And you can see how alignment style label set. This is what ramp production, production. I can put

analysis there. Start when, I don't know so I just go with that.

When I hit OK, I see the ramp. I start working on this. Typically, you would create a borderline. Let's say you've got to survey borderline. You already know the PI point. You picked the PI points. In that case, you could use the tangent, tangent, no curve. Or Caltrans was big on using the fixed line with two points.

So you would pick this and specify the start point. I'm going to go with station offset. And this is my alignment, so I'd pick this alignment. And then I would go along 6500, enter, offset 22 feet is what I said. From there, let's say it was 6300 offset 22. So I get-- what'd I do wrong?

You might not know, but I have to have the wrong pair so I'm just going to hit Escape one more time, delete the subsegment. I had to do minus. I always forget that. Station offset, select alignment, 16500 Enter, minus 22 enter, 16300 enter, minus 22 Enter. Got it on the wrong side, good. Now I got it fixed.

So this is my first. And the reason I started with a sample small thing is I can extend this guy to meet every other street. And then I don't know where the PI point on the site is, so I just have a small sample. This is the last part that Civil 3D would actually do for me. When I fit the curve in there, it would extend the tangent and find the start of the curve for me. So I leave it to some small number default here.

The criteria here, from highway design manual of Caltrans, is once you know the point-- this is the point that I have marked. This is the point that the point of tangency with our alignment center should end. So I'm going to pick Fix Line again, and start point is station offset.

Select the alignment. I'm going to say this, which is another alignment and start point is disguised on that 16547.54. And the offset. So, and that stationed right there, this is the left edge of travel where this alignment. The alignment that I'm creating is also the left edge of my ramp so that you meet the right edge of this point. So that's 12 feet away from it.

Again our criteria are constrained on it. So I'm talking 12 feet positive this time. Now, so I got this one point. Our Civil 3D does not tell me really good did I really catch that point or not? How do you find out if you really got the point? You look at your command line, which, so much you look areas, and you see that it has some northing-easting there, which means you did get that point. Good.

From this point the highway design manual criteria from Caltrans again, is that for this length, in 300 feet, I need to deviate six more feet. So if that point was 12 feet away on the edge of travel way, the next point, if I use this alignment, should be 18 feet away and 200 feet. So I go with the same set of stationing-- 16247.54 and they offset this time is 18. And escape.

So what I did is I got my first tangent and I got my last tangent. Now what's funny is, you will see labeling on where it started but you don't see labeling over there because Civil 3D does not know how long and what you're going to do to it. So there is no labeling on it. That piece is there, no labeling. Again that point, it started exactly at 12 away. This, in 300 feet, you are 6 feet away from this. That's Caltrans [INAUDIBLE] coming straight from [? Ohio ?] to [? Denado. ?]

So now, as I said before, I would love to just join these two with a curve. And that will do it. But again, the Caltrans criteria is that you need to have a curve. From this point it has to have a certain angle delta. So I need to specify that.

What do you guys do for curve from end of a line? These are my options. I've got fixed, I've got floating, and I've got free. So I need to create a curve that has a very specific angle. So I need a curve loading from end of an entity, not thru a point, and having a very specific radius length or angle. It will let me type it in. So I want this option. Entity to attach is going to be this. I want this to be counterclockwise.

Now, what I did not talk about big or harp on this is, that Caltrans on this template, I have Caltrans XML file for design criteria. And that design criteria, reading on the speed that I have on this, which I didn't talk about, is giving me a curve radius of 3,900. But by default, the alignment starts with a higher speed. At that point we do not have that full speed so the curve radius at this point should be based on their criteria 3,000. So we'll go with 3,000 at that point. You can leave with the 3,900, come back and change it. But for now, we'll go with that.

Delta angle in this case is a very specific angle. I happen to remember that. Again, you need to set your template. This is three degrees, 11 minute, and 29 second. And Caltrans template takes it that way. You get a curve. So this creates a curve. Good enough. All right.

