

**ANGEL** As soon as there's a small lull in the beeping back there, we'll go ahead and begin. Because I  
**ESPINOZA:** think we're going need every bit of the 90 minutes to discuss things. Hello.

**AUDIENCE:** [INAUDIBLE]

**ANGEL** Yes sir.  
**ESPINOZA:**

**AUDIENCE:** [INAUDIBLE] I'm doing media capture [INAUDIBLE].

**ANGEL** Absolutely.  
**ESPINOZA:**

**AUDIENCE:** OK, and do you have any audio on your computer at all?

**ANGEL** No.  
**ESPINOZA:**

**AUDIENCE:** OK, thank you.

**ANGEL** Certainly. OK, how about now? Is it any better? I think a little bit better. That should work.  
**ESPINOZA:**

What just happened? My screen went to blank. That'd be the 8 o'clock buzzer, isn't it? Class is in session. As soon as my screen comes back-- I think they-- let's see if they can toggle it back so I can-- right as we were getting ready to start too, how unfortunate.

It's still obviously showing what it needs to show. My screen is completely black. They captured it back there. I don't want to have to work over my shoulder, but I will if I have to. Who's the room monitor for the event? We will work with what we have. We'll try to make it work.

OK, so I'm going to be working then over my shoulder, looking at the large screen, and we will proceed. Thank you all for joining us this morning. I know it's not often easy on the last day after the big party to be present and fully aware at 8:00 AM on the last day, but I certainly appreciate you coming out and being here this morning.

Earlier, as people were trickling in, I did ask how many in the group had used InfraWorks 360.

And now that we seem to be-- have the vast majority here, I'll ask it one last time. How many of you have used InfraWorks 360 already?

We have a couple over here. So we're still in the neighborhood of now about 15% to 20% of the group, so that's great. That's wonderful that not everyone has seen this already.

So very briefly, one of the things that we're going to learn about InfraWorks 360 is that it is possible to create just about anything that you can imagine, both that exists, that might exist, that never will exist, that existed a long time ago, whatever it feels that it's important to communicate, and at whatever scale. So in the upper left-hand corner, we'll start with something small. That's basically just a home, and the property of that home is what's modeled in InfraWorks 360.

And as we go up in scale, this is a small university. How many of you from the Detroit area, anybody? Lawrence Technology University-- Technological University right here. Boulder, Colorado, this is Boulder-- university of Colorado at Boulder.

Obviously we see a golf course. This is a dam area. It's a little difficult to see there. The iconic New York skyline with the Statue of Liberty, all of Southern California, the Palos Verdes peninsula there, the island of Oahu-- and whether we're talking about projects that may be for above ground utilities like [INAUDIBLE] transmission below ground utilities--

**AUDIENCE:** Can I help you?

**ANGEL** Yeah, my screen went black.

**ESPINOZA:**

**AUDIENCE:** [INAUDIBLE]

**ANGEL** Certainly.

**ESPINOZA:**

**AUDIENCE:** [INAUDIBLE] try again.

**ANGEL** Yeah, I didn't know if I did that, that it would lose the recording back there. I'm great, thank you.

**ESPINOZA:**

**AUDIENCE:** [INAUDIBLE]

**ANGEL**  
**ESPINOZA:**

OK, thank you very much, Travis. Substation design, new energies, there's windmills in the background, this being near Palm Springs where they have solar and wind farms. Light rail transportation, this is LAX in an actual model.

So we're seeing bigger scales, the port of Long Beach. And even for potential disaster situations, this using one of the plug-ins we'll talk about, we happen to have the creator of the technology in the room, and we'll talk a little bit about this. This being a flooding simulation, we'll talk about the very simplest way I could potentially do something along those lines, and then the much more sophisticated way that we can do that.

The class description was to get a complete view of InfraWorks 360 software. To get a complete view in 90 minutes, I'm probably going to have to speak a little bit more rapidly, and I will only pause for questions just at certain points. So if you can just hold the questions until I pause, probably when the software is going to be churning and it'll take about a minute or two, we'll stop the questions and maybe do other things along those lines.

And see, not only does it deal with conceptual design, but preliminary planning detailed design for roads, bridges, and drainage. The creation of images and videos could not be simpler for anyone that's ever outsourced those sorts of efforts we'll see, and then collaboration with others in other industries. We'll talk a little bit of tips and tricks for those of you that have used the product already and maybe a little bit comfortable and familiar. I hope that this time will still be well spent for you. I hope to be able to offer a couple of tips and tricks of why-- make that a little bit easier, more efficient for you.

And this feature-- this session features InfraWorks 360. There is another product called InfraWorks 360 LT. We'll talk a little bit about the differences there. And a little bit of AutoCAD Civil 3D, just a touch, not really very much at all. OK, this goes down. Here we go.

OK, so at the end of the session, the four things that we really wanted to get across with the session-- or that I did when I put the session together-- was not only discover how easy it is to use-- excuse me easy to learn-- also how easy it is to use, and how powerful, ultimately, it is. It is incredibly powerful at what it's capable of doing. And then how it's capable of integrating with other applications. And that relationship is everything, because both with the suites that have existed in the past and the collections that exists now, the point was never to get more software into people's hands.

That's not the point of why they exist. They exist so that people that create something like a

Civil 3D drawing can get more value from that Civil 3D drawing when they utilize it, that same information, in other applications. Whether I take it the Navisworks for construction, simulation, or clash detection with other data, or move it into 3ds Max for a detailed visualization, or whatever the case is, there is lots of value that's inherent inside of a model. And when models get together with other models, like magnets, you get more power, more capability. And that's what the collections are there for, to be able to extract more value out of what you've already done, right?

And I certainly understand the idea that, well, this is what we get paid for, and this is what we do. But there is still potential there, and you can offer your customers, your owners, or your constituents a lot more from the data that you already have with a little bit of just different workflows. We'll leave it at that.

OK, so very quickly, my name's Angel Espinoza. I've been with Autodesk nine years. Prior to that, I was with an Autodesk reseller partner for nine years. If you Google Civil Angel, you'll probably find the Facebook, the Twitter, the YouTube account.

I am the original author of *Angel Civility 3D Thoughts*. The interesting point about that, I've been a little bit hands off on Civil 3D in the last year or so. Whenever I've needed to find something-- right, quick thing Google-- and interestingly enough, sometimes I've answered myself from the past because it comes up on my thoughts that I started in 2004 talking about Civil 3D, and the answers come back from then.

And I started as a young man in the civil engineering community in Southern California where I'm based. Did that for about 14 years. I was talking with someone here earlier, Bob sitting in the back, and I told him, Yeah, I live very near Disneyland. So Disneyland, for me, is a touchstone, a touch point, and so that's in the area and the community around which I've worked a great deal.

OK, so an overview of InfraWorks 360-- oops, back up one. When we start talking about InfraWorks 360, the first thing we're going to learn is that it is possible to create models yourself. So the first thing I'm going to do is I'm going to open a model that I've already just begun. All I did was basically just give it a name. You can go up to the top and choose the new and just give it a name.

And what you'll find is that you will be in an environment that, if I were to roll the mouse wheel back-- and that's one of the things about how we maneuver that we'll find out about-- if I roll

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the mouse wheel back, I'm zooming out. If I roll it forward, I'm zooming in. And then if I left pick and orbit, what we'll find is that we're basically looking at the entire globe in the environment, right? So the data that you create and the project that you will build will ultimately sit on this geoid somewhere, OK?

So I'm going to come back over here. We'll talk a little bit about this particular project. The first model actually that I ever built was near the city of San Luis Obispo. So I'm going to talk, then, about the icons here. These are called the intelligent tools, under the I.

The intelligent tools are what exists also in InfraWorks 360 LT, so if you have that as a part of your suits, you have everything that's under the I, and that is still a great deal of information or great deal capabilities. Above and beyond that there is the icon for road design, the icon for bridge design, the icon for drainage design, and again we all share the display capabilities and so forth. We'll see those in some of the configurations and setting tools.

So underneath the I, the very first option is basically managing your model. And the very first icon is the data sources. That brings up the data sources panel.

And I just wanted to quickly point out that there are lots of different data sources that I can ultimately bring into this environment. Now some of those are kind of abbreviated, because it says very simply raster. But if I were to make that choice for raster, what we will find is that there are literally dozens of file formats for raster files-- they should be visible down there in the bottom-- raster file formats that are possible.

So some of them are just, what does it say, SketchUp, right? There's only one SKP file format. But some of them are wildcards for many other file formats. So what we'll find then is InfraWorks is very capable of aggregating data. Not as capable perhaps as Navisworks, which can bring in approximately 60 different file formats, but this gets into the-- I'm guessing, into the high 40s, probably, when all is said and done.

OK, so what I'm going to do is I'm going to just browse to a set of data that I've had here. And my resolution is a little bit less than what I'm seeing up here, so I may have to look over my shoulder. For this demonstration, I have some sample data, and that sample data is GIS data. And that GIS data is for California for San Luis Obispo. There we are.

OK, so a while back, I had-- when I was creating this very first model, I had some information that was in Civil 3D. And in Civil 3D, you can export out a LAN XML file. So this file right here,

although I can barely read the gibberish on my screen, that looks to read XML.

Yep, that is the LAN XML file of the surface. So I'm very simply just going to drag and drop that into this environment, and everything about InfraWorks, ultimately at its heart, it is a GIS application, so it does translation and rotation of the information on the fly. As long as there is an intelligible coordinate system assigned, to the data it can then place that data exactly on the [INAUDIBLE] of the globe exactly where it needs to be.

So what it's already determined from the LAN XML file-- you may be able to make it out-- is that it is a terrain. It's using the California NAT 83 zone 5 US foot coordinate system. And if I very simply just choose Close and Refresh on that data, it will then brought bring in that surface, right? So it was just a drag and drop from the File Explorer.

Now you can certainly go up to the data source, just pick the specific file format. But I think what you're going to find, depending upon how your data is organized, it's very often just simple just to drag it into the window, and it knows what to do with that data. It's very intelligent in that sense.

So next I'm going to go into that same data source, and then there's a JPEG here, and that JPEG does have its associated world file, which tells it again what-- at least, the world file what-- it contains the insertion point, the rotational value, and the scale for that image. What it does not contain and does not know is what coordinate system that world file is associated with. So I'm just going to very simply tell it the exact same coordinate system that the other data was coming from and choose Close and Refresh. And that image will then automatically be draped on the surface.

Now what I've not done yet is shown you the surface itself, so we do see some hills just south of the downtown San Luis Obispo area. This image did have, interestingly enough, a little bit of red. I don't remember why there was red in that image.

But we see things like a lake over here. We see the highway system, or the highway that runs through the city. There's a park. There's ultimately some railroads that come off on this side. And we're going to interact with this a little bit.

Now, if you do not have any imagery whatsoever that you have access to, but you have terrain-- so what I'm going to do is I'm going to turn off the image for just a moment, is we also have the ability to add it says data sources. Add database data source, and one of the options

is to use Microsoft and Bing maps. So we can then choose, and I'm going to choose the level of resolution for the imagery that I want to come in.

Now by default, what we're going to be doing in a little bit, we can build the model for you, and by default that process will always bring in a level 17, which is approximately a meter per pixel, right? That's OK for large models, but if you need a small model, that could look a little pixilated, may not be the best thing. But you can ask for as small as a third of a meter, which is approximately a foot per pixel.

Which when we start downloading the data, we have to understand it's a third less this way and a third less this way. That means I have nine times more imagery that I'm ultimately downloading to represent that, right? So when we start talking about image and image size, that certainly brings up the question about computers, and we'll talk a little bit about computers and capabilities over the course of the session, but just wanted to mention that very quickly.

Now for this class, for the sake of speed, what I'm going to do is I'm going to bring in a level 15 and choose OK there, OK there. It's basically adding it to the data over here. And I'm going to double click-- nope, that's the same one I just had, sorry, wrong one. I'm going to double click on this. And I could name it. I could just say this is Bing imagery, Bing, and choose Close and Refresh.

When you close and refresh, that's when it's actually going to do the calculation, and now this is bringing in, from Microsoft Bing, at least the version of the imagery there. Now of course we often get asked, are there any other sources that are available through the system and through the process, and the answer is-- free and directly accessible, the answer is no. But any imagery that you have access to, just like the one that I dragged and dropped in, can be applied as long as it has a georeference location. If it doesn't, placing it is a little bit more cumbersome perhaps, but being able to do this certainly allows me a certain amount of speed.

Now you so I came in relatively quickly, but like I mentioned before, if I were to zoom in relatively close, it's a little bit pixilated at that resolution and level, right? I just did it for the sake of speed, but we saw that I had four other levels significantly higher detail that would have taken longer to download but would have given me a higher resolution imagery. Now the other thing I'm going to do, now the rest of this I'm going to do a little bit faster, is that I'm going to bring in, from a shape file, streets.

So looking at the shape found the collection, I'm going to just drag and drop the SHP file in

here. And it says, well, that SHP can be one of three things, right? Could be point data. Could be rectilinear data. Or it could be polygonal shapes.

This happens to be the center lines of streets, so it's rectilinear. And the question is, what do I want to represent? Right there it says empty for type. What do I want to represent that data as?

And it could be-- technically anything the software can build, I can use it as that type of object, so that means roads. It could be rivers. It could be pipes as in pipelines for underground utilities. It can be lots of things, so we have that decision. Very simple in this case, because it was streets I'm going to choose roads right there.