Once I do it, that creates another complication. And what is that complication? A floating curve is a floating curve. You cannot capture the actual angle coming out of it at the other end. So to capture that, you need to do something and I'll talk about that. The next curve that's going to come in is going to be a curve that is tangent on both sides of the tangent. So I'm going to use

one of the three curves. Point that I should use, but the criteria that I have will have to do something else.

So what I want, is I want a fixed line from the end of a curve and having a specific length. So what I'm going to do is to capture the bearing that comes out of it. I just make 100, 200 feet temporary line that goes off, and then I use points on that to drop the curve from the other side. So I'm just going to create a fixed line, Ok? And length could be anything-- 100, 200, 300, whatever makes you easy. But I got a curve.

So now that curve is huge. It's very slight. So you realize the style I'm using is production style. Everything is white. I have no idea did I really create a curve in the middle, or was it a tangent? So that's where analysis styles comes in and they display curves in different color. But anyway, so I got this.

Then the last piece to make sure the curve is tangent here and tangent here. By the way, this piece that I added, the small piece, is not actually part of the alignment. I'm going to ultimately get rid of it. So I have to know, and this became a very important part when we were talking to Caltrans and their employees, that they would make the mistake of picking the endpoint here. But this piece is not an actual piece that's part of the alignment. So we'll get rid of it.

So now we have an option for this that I wrote down. What I really need is a free curve, right? A free curve is going to be tangent on both the sides. You will agree with me, right? That's what a free curve does. Difference between fixed, floating, and free, fixed is a fixed three point curve. It does not care about tangency. Floating curve is a curve from the end of an object like a tail. It's tangent on one side. The other side floats away, OK?

Free curve is a curve that's free to rotate and it's tangent on both sides. So we've got two tangents. Typically this is what we do most of the time. You do subdivisions or you do anything else, you've got tangent coming in. Do a curve, free curve on both sides. I want that option. I really want to get free because I want the curve to be tangent on both the sides. Problem is, I don't have a PI point known yet, so I can use that option. That's for this specific command. It's meant for that and this is how it works.

So you're going to pick floating curve, entity to attach to, and I would pick this point. End point is going to be END. It's going to be right here, so I don't want this to be the end. I want this point to be the end. And then, and then I have to pick this point. What do I do now? This curve is sort of the worst. I don't have a point here that I can pick to make a tangent. But this is the

command. That's how it's going to work.

That brings up a very good point. So, what I wanted to pick at this point, was to pick this side. That line that I drew, a temporary line, was just to have an end point that I can pick and snap to. But right now, the way it's working, is I get the worst of the whole thing. I don't get the curve that I want. I'm getting the complementary part of it. And this is also something that I ran into big time with the Caltrans employees and I'll tell you what happened here. I sort of did it on-- well, I won't say that but--

There's a deduction off every sub-entity here. Every tangent and every curve has its own direction. So if you look closely, this is the beginning. This is the end. Which means this tangent-- and you can display as an arrow-- this tangent is running like this. If you remember, the tangent I drew on the north is also going in the same direction.

So now I have a clash. Either you follow this direction, or you follow this direction. Either way. But that's not the case so I need to reverse sub-entity and so I just want to highlight this button. You know you can reverse the direction of the whole alignment? This specific button reverses the direction of just one sub-entity. When I pick on this, Civil 3D will yell at you, don't do it. You don't know what you're doing. I'll still do it.

So now, I've got a beginning and I've got an end. So this now follow the same direction all the way through. Now I'll be able to add that curve. The option is, even though it's right on the top, I'll pick this guy. From here, end point is END. This guy. And now you can see clearly, to make this curve floating curve, tangent on the other side, I'm just going to use the end point of that temporary line that will make a tangent on the other side.