And then one other thing related to roads, it says, OK, you want it to be a road, but what type of road? What do you want it to look like? And I have the choice immediately to just pick a be a default style for all of the roads.

Now some of the roads may have curb and gutter. Some of the roads may have sidewalk. Some of the roads may just have edge of pavement. At the moment, I'm just assigning them all to be one style, right?

So I can-- I'll pick a style here. That one doesn't look bad. And there are lots of other data that I can import, so I can interrogate the data and find from the shape file itself, the class, the street name. I think that says street name right there.

Again, my resolution here is-- street name, I'm good there, right? For the class, maybe I use that as the description. So there's lots of information that I can utilize as a part of that.

And lastly I'll just go to choose Close and Refresh. And what it's going to do is, from that shape file, it has built all of the roads that were possible from the shape file itself. Now, if we zoom in, we can start to see how accurate was the shape file, perhaps, to some of the Microsoft Bing imagery.

I would say, generally, this is pretty decent. If I were to turn off the Microsoft Bing imagery and go back to the image that I had originally, you will find that original image and how it was placed. Now however I got it, I don't even recall, was not perfect. It's good in some areas, but in some of the other areas it's short, so it probably needed to be enlarged a touch.

OK, so I'm going to come back, just add in other data. So just to finish off the process here, we



understand now how simple it is to drag and drop information. So just showing some of the other objects that I can build from scratch, I'm going to bring in the lake. And we tell it once again what is it.

This is polygonal data. I want it to be a water. What type of water? We can see the rule style down here for the style. Basically, what is its appearance, and I want it to be the default water.

And I could extract the name, if it's there. I don't know that it is, so I'll just hit Close and Refresh. And then right there, the water has been dropped into the environment, and we see that the water is in fact kind of rippling and it reflects things in the background. If there's buildings or trees or the sky or the moon or the stars, it will actually reflect in that situation at night.

Now the other thing, just to finish this, we will go back. We'll drop in some schools perhaps, and-- shape-- we'll stylize that. What do we want that? That's going to be, in this case, a coverage object, coverage area. And I want them to be a particular color, so I'll use colors, and use perhaps transparent orange. That will be visible, Close and Refresh.

And coverage objects basically drape on the ground until I don't want them to. So at the moment, they will conform themselves to the ground at whatever-- if it's hilly or whatever, it's just going to, like cellophane, just sit right on the ground. Now if I don't want it to, we'll see how I can actually interact with the ground and raise it and lower it and create some rudimentary grading with that type of an object. That's going to be possible.

Now, so here you can clearly see, one, I had have the data, except for the Bing imagery. Two, it had to be georeferenced. Three, I had to organize it somewhere, and then I dragged and dropped it individually, and it took a little bit of time. And usually, when I would do this before the next capability was available, it would take me about an hour to go out and find open source information of terrain and georeference ground imagery and shape files for the roads and rivers and streams, et cetera, to put it all together.

But now what's possible with InfraWorks 360, and this is not possible in the LT version, probably the single biggest capability that's-- would not be a part of InfraWorks 360 LT that comes with the suites is this capability right here called model builder. So if I were to choose model builder, basically what we can do is, anywhere-- interesting, I would think my internet access is a little quicker than this. Anywhere that will come up on the map-- wow, the gremlins are really out today-- I can then just either search for a city, an address, a street address, a

particular street, and that-- let's close that down and try that one more time. Hopefully I haven't-- there we go. So if we were to, say-- what came up earlier? Bob, in the back, what was the name of your city again?

**AUDIENCE:** Phoenix, Maryland.

**ANGEL**

**ESPINOZA:**

There we go, Phoenix-- I should have remembered that-- Maryland. So we can very simply type in Phoenix, Maryland, and it will zoom right to that area. And notice over here, I have a square-- in square kilometers, how big of an area I'm currently looking at it in that window. So if we were to move here towards this north coast area, and towards the river and it's tributary here, it is updated how much space I'm asking for, right? I can also verify what I'm looking at by choosing the bird's eye view, and I've chosen to turn off the angle view because it does tilt at it if it can.

So here, what I'm going to do is ask for this particular area, which contains a river, a road, appears to be an iconic bridge, a lake, and some streets. So we're going to call this Phoenix, MD. I'm going to apply this to a group. And group is basically my way to coordinate my data, to stage my data, or perhaps protect my data. And I'm just going to ask it to create the model.

Now, I get a message that tells me I will be notified via email once that model is ready. I'm going to talk very briefly about what it's going to do. Up in the cloud, it's going to put together road data from-- you maybe we will make that out, it says from open street maps. It's going to bring-- which not only road-- road, rail, water features from open street maps.

It's going to bring in building footprints if they're available in that area, again from open street maps. It's going to bring in that Microsoft Bing imagery. And for the terrain, it's going to use the USGS inside of the United States. Outside of the United States, it's going to use one of the space shuttle radar topography missions that-- the data that was captured there back in, I think, around 2002. Or it's says ASTER GDEM for, again, portions outside of the United States.

So it's that simple. I'll go ahead and choose Close, and already you see it just appeared. It says Phoenix, MD, created today by me. I put it in a group called customer models. It has a certain size.

I'm going to click on it, and that data will be downloaded. So I can start with absolutely nothing, and in a matter of minutes, have something-- terrain, georeferenced ground imagery, roads,

water features, et cetera. Question, yes sir, while that's opening.

**AUDIENCE:** You have a predefined set of sources for that sort of thing, can you add other sources?

**ANGEL**  
**ESPINOZA:** Absolutely, you can always go back to the data source window that we were at, or you can drag and drop if that information is co-located or in the same environment. Doesn't have to be. It could be technically somewhere else, have models that span areas.

**AUDIENCE:** So if there was a, for example, county government in Maryland that had information--

**ANGEL**  
**ESPINOZA:** Absolutely

**AUDIENCE:** --all that matters is we can [INAUDIBLE]

**ANGEL**  
**ESPINOZA:** Absolutely, I can come back over here to the data sources and continue to add to it. And one of the things that we'll do a little bit later is we'll see the relationship between Civil 3D. And Civil 3D will be able to reach right into this InfraWorks model and pull from it surface, road alignments, et cetera. And InfraWorks can reach right into a Civil 3D drawing and pull from it surfaces, road alignments, pipe networks, et cetera.

So this bi-directional handshake make these two tools together what some people are referring to as the dynamic duo. They work very well together, and they're intended to work well together. And it doesn't matter where the information starts, you can always get it from one into the other. And then you can always supplement, right?

So the possibilities are almost endless. But here, we will see that-- we see that the ground is not flat. We do see the water feature. If I were to remove-- that's a shape file, right, it came from open street maps. If I were to remove it, we can see the imagery down below. I could have the undo capability.