So when I pick this, this is tangent. And I get labels all the way to the-- I should get labels all the way to the end. Not yet. I got labels all the way to the end of this curve, but they're not going all the way to the end. Right? Somebody is not sleeping, thank you. Yes, you're right. I've got an ambiguous direction, left or right, so I need to get red on that temporary segment that I made. So I'll pick this guy, and get rid of it. And now I get the geometry taken care of. So that completes my alignment.

It doesn't end here though. I got the alignment geometry good, but the whole stationing is messed up. I got the end here. I've got to begin here. And by the end of the curve and the stationing on this ramp totally messed up. So I need to fix it. So Caltrans criteria, the other way

Caltrans labels these guys, they want at that point, at the end of this ramp, to be the same station as the main highway.

So you need to find out, at that point where that ramp ends, what is the main line station. So what you would do, at that point you would take on the mainline alignment and you would go and add a label station offset, END. And let's say I picked up on it right there. END, should make a station's dat point.

OK, so this is my-- what is my station? So that station should be the station that I should see in the end over here. And other criteria, Caltrans again, is that the direction of the alignment should be the direction of travel. What is the direction of travel right now? Let's verify. This is the beginning, and this is the end. That's not going to work. This ramp is an on-ramp. it starts at the bottom and goes up and meets that tangent. So I need to reverse the direction.

So I would pick, and by the way, I have fixed-- you can see this point of tangency, the alignment extended the tangent to the start of the curve. This side I did not do anything. So I need to manually use AutoCAD stuff to just sort of extend it up to this main line alignment. This is the street-- the street-level street. So I need to extend this alignment all the way back there. I would do some CAD monkeying. What I did is I would pick both these guys. There's a lot of labels overlapping, I would just isolate.

And I would make sure that my object snap are running. I need the extension and I'll put it in the section. I can turn on others as well. But point is it's just click, click, and that's that point. And then I can right-click and end object isolation. And that completes that. Now, the direction. Modified, nothing great in that. Reverse the direction. Again, Civil 3D yells at you. You yell it back. End, Begin. All right, good.

So, I can change now the station for this point, but where is my zero? You guys see the zero somewhere? Somewhere, it's there, along the alignment. But not the end of D2. What do I know, and what do I want? I want the end of the ramp. So I know the station and the endpoint to be something. And in Civile 3D alignment properties, I can type that number. But I don't know if I'm typing that number for the reference point. So I need to fix the reference point for this alignment before I type in that number.

So I'm going to click on the alignment. Go to alignment properties. Station control I would first picks the reference point. Again, Civil 3D yells at you. And I'm going to go End, and I pick that point. That point that I knew off is not negative. It is, what is that number? 165, let's here.

16545.64, and that-- oK That is the exercise. So I think I gave you more than one tip on the alignments. we can end here. Just kidding. Dry.

There was somebody yesterday was talking about monetizing his look to Bill Gates. I think I'd like to monetize my accent, but we'll see how it goes. All right, so take on the alignment and change that direction. And we got the station here, so this is a good use of everything that you know of alignments. And if you have not used it-- if you have used it, great. If you've not, these are the various things under the alignment. A lot of tools there that help you design the alignment.

The next thing we'll talk about is on profile's. And again, very similar. It's a hidden tool.

If you're using a great, If not, the tool I'm going to talk about now is the Solve Tangent Intersection. I'll show you how it works. So I'll create the alignment for this. And I'll talk about some other things also.

This is an existing street, so we know where it starts. We know where that tangent is so we can get that point. And on the end, this program goes and meets an existing ramp over there, so we have to match up with the grade and know exactly what's the elevation of that. So what we know, that ramp will use that.

So we have an end constraint, and we have a start constraint. Another constraint, the ramp can only go up 8%. So if you guys know AutoCAD drafting really good, no big deal. You make a tangent here. You know the grade and the elevation. At the end, draw two lines. They'll meet up somewhere. You're good.

You don't have to listen to what I'm going to say, but I'm going to show you how a tool is going to work and achieve that. That Solve Tangent Intersection tool, that's how it's going to work. So, you going back in the software. I have an alignment and I have a surface so I'm going to create a surface profile real quick.