I also want to point out that there is no save. Everything you do is instantaneously-- it is a SQL database, ultimately. It's a database, it's not a single file. Everything you do is recorded into the history of the model. So irrespective of if the power were to go out or if my laptop were to crash, I never lose any work. The moment I do something, it is done, so that can be a good thing.

Now this model does happen to include some buildings. These buildings are the footprint of

the building extruded up to the height. If I were to just hover over one of these buildings, we will see the original source. It says-- let it come back-- OpenStreetMaps, and I can click on that link, and then it will launch to the OpenStreetMaps site.

And again, my internet connection is a touch slow, slower than I expected, but there is the data that pertains to that footprint, right, that is freely available. Now again, if you have other information that's more current or more detail, you can always utilize that, but this is a fantastic starting point that you can get to in a matter of a couple of minutes for free, right? The cost of the software of course, but without any other significant effort.

So what I'm going to then do-- so we talked about building something manually. We talked about using a model builder, and again that's the most significant difference between LT and the full blown product. The other difference again being these road design, bridge design, drain design which we will cover a little bit later today.

OK, so I'm going to close this particular model, just go back to the PowerPoint for just a moment. And by the way, I apologize. I didn't get my hand out up there until rather recently. I don't know when it filters through the system. So I do have it here.

And so we talked about InfraWorks of the entire globe, the types of drawings-- excuse me, models that it's capable of doing. You can build it yourself. You can use model builder to do that. That window was what I chose to utilize, but there were other options where I can draw my own polygonal shape, rectangular shape, my own irregular polygon shape. Or I can use a shapefile that would define the actual extent of the model so maybe like the city boundary or a particular parcel of land.

If we have any shape, we can utilize that to define what type of model we're requesting. As long as it was less than 200 square kilometers today, which translates to about 77 plus square miles-- and that's a tremendous amount of land, that we'll see in just a moment-- but that is expected to go up and be able to increase. Now, we do receive an email that usually indicates that that model is ready for download. Normally, what I do is, even before I make-- I'm cognisant of the email, it appears in that first slot, and you can just download and you're ready to go.

OK, so on the home screen, wanted to talk about the home screen for just a moment. Here is the fact that it tells me that I have InfraWorks 360, and I'm subscribed to Autodesk InfraWorks 360. There are some preview technologies that you can toggle on.

One has to do with corridor optimization, land areas, and grading behaviors. We'll talk a little bit about land areas and how they differ from coverage objects, which again helps us form the land. There's something about sustainability-- is that what that says-- maps, and over here.

So here are the tiles. I happen to be filtering to just the tiles and include my name, or angel perhaps in the title. Like cities like Los Angeles, they would appear on this list as well. But if I were to remove that, you would see all of the models that I have access to.

Some of them might be demo, and some of them are models by coworkers that have given me access to their models, right? So that's the whole purpose of groups. You have membership in groups, and everything that you're a member-- every group that you're a member of, you then have access to the model.

Now the administrator of the group does have control what type of access do you have to that model. Do you just-- can you just view it, or can you actually edit within it, or what can you do? Can you actually delete it? So there's different forms of collaboration, which in the handout, it's on the very last page of the role, but basically I'm able to see a great many models and I'm just going to isolate down to just the ones that say angel.

So there's that SLO one. We talked about the Phoenix, Maryland-- thank you very much Bob for the reference. Now downstairs, if you were able to make it to the booth that did InfraWorks 360, the theme for this particular Autodesk University was model your favorite place. What is your favorite place? And what if you had the ability to make a model of anywhere on the planet, what would you choose to make a model of, right?

Now I happen to absolutely love InfraWorks. I've been working on it since the very beginning. I will work on it in the evenings if my family's out. Sometimes even if they're in, I'm still playing, technically playing, in InfraWorks. I enjoy it that much.

And part of it has to do with, ever since I was a little kid, I always enjoyed miniatures. And I will buy any little miniature of anything that I see. I have a little White House and a little-- oh, I just drew a blank. In Rome, the Saint Peter's, and the Coliseum. I buy all these little things. And I like little people and I like little soldiers.

And I'm not going to lie, I like *Star Wars*, and little *Star Wars* figures. I'm wearing my *Star Wars* T-shirt underneath, because for me, *Star Wars* was a tremendous escape, right? And I would

collect all the action figures and collect the vehicles and all of that. Everything's out of the packaging, so it's-- none of it's stored away. I had kids, they wanted to play with them. Yeah, sure, go to town.

So for me, one of my favorite places that unlocked my imagination was Skywalker Ranch, right, the original-- it didn't exist originally, but where, ultimately, George Lucas decided to build a complex to expand the universe of the Skywalker-- of the *Star Wars*. So I decided to build a model of Skywalker Ranch, so I'm going to go ahead and click on it. And that model, I tried make it and use the full extents of what model builder can automatically create for me. Which means it is approximately 200 square kilometers or approximately 77 square miles.

So within this entire region, within this entire area, there is-- and it's, the way you can find it, if you were to go to Google, and if you look for Lake Ewok, you will find Skywalker Ranch, and it's the one and only Lake Ewok in the entire country. And if I hover on that-- let's see, let's do that again. Click on that. It's a legitimate lake. It is in the databases of all mapping services, and there is Lake Ewok, right? So that helped me find Skywalker Ranch.

So as I started to look at it, ultimately I thought, wow, there are large buildings, and I'm sure there's a tremendous amount of technology within those buildings. But I thought, that's a somewhat rustic, humble environment for the vision that created galaxies long, long ago. So I thought, OK, well that's what it looks like, but what if I were to make it what I want it to look like, right? I want to see *Star Wars* vehicles maneuvering through there. I want to see Stormtroopers having target practice and trying to hit the side of a barn, or whatever.

That's the type of thing that's possible, so we're going to learn some of the tools within InfraWorks to make this environment different. Now what I'm going to do, and I have this on a different-- what's called a proposal. So a proposal, you can consider to be somewhat of an alternate dimension, or an alternate universe, a mirror universe.

So by default, when you start a model, there is always-- and it will there will always be there-- be a proposal called master. So what I'm going to do is I'm going to drop this down and choose Add, and I can change it. I'll say My View, My View. So that's all caps there. That fine.

And of what this can be, so as I start to grade, and as I start to design within this environment, what we will find is I will still always have the master which was the original state of how I received it just in case I want to go in a different direction. And I have this other universe, or alternative reality, called My View. So if in My View, Lake Ewok actually wants to be bigger, or

needs to be somewhere else, I can absolutely put the lake on top of a mountain or on top of this field, and it would be different than where it was in the master. So as I go back to the master, right, the lake is still over there. But if I go back to the proposal that's called My View, the lake is over here.

So as you start planning designs, you have the ability to create different visions of what that parcel of land will be. Is it going to be a park? Is it going to be a school? Is it going to be a hospital? Is it going to be-- the road designed this way, or is it going to be designed that way? That's all entirely possible so that whoever's in charge would making that decision, ultimately, can have the full perspective of the impacts of one design versus another in this environment, right?

And then you can see things in the context. So if I were to use the Autodesk ease, it says design what can be in the context of what is. Well there is what is, but what do we want it to be? So I won't go back to the My View.

I'm not certain if, once I go back and forth amongst the different things, if I can do the undo to put that back. That's OK, I'll just grab it and just position it more or less where it was. Close enough for government work here, with my apologies to governments, sorry.

OK, so as we start to learn about the tools that are possible, the first thing I want to talk about-- I'd already mentioned it-- the ability to create. So I'm going to create, and there's lots of things I could create. I'm going to jump down first and talk about coverages, because I did mention them earlier. So if, in this particular land, I wanted to subdivide or sell a portion of it, I can specify a boundary and say, this boundary right here-- and I'm picking, picking, picking, and I'm going to double pick right there when I'm done-- is being then defined by some color.

Now I have the complete ability to come back in here and fine tune this, and move these around if I so choose. You'll notice that I am receiving information about the perimeters, distances, and the overall area of that boundary. Now by default, it just used some sort of reddish color to denote something.

I also have what's called a style palette, and it manages lots of different type of data. And what we can do is manually drop in other colors or other styles or, depending upon what we want, if we want that to be completely-- I'll use a land cover. Where's my land? There we are. If I want that to be completely manicured grass, I can make that manicured grass.

Or I'll use the-- better yet, the terrain ones over here. These are a little nicer, because they do change with the resolution as I zoom in, and it will change its appearance ultimately. And there being the manicured grass, or another type of grass, or asphalt, or concrete, or tile, or whatever, dirt, or rock. Whatever you want it to look like, it can look that way.

Now the other thing that a coverage can do is I can-- within this coverage, I'll create another coverage, and maybe the intent is that this be a pad for a building. Now I very simply just created that shape, and I can add vertices to it. I can move the vertices around. Add vertices is Alt Pick-- Alt Pic, there we go.

That will add a vertex which allows me to move it. I can Shift Pick on that vertex to make it go away. That same capability applies to everything that we create, whether it be buildings, roads, water features, lots of things. Alt Pick, Shift Pick, and then also there's Control Pick which allows me to split things like roads into two different types of roads.

Now I mentioned earlier that it is possible, and I'll do this exaggerated for the sake of clarity. I can do some land forming. So I just lifted that up. I can grab one of the vertices and I push that down, and I am interacting with the terrain. And you can see what I've done there, and I've done some sort of grading, right?

Now the other thing that's possible is, every time you see two cubes-- two squares that overlap, that's basically the analysis. So there's analysis for all of the intelligent tools. Over here on the roads, there's analysis for the road design capabilities. Under the bridge, there there's an analysis for bridge, and then likewise for drainage.

So back over here on the analysis, it has the ability-- gives me the ability to do things like terrain themes. And what I had already done was I created a terrain theme. And we'll create another one on the fly here real quick, because they're super simple. If I wanted to know-- oops, I just moved something. I want to undo it put that back. I moved my parcel-- my grading object.

If I wanted to know, elevationally, how this all-- I can very simply say, let's create a new theme. It's going to be elevation theme. There's six colors from red to blue by default, and there's lots of already preconfigured colored ramps that I can utilize. And I'll just very simply say make that somewhat transparent, hit OK, and the entire surface then will be themed. All 200 square kilometers or 77 square miles will be themed elevationally per those six bands, right?



Now, the other thing that I already have on here is things like-- I have slope banding. So if I wanted to know where is it flat, that would be the things that are shaded in white. Where is it starting to get steeper, yellow, green, red, right. There's a blue in there somewhere, and it gets deeper. So if I wanted to know on my piece of land, where do flat area, I can make that determination from there.

I also have another model-- excuse me, another style, that as I come in here to Skywalker Ranch specifically-- escape, escape, escape-- I've asked for generally flat, and then I also asked that very flat. What is very flat? And then I can have that level of understanding. So the product does help me analyze lots of things, I'm just using one as an example.

And also here, the earthward volume calculations, which is what I'll do next. But there are lots of other-- you can see in this analyze, there's lots of things that I can analyze and different ways that I can do so. One includes measuring distances, measuring distances along a path, et cetera. I can find ranges and bearings, et cetera, from one point of view.

Now I'm going to use terrain statistics. And just like I laid out that coverage object, just like I will lay out roads and buildings, I'm picking, picking, picking, picking-- double picking when I'm done-- and then it's calculated the cut and fill that I did based on that grading object where I lifted it up a lot and I put some of that down. Right, so if I'm reading that correctly, that says volume of cut 4,963 cubic yards, volume of field 9,700 and something-- my cursor is on top of it. And net, I'm in 4751 positive of fill, right? So I had much more fill than I did cut.

**AUDIENCE:** What's the-- what is the default slope [INAUDIBLE]?

**ANGEL  
ESPINOZA:** Right now, anything under the I can be considered somewhat conceptual or really rough and crude. I just grabbed one of those-- there was an elevational value that I just raised it to, but I don't know what the end slope was.

**AUDIENCE:** Can you control it?

**ANGEL  
ESPINOZA:** I can control the elevational value, but not the slope. So over here, within these tools, these are more conceptual in nature. Underneath the other icons, there are going to be design specific capabilities that we'll talk about a little bit later. But here, with the coverage object, it's just very rough.

Now I'm going to go ahead and remove that and talk about another object type. Get into edit mode, hit Delete. That's gone. Another object type that's somewhat similar is to create the

land area.

This one behaves similar, but is always flat. It never drapes itself to the ground. And there you can see that it created a flat area.

Here, let me turn off my theming. It created a flat area, and what I can say-- and I'm going to even delete this one for the moment. I have, underneath the styles and grading, different options on how that should daylight.

So right now, if I wanted to daylight out three feet irrespective of cut and fill and slope, give me some irregular slope that daylights out at 3 feet, that's the scenario right there. But if I want to do cut and fill at particular slopes, like this is three to one and cut, two to one and fill, I just drag that on there and I have three to one cut and two to one and fill. And I can even specify what type of materials for cut. It's using talus, which is this rock over here. And for fill, it's using manicured grass, which is that lighter green over there.

Now if I want to, this is a different situation here for different grading. Instead of my cut being at a slope, maybe I want to have a retaining wall. I can very simply just drag and drop that, and we will see that the grading will change, and I now have a retaining wall simulated along that area, right? So I can very quickly and easily define and change these things.

And ultimately they do Daisy chain. So if I were to grab this and say Control C, Control V, I'm going to paste another one right here, and lift up this other one. And again, there's elevational value, ultimately, to the entire process. You can see what is Daisy chaining to the other one.