And that's the profile along this alignment B2. OK? Now, from somebody else, let's say somebody else is doing the design of this CD1. This CD1 is actually the left edge of travel way of this ramp. It's 12 feet wide. So at 12 feet, 2% crossload. The D2 point at the end, you can calculate. It's going to be subtracted. You can calculate 12 feet minus 2%. You get the elevation of this, and that's going to match up to the grade at the end of this. And that grade-- I already know it, we figured out-- it's 1.13. Somebody gave me the profile. I would just bring it

in.

So alignment, centerline, ramp, profile, a ramp one profile. I'll just create a reference to it. OK, good. Whatever style it comes in I'm just going to create the profile for that. I accept all the defaults. Good. So, this is the profile of that other ramp.

All I need to do now is to project this ramp, superimpose on this grid. And now, I know exactly where to start. I have the end of constraint in so I'm going to use those and create a profile for this. I am a big fan of picking up objects on the screen and using contextual tab. We give it a name, finish grade, all good.

And so I know the first two points. But basically I can kind of draft something. There the center line here, somewhere, and there is a specific grade that goes on to, so I'll just kind of put two points in there and I'll modify them later. Start somewhere. OK, that's fine. We can go over this. 15345.

OK. So I got this very first tangent taking car of. Now, this grade that I'm looking at, this grade is-- well you can figure it out a multitude of different ways. That grade I know is 1.13 so I'll just use that. And I know-- I just calculated these things before-- the elevation is very specific at this point.

So it's going to go parallel, point 24. A little bit lower and this. Predicted 2 or 2% down. So we know the end constraint. We know that it's going to go up from this at 8%. So I use this tool to solve tangent intersection.

And, OK, the way it works, I have a point so I'll go with the P as a point. This is the point so I pick this point. And the grade is 8%-- goes up. For the and I go with station, the profile view-- I'm just reading through my command line. Somewhere here, let's say 16537.76, And the elevation there is 2736. I just know these because I have calculated them ahead of time.

And the grade from this point is -1.13, we know that. So it's going to go up and it's going to create your PVI point for you. So it found the PVI point. If you are doing such things, of course you can use AutoCAD for all this. Because you can make this line, you can get this line, see where they join.

But this tool, once you understand how it works, a little faster. And then of course you can add your curves to it. So free. This is a 400 curve. This would be 100 curve. And then add labels. So for profile, if you're not doing this, the Solve Tangent Intersection is a nice tool.

All right. We still are an hour which is good. We have some more time to go. So what I will do, is I'll talk about the intersection. How many of you use Civil 3D to do a whole bunch of intersections and create corridors, and use the intersection to-- if you are doing it, there is one thing that I saw was used here and I found it really good. People never thought about it, and I'm going to talk about what this tool does for you. It's right there. I'll show you how it works. But I'll summarize it right on this page.

You can see the point number three. You can see how the projection from the curb don't kind of meet with-- and I think this would be a good one to use here now. Will it work? Yeah. So see this guy? These lines don't meet up with the main line. So this is the corridor that is through the intersection. This is my curve. And these points don't meet.

This does not make a big deal, but slight contour when they get created are not nice enough in this area specifically. Sometimes, for the most part, Civil 3D does a good job. But sometimes, this area will create interpolation. You know how all the corridor basically is interpolated. It's interpolation from this point, to this point, to this point.

So, if you have an operation from here to here, then here to here which is good, then into interpolation from this point to this point, that's going to make some difference. It's not straight and smooth. So what you do is you follow this tray by adding specific points. Wherever these guys are, you match up with that which is what I did on this area. This area still not good. This is-- so this is the trick to do on intersection. If you're not doing it, you should do it because ultimately it helps improve the corridor.

So let me take you back to another example of corridor. I've got an intersection. And you can see how these T's don't match up. So it may make a slight difference. I'm going to make a surface from this corridor. I'll say top. And we'll display the surface and point to finish, let's say. And we'll add top. Pick this, this, and maybe we'll finish on, maybe later on. And then I would stop this guy right at the boundary. Rebuild corridor and I get contours. They're good. This is supposed to happen because of triangulation. That's just the way it works.

But what you do can help improve the contours in this area if you just change that frequency. So if you go into the error frequency and you pick this region, the frequencies [INAUDIBLE] on this alignment every whatever this is. So what I'm going to do is I don't want Civil 3D to create the cross-sections where it does based on these criteria. I'm going to have Civil 3D just ignore

all that criteria. So I'm just going to put a big number.

Civil 3D would not do anything now. Not every 5 feet, 25 feet-- that alignment is not 5,000 feet so I'm ignoring everything on that alignment. And I don't want spyros. I don't care but I don't want any other cross-section there. So I'm going to say no to all these guys.

On vertical curves as well, I don't want anything. Vertical geometry as well I don't want anything. So I basically get rid of everything. So basically, I don't have any section created here by Civil 3D. And I take control of all that myself by adding plus. And I'm going to match up and snap to all these points. I have three endpoint, midpoint, center. And I'm going to snap that point. I'm going to snap that point. I'm going to snap that point. And this point. And this point. And this point. It's tedious, but it's going to make the corridor more accurate. And well, maybe that one. And that's it.

So now, I have overwritten what the software was doing with these sections that I have created myself. And I'm going to hit OK on this. So now, all the sections I just similarly, I should have done, and gone ahead and decide on what I want to do. But when I hit Enter, you see the contours change a little bit? Specifically in this area I may have better contours. If I pick these contours and I look at it in 3D-- and by the way, Caltrans is big on hiding anything that is heavy. So their styles turned off everything that will suck machine power.

So now that area of course, beyond a certain point, it's interpolated. But you got some better triangulation and better surface formation in that area which wasn't as good. This just helps. Just a little bit of minor improvement, which when I was talking to the guy over there also, it is minor yes. But it helps overall to make better contours. So that was the trick right there. This is-- I've been doing this for so long and I realize that most people that I talk to don't do this, so that's so I thought I'll highlight this in the class is all.

So, that is my criteria for intersections-- frequency. And now, we have more time. So in the meantime you can ask questions if you want. I'll decide if I want to take and answer that or not.

[LAUGHTER]

So this is another big, for the material quantity. How many of you take and use the QTO provided with Civil 3D, and you do sections, and you create tables of material and artwork? How many are doing that right now? Nobody? Or are you just tired, post-lunch?

All right, anyway. So what I want to highlight is, that ramp that I have-- side were to open up, where do I go? So anyway, right here. I'll just open this up because I never saved it. So once that ramp comes in, and the way we did is you're going to have a corridor here from that ramp. You're going to have a corridor here from this. So these two corridors, when they come and meet and they're part of the same corridor-- two different baselines. OK? The material calculation for this area and this area from the other alignment, they will overlap. Right?

Have you ever thought about that? Have you ever dealt on that line? But Caltrans is big on this because ultimately, all the subassemblies that they have customized, they want to use all those subassemblies to give them material calculations. And to give them reports, specifically their slope stake report. That's big on this. All that comes from the coding you've done on the point, link, and shape.

So the same thing here. This is possible then you've got a good. subassembly. But when you got an overlap like this, OK, you're going to get wrong material calculations. Right? And so wrong material calculations may be good for somebody. You know I told them, why would you do that? Just get kickbacks. Even to the contractor, you get more money back right under the table. Anyway, sorry. When you to there.

And so this is a problem, and what they did really, there's no good way. Is you had to literally divide, just like you would do on construction, how it's going to get constructed. You would construct this guy, and then this guy.

So you basically end up making some alignment and then you cut cross-sections. You snap to that alignment from this side, and you start with the same alignment on the left side from this side. So you basically break the corridor when you're cutting material quantities, and you create section and section views.