If I were to move it, it updates. If I change the vertices, it updates, so forth. All of this has been happening dynamically, and I can then specify and simulate a grading entire residential community, hillside community, if that's what I ultimately wanted to do.

OK, I'm going to then talk about-- I'm going to get rid of that. Oh, I'll one of those actually. I'll leave one of those. The next object that I can create that I'll create at the moment is a building. I, just like everything else, pick, pick, pick, define the building footprint, pick, pick, double pick when I'm done.

That building got created as some default height, some default style or whatever I used-- someone used last or I used last. You can see that I can increase or decrease the height of that, the number of floors will update to properly show the representation of that building. Also,

there are building facades that are, again, styles, right? I'm going to scroll over here.

Facades, there's lots of straight out the box facades, and I can just drag and drop a facade onto that building roof, and that will change that building appearance entirely. So if I wanted a prison, I can have a prison. If I want condos, I can have condos, with balconies, with railings. It's all in 3D if I so choose.

Now, additionally, that building, if I look at the properties of that building, has a style which is called banded applied to it. If I remove that style and update it, I can have simply massings. So depending upon what you need to show within your model, you can have simple massings, you can have buildings that are somewhat representative of what will ultimately be there.

If we don't know what's ultimately going to be there, we can even have a style here that I'll use. It's called-- it's under the metal. Nope, not in the metal and stone, it's under the metal and glass-- a building and scaffolding, right?

And we don't know. The unveiling, it's not yet official. While the architects are doing their Revit model, I can represent it as a building under construction, and then ultimately unveil it once I get that other model and replace it, right?

So these are very simple models. They are ultimately hollow inside. There's no floors. There's no-- although there's window appearing objects and doors, there's no actual physical property of a window or door.

So these buildings-- and just like we did otherwise I can reshape them, I can recreate them, so forth. Lots of flexibility, very simple and easy to use. The fact that you just pick, pick, pick, pick, double pick when you're done, you've learned about 20% of what it takes to run this particular product, right? And that's not a joke.

So the next thing we're going to do-- and you remember this is My View, my vision of what should happen here-- let's say I wanted to create a road through here, and I want that road to have a particular appearance. So I can create a road, and I'll just very simply use something small like sidewalk. So let's say-- and I'm not going to be able to create very exactly the image I want-- but let's say this was supposed to be in-- gosh, I already did a bad job. That was supposed to be Yoda's head in the form of a sidewalk, right?

This did not limit me from how I laid that sidewalk out. And from the styles-- here there's road styles-- I can very simply drag and drop other styles onto that like I did the building, and it will

not limit how I layout that road. These are called sketch roads, or planning roads, and there's no limitation to that.

Separately, in a moment, we're going to get into design roads which have much more specific properties and characteristics that must be adhered to based on the design speed. Horizontal curve, vertical curve, et cetera, all of that will be a part of what a design road can do. A sketched road, I can come in here and, similar to what I did with the coverage object, I can raise that, I can lower that. It's just elevational values. I do not know the slope between them.

This is ultimately a spline, right? No road that cars drive in or trucks are technically splines. They might have a spiral in them, but most of them will have radial curves, and this clearly does not adhere to any particular design speed. So I'll leave that there for the moment.

So we've talked about roads, buildings, coverage objects, but we see that there's lots of other things that we can create like underground pipes and connectors, which could be manholes or inlets of various types. There's rail features. There's water features that I can draw. So if I wanted to create another Lake Ewok, a baby Ewok, I can specify the shape of that water, double click when I'm done, and then I've specified where that water needs to be, right?

And completely editable, again Shift pick removes that vertex. I can rotate it. I can replace it wherever I want, so lots of flexibility in how this ultimately works, right? Probably want to do a little bit of grading and not put a roller coaster ride right next to it, but we get the point. There's lots of things that I can quickly and easily do.

If I wanted to shield the main green and lawn of the main building from the rest of the site, I have the ability to create a stand of trees. And I'll very simply pick, pick, pick, pick, double pick when I'm done. I'm going hit one escape which shows me then this slider. If you can make it out, I apologize for perhaps not being able to do. This slider I can slide to the right and make it more trees.

Touch it twice, get them all, come out. There we go. I can slide to the left and make less trees. I can increase the height of the trees, or decrease the height of the trees. So I can then specify both the nature of the tree, and here are lots of styles for different types of trees.

This being in California-- go to more styles-- maybe the intent is that they actually be palm trees of some sort. Where is a California palm? Here it is. South Carolina palm, sorry. Here we are. So again, a tremendous amount of flexibility to create the environment that we need.

So if I were to go back to the handout very briefly, what we've done is we opened a model, we started to sketch. I have some tips and tricks here about adding vertices. What does that say? Add a vertex, delete a vertex, split an object, find placement of the grips. We will create-- there's lots of things that we can create, a road.

I did not yet do this in that. I should do that real quickly, which is an intersection. And whenever two roads cross-- I'm going to create another road using perhaps a different style. Let's pick that style which is the same one as the road there, pick, double pick.

Where two of these roads cross, they will create what I'll call a rudimentary intersection. I have no control over it. I don't have any control over the radii. That's the default value. I don't have any other way to pick that intersection object and intersection location.

If roads-- bless you. If roads are of different styles, they will blend into one another. So the grass on one side blends into the sidewalk on the other. Again, that's somewhat fixed and controlled.

Now these planning roads are sketched roads can have value. And without any road experience, I could do whatever I wish, some sort of approximation. But for the true road designer, there would be a different or other capability that we'll talk about here in just a moment.

Now I did talk about the buildings. Oh and for the sake of the roads, let's do one other thing here. I want to talk-- I going to undo, bring those roads back. That any of these road signs that are straight out the box are easily configurable by anyone to update.

So what I'm going to do-- and you're sitting the closest. Thank you very much for being that brave. I'm going to grab one of these, and I'm going to make a copy of it. Now I'm going to double click on that copy, and this is the definition of that road.

So what we'll see is that the road is currently-- what's that's say-- 9.8 feet. Let's say I run a road that's 12 foot lane. I'm just going to hit 12, you should see the preview update.

Separately, it say curve, which is about half a foot. I can make that exact and 0.5, six inch top on the curb. Green space, how wide do you want the green space in front of the sidewalk?

**AUDIENCE:** Three feet.

**ANGEL** Three feet, so I'm going hit three, Enter. That changed a little bit. How wide do we want the

**ESPINOZA:** sidewalk behind the green space?

**AUDIENCE:** Five.

**ANGEL** Five feet, Enter, that has changed the preview. So I'm just going to hit OK, and then drag and

**ESPINOZA:** drop that new style that we just created on the fly on top of this road. And you should be able to see not only where the road widened, but all of the components will change and widen as well because I can we went wider on everything.