You make an alignment. That's what I call you call that match line. So if you see this, match line. This match line is basically a point and alignment where you curtail the alignment on the corridor from here at this point. And this corridor at the same point on the left of the target when you cut sections. So that was the answer. You get good material quantities.

Now if you're doing it good, if you understood it, great. A very good point on this-- what they did is they made the alignment D2 itself, this alignment, D2. The one that we-- I closed the file. But this alignment that was here, this ramp, they made that ramp alignment itself out of that match line. Well that created a problem. Because when you're talking about match line-- and

Civil 3D will cut sections-- it does not like the match line or the break point for this side and this side, to be the actual alignment that's making the corridor. Or that is part of a baseline.

So the trick, and this is important if you're going to use the QTO part of it, is that you actually make the alignment a little bit left or right. In this case, we're making an alignment that would make a point 01 feet to the left of the baseline that was being used in the corridor. And that was an important point. I'm trying to shake you and make you aware of.

So if you're using it, that alignment, It's just that Civil 3D will not do calculations. You know what happens, right? Civil 3D, when it starts thinking? Anybody been through this, no? OK. So, it can happen to you guys. And so it go into loop where it's not getting the material calculations. So the trick was, to have one alignment created, like point 013 to the left, and it will divide left and right. And you get two tables of material quantities. Payment structure, or to-work, or whatever you want.

All right. And then merging. Has anybody tried pasting two surfaces? I think your Land Desktop does that. All other engineering software do that., OK. Problem and that, when you merge two surfaces you do not have a control on when the two merge, what happens to the area. The specific area where they merge. You realize that?

You can paste two surfaces, the newer surfaces will come and replace the old. Basically you've got a new z for the same x and y. Right? So you know these things, you got a new z. That point is good, but because you don't have any control beyond this, the next-- the triangulation-- is going to find a point, any point on the surface, and just triangulate to that. So you are not controlling it. Does that make sense?

To control that, what you end up doing is you actually extract a polyline, a bar. Let's say you're going to paste one surface onto another. You get the border from this surface and you trim the surface where you are going to paste this guy at that specific point.

Now you are better controlling that surface. You're not letting the software triangulate to whatever point beyond that. You are controlling a point. Maybe you can offset one feet, or two feet, whatever that is. But you got a 3D polyline which is extracted as the border from one surface, that gets pasted as the inside boundary on the other surface. And then you pass the surface. Now you control what gets pasted. Make sense?

There was a very big article and a big discussion we had at Caltrans on this. Like, at least 50

page booklet was created, step-wise on how this was going to happen. To help everybody. 4,000 users, not an easy thing.

OK. So that was on merging. Export to DGN. A lot of people mentioned using Microstation and converting AutoCAD to Microstation. You know, I remember I had a colleague, and this would be a good 10, 15 years ago. He used to tell me, you know I did a class, two days of converting AutoCAD to Microstation. It was not a command. It was a process. Now you've got this command. And it's all thanks to Caltrans.

It's now part of Civil 3D. I'll show you where it is. It's on the output tab. Export, Civil 3D, Drawing. This command is a direct result of the efforts that happened with Caltrans. Well, I think so, I'm not sure. I can't say that. Maybe, but yes, it seems like that. I think it is. Not sure though.

But Civil 3D Drawing. So this command will let you convert to AutoCAD bind. This is a very powerful command. It does a lot of things in it. So you've got export settings, just like you have e-transmit settings, but a similar format. You export to DGN or you export to drawing.

When you do DGN, you're going to get more settings. So, export settings. You can see with AutoCAD not a whole bunch. All you can do is versions. You don't need to do a whole lot. But when you talk about DGN, you've got parameters. How will the line types work? How will that text work? So speaking of text, you know sometimes, even this command you cannot just you know how, export Civil 3D command. The export to AutoCAD dumps down all AutoCAD entries, right? Just gives you line or follow line instead of Civil 3D objects.

So that command, even that command, runs some routines in the background, brings down all similar entities to AutoCAD. This command, if you have text, sometimes you will get issues with the conversion of drawing to DGN if you have used explode. But we found burst. If you are converting AutoCAD to DGN, burst works before you run this command. Just kind of giving you an idea, right? This is tips and tricks, right? I gave you more actually, in less time. Less profit. Anyway. So this is a command that was helpful and that will be helpful moving forward.

And then, I guess we can end it here, is the Coordinate Geometry Editor. If you've not used it, it's a powerful command. Caltrans used it big time. It's on the analyze tab, survey. This coordinate geometry, the COGO Editor. For the most part it's a good command. It does various things better. But yes, you know there could be some improvements to it.

But this command, if you're not used it, it lets you-- if you've got a deed that you're going to

type in, right? A lot of times you are typing in deeds from somewhere. And you're just typing in AutoCAD and you can maybe save it in a notepad somewhere and save it because that's a lot of time typing that thing. This guy, if you use this, there's a bunch of tools on the tab for example, you can save. Whatever traverse you create from this you can save as a text file outside.

So you can use to create that as AutoCAD lines from within this tool. So there's a bunch of buttons on the top . I may do a class on that next time. But this is a powerful tool, COGO Editor. If you just type COGO Edit, it'll show up. And Caltrans is using this big time.

All right so, having said that I'll just review. Caltrans implementation was on 2012 and there was a lot of customization that was done by Autodesk and Caltrans taken together. They both did some stuff to get the 2,000 users working OK. They used data shortcuts. And they used data shortcuts big time to split projects. And they use two-tier data shortcuts, specifically, certain departments do that.

So you can use it too. In two-tier data shortcut, if you don't want to share something with the other team, it's internal to what you guys do. You can use and keep data shortcuts through that throughput with you if you make two levels. Without crossing break lines-- always, whenever you get break lines that are crossing, you can use that tool. Remember, figures, feature, surface.

Then I showed you on the alignment-- actually this was just one thing, but I showed you way more than that-- floating curve with just one tool and a bunch of criteria. We talked about the alignment. And then the Solve Tangent Intersection, again, you can use the AutoCAD line work for that. We all are good at that. But this is the button that does it.

Now here's another thing with Caltrans. You could say we can use AutoCAD and get to that point, but Caltrans, they will not like it. They want to do it the engineering way because they think that's more precise. They will not want to have anybody just draw AutoCAD line work, because they would think even though the label was short of 8%, everything would be right. But no, that's not the engineering way. The engineering way is to use the right tool for that. So, that was big. And then this one, intersection frequency, if you're not using it on the corridors, every region will have a different frequency. You get contours that are sort of up or down. This solves that. OK.

Having said that, we talk like two minutes on my company. I got a free trip to Vegas. I work for

a company called Ideate. Like I said, me and my colleagues, we have been training Caltrans and we did that for the last three years, OK? And I think we're good. I believe so because the contract ended and they hired us again. Those guys who did not do a good job did not go back and teach Caltrans. We went back, and we did that. So we're Ideate. We're based in San Francisco. We can help you guys as well. We've got my colleagues sitting here. If you want training solutions they can help you with that.

Having said that-- I know it's being recorded but I've got to say that, sorry. Autodesk University and this class, thank you. And now this is the end of it. Any questions? I can decide to answer yes. Yes, sir.

[INAUDIBLE]

Right. No, no. So I think when you're talking about ramps, the mainline highway could be centerline, but for a ramp which is the one lane, right? I mean, if you do half way through how do you do? I didn't talk about that. There's a big picture behind, the superelevation. Because all the design criteria is being used to create superelevation tables, you're basing it the way superelevation work. You have the left edge or the right of the tidal wave. The superelevation tool assumes submatrix section. So it would create and give you a table. You ignore one side of it but this side still works OK. So it was either the left edge of [? travel A ?] or the right as a control for grading. If anybody is awake you can ask questions. If not, I didn't see a lot of people checking their phone though. I did a whole lot. All right.