So as I drag and drop it on there, everything updates, including ultimately the width. That if I measure from the top of the curb-- could be in the back of the curb actually. Yep, should have been the back of the curb-- to that edge of the green graph, three and half, because the curb was half a foot, right? So absolutely easily configurable and definable.

And ultimately, if I so choose like some of these examples here, they can include what the software refers to as decorations, which in this case of street lights and trees. It can have cars physically in the roads. I can have people walking on the sidewalks.

Again, we're only limited by your own imagination of what do you want to include. I can have a road style that is basically the road under construction, which is all dirt, right, and the rough grading of that road. Could have barriers, or barricades, traffic cones. Whatever we want to include in that style, I can include that as part of the style and just drag it and drop it on there. Yes sir?

**AUDIENCE:** So if you were changing existing road, would you follow the center line or do you have to draw [INAUDIBLE]?

**ANGEL** Whatever the existing road is defined by, and whatever this definition says should be, that

**ESPINOZA:** center line alignment will be the center of this definition. And I could have it technically be asymmetrical, and have three links to the right and only one lane to the left if that's what we want. But it's all whatever is defined here gets applied to that line. And that line can be the center of a lot of road, could be the center of a channel, could be the center of lots of things. And whatever I want to push along that space, it's certainly possible.

Now the road can be technically untra thin and all I have is people walking. So if I wanted to have people in the environment, it will try to interact with other roads because roads do that. But technically, it could be practically blank, and I just put from here to here, and there's just to

much people, right? So there-- again, the limitations of very few. It's how can we creatively use these tools, right?

OK, so back to the handout very quickly, and I did the buildings, I did the tree, I did the water, I did the coverage area, I did that the terrain leveling. It's called terrain shaping there. I did the land area, talked a little bit about that. We're going to now talk about that three design capabilities, and they are road design, bridge design, drainage design.

So what we're going to do then is I'm going to remove these great sketched objects here, and we're next going to create a road. So if I wanted to have a bypass road that didn't go all the way to the main building, maybe went over the Lake Ewok here and there it's going to be some other buildings or structures in front, I can. And I think I've-- when you get, by the way, from model builder, these are always what are called planning roads or sketched roads.

But you can pick on a planning road-- let's see if that one-- that one, I might have already done so-- yeah. You can pick on a planning road. Let me find one somewhere else on the scene. Here, and I can right click and the choice is convert to design road, right? So if I choose to convert that road to a design road, basically all of the roads that I wish will then be designable, and this takes it up to a whole other level, and we'll talk a little bit about that.

So for design roads, I can right click here and say, show me the profile view. And there is the profile view of that road with all of the vertical curves et cetera as it compares to the ground, which is in green, right, of that particular road. Now I'm going to create my own road over here crossing Lake Ewok. Maybe I'll create two crossing roads here.

First road is going to be create a road. There's two types of design roads. There's ones that are based on styles that are all the styles that we see over here on the right-hand side of the screen over here, all of these styles. And then there's another one that's based on components, and that gets me even finer control over that, because I can add curbs and sidewalks and barriers just in certain regions, versus the style which is for the extents of the style.

Now I can apply different styles in different portions of the road which will make it transition from asphalt to curb and gutter back to asphalt, whatever. But with components, I have even finer control. Unfortunately, with 90 minutes, I can't do everything that the software can do, and I certainly wish to cover some of the other capabilities still.

So I'm going to create a local road. I'll pick this style here. I'm going to pick that intersection there. And perhaps I'll draw it here. And the first thing you'll notice is that, as I try to bend this around, it does limit things like the curvature of that road based on the design speed. Now I didn't change the design. Maybe I want that to be 30 miles per hour, 30.

Let's start that again. Do a local road, pick the style, pick the intersection. I want that to be 30. There we go, 30 miles an hour. And then now, based on 30 miles an hour, that curvature, that blue arc that you see, is defined by a design speed and the highway transportation guides and manuals and [? actual ?] standards on horizontal and vertical design for these roads, in this case the horizontal.

And I cannot create that type of an angle for a 30 mile per hour vehicle. It just wouldn't work. So it does help me then design a much more detailed and much more accurate.

Now I double pick there, and what it's going to do-- and this little access road, I'm just going to delete it just for clarity. Probably a dirt road that I didn't change. What has happened is, not only over here where this road met-- where one designed road met another design road, it created an intersection. But also where my design road went over the water, it created a bridge.

Now as I touch the design road and look at it from above, I have the horizontal Pls for that design road. Now I can grab it and reposition it, change the location, change the geometry. Everything will update on the fly. Now the moment I start to turn more flat to the screen, you will see that those grips went away right there, and I'm now actually seeing the horizontal-- excuse me, the vertical Pls for that road. So if I were to right-click and show that profile view, there's only a grip there and there's a point there and a point there and one straight grade in between them.

Now I can add a PVI there. And what's actually happened-- I'll try to make it so I can see both. There we are. That PVI is this PVI. As I move this up and down, you will see that I'm actually going to change that road up above.

So if I want to place it more towards the center of the bridge and raise the bridge over the water a little bit, pick, then everything will then redesign. I'll pick up up here to make that active. That road will elevate and I had a very slight vertical curve.

Now if I wanted to change the vertical curve late, I could type in a value there or just visually



grab and grip it and then change that vertical curve for that bridge. So we have then the capabilities of doing detailed road design per design standards that follow particular design features. Like in the case of this intersection-- I'm going to close my profile view-- that intersection is a traditional intersection, uses a passenger vehicle for the design vehicle for the curb returns.

If I were to change that and say, well, they're often going to receive heavy equipment, maybe I need to have a larger design vehicle. You will see that, based on the one way nature of these roads, this one's going this way-- that one didn't change for some reason-- the curb returns got bigger. I can change this one myself. Maybe because the water-- I think the water's prohibiting that, which we can change.

Now the other thing about this, there is the tradition. I'll set that back to passenger vehicle and we'll see that go back. If I wanted to, I can grab into this area here, and then create a widening maybe for a right turn lane. Let's do it over here.

It starts to get into the other road. Let's do it like this. I'm going to grab this, right click, and say, I don't want a traditional intersection, I want a roundabout. So much change that to a roundabout, and hopefully it doesn't go into the water too well.

Yeah, it went into the water. Let's move this this way. There we go. Have this recreate. It's not touching the intersection. One moment, sorry. That's my bad design not the software. It knows.

OK, I'm going I ignore that one for just a moment and build another crossing right over here, local road here, here, here. And then I'm going to build another local road from here up to the main circle up there. Grab this one, I'm going to change that to a roundabout. I'm going to take-- yeah, that looks good now, excellent.

So that roundabout, notice there's grading on the whole thing, if I were to grab that roundabout also, there is design standards for it. So based on the Federal Highway Administration, is it single lane, is a double lane, is it rural, is it urban, is it a mini. Whatever the case is, we can have that designed. Also, if I tilt down, I'm now also able to control-- let me grab that-- the grading.

So if I wanted to have it grade in a particular direction, I can lift this. Let's turn the high side around and grab this and raise or lower it. Maybe I want it to grade towards the water. You

can see I can change that plane, right. So all of that is absolutely doable.

We saw the road design. We saw the bridge design. The bridge design has even more capabilities. If I touch the road once, I'm touching the road. If I touch it again, I'll be touching the bridge.

And if I right click, I can decide which of the bridge components do I wish to see. Do I wish to see the road in the deck? Do I wish to see the piers and girders? Let's turn off the road in the deck for just a moment. I'm going to ask for also the quantities on that road.

It's a particular type of road cast in place, pre-cast materials, cast in place materials. If I were to change that bridge from a precast I-beam bridge to a steel plate bridge, everything would redesign all per proper design standards. You'll see that the quantities, there are no longer any pre-cast, and there's now structural quantities in there that did not exist a bit ago.

Ultimately, if I wish, I have the ability to send that straight to Revit. So I can take that bridge, send it to Revit as a family so that people can then-- that are much more capable in Revit than I-- add their important data to the model, right? That's very quick and very easy.

OK, now the last thing here that I'm going to do is-- was there a question? Sorry, for this road here, I'm going to right click, and there such drainage, and then add a drainage network. So there are some default values here. There are catalogs of inlets, catalogs of manhole structures.

I'll pick these. Close that one, pick this one. And you can see there's different objects here. I can specify the values very simply at the bottom. Depending upon the values and default values that are here, how I left it, says press Enter to add a drainage network to the entire road.

Now this road understands there is a bridge. I'm not going to put drains necessarily as a part of the bridge that may have its own drainage system back into the lake. But maybe over here, it will add the manholes and structures, the outfalls to that network. And I probably want to reposition that into the main area over here. Ultimately that is a huge kickstart of everything that I do.

Now, I'm going to pause for just a moment. I'm going to close this model for just a moment and come back to my Civil 3D and point out that I can reach right back into-- so under the Insert tab, I can reach right back into that model. In this case, the model was Skywalker

Ranch.

And as long as the coordinate systems match up, and I had changed that to California's NAT A3 zone 5 US foot. My drawing is California NAT A3 zone 5 US foot. I'm going to ask for a particular area of interest, select my area. I only want to work within and grab information within, let's say, this area right in here.

And now, within that area that I've just defined, it's going to look in that model. Now that was 77 square miles, and it's going to say what in that area, and I can refine that selection set even more. What within that specific area do you want to bring across?

So I'm going to bring across-- I don't want the planning roads. I don't want the terrains, because those are already there. But I did create some new design roads. I did create a new roundabout. I did create new coverages.

I didn't catch the bridge. I was hoping to be able to catch the bridge, but the bridge would come across as well into AutoCAD as 3D solids, right? And those look pretty good. I'll hit Open the model. And 12 objects will be brought across from the InfraWorks model into Civil 3D.

So as I zoom in here, which include the-- there's around about, right, the roundabout, the intersection down here. Did I not ask for the drainage? No, the drainage network was over here on this side and I missed it with the bridge, didn't I? I was expecting to get my drainage network as well. All of that would come across.

Now the exact same is true in another sense. If I were to create a new surface from a new road or a parking lot or anything like that, remember that inside of InfraWorks, I have the ability to reach right into a Civil 3D drawing and grab surfaces, alignments, profiles. And it's a bidirectional exchange of that data, right? OK, so Bob, because you were the first gentleman in the class here and I was able to ask you some questions-- where are you, there you are-- I have an InfraWorks 360 T-shirt for you. Hopefully that you haven't gotten one already.

**AUDIENCE:** Thank you.

**ANGEL  
ESPINOZA:** My pleasure. OK, so quick quiz, time for a quiz. How many square miles will the model builder allow me to import?

**AUDIENCE:** 77.

**ANGEL** OK, I heard it back there first. OK, 77 square miles. OK, teacher time.

**ESPINOZA:**

**AUDIENCE:** [INAUDIBLE]

**ANGEL** I heard that one. Was there another?

**ESPINOZA:**

**AUDIENCE:** [INAUDIBLE]

**ANGEL** What's that? So the room monitor, is there another-- I have one more T-shirt.

**ESPINOZA:**

**AUDIENCE:** Thanks.

**ANGEL** My pleasure, thank you. OK, so we've talked then about some of the design capabilities. I  
**ESPINOZA:** have 20 minutes left, just enough time. Still going to want to do some simulations. Still want to go do some more analysis. And yes sir, question?

**AUDIENCE:** [INAUDIBLE]

**ANGEL** In that direction, as a matter of fact-- the question was, will it recognize updates to the Civil  
**ESPINOZA:** model in the Civil 3D drawing? OK, so in one direction it absolutely does. If I go to the data panel, and as I pick any of these data sources-- so irrespective of what it is-- I have the ability to refresh, and that's that little refresh icon. So if your data source is a Civil 3D drawing, and you change an alignment or you regrade the surface, it will-- you just have to hit refresh, and it will bring in the latest greatest version.

The direction in the Civil 3D is a pull, so it'll only grab that information at that moment in time. So there the option is delete the object, re-pull. Questions back there?

**AUDIENCE:** [INAUDIBLE]

**ANGEL** Yeah, absolutely, in the handout and in the help system, there is reference to Alt Tab. Where's  
**ESPINOZA:** my hand out word document here. I'll jump back down to the bottom. And right here-- page width-- it talks about what type of consumer that you add to the group, what are they capable of doing? So for that project manager, you want him just to be a reader, right, and just view the model, not be able to touch it. Some people will have edit control, authors, publishers, and then there's the administrators of the entire group. Yes, sir.

**AUDIENCE:** Could you pull [INAUDIBLE] of your structure, and can you set the default--

**ANGEL**  
**ESPINOZA:** Yeah, there's a library inside of Civil 3D, a setting that controls the-- similar to SSA, right, to control which one's which. And if it doesn't, it just supplies a default. But we saw, I can just drag and drop something else onto it and easily change it. Or in the case of those, it's actually just a right click or drop it off the palette where you can technically swap to another object. Yes, sir?

**AUDIENCE:** [INAUDIBLE]

**ANGEL**  
**ESPINOZA:** Super elevation, OK, good question. OK, so one of the things that's possible for roads, and this is before we get into-- so we're talking about bridge design. We did the bridge design. We did the roads. I'm about to get into drainage, but let's go back over here.

And I have here the distinction between the design roads and component roads. So I can take a planning road turn it into a design road. I can take a design road and turn it into a component road. Component roads are not controlled by-- let's come over here. I'll find an area to design a component road. Component roads are not controlled by the styles in the style palette.

So here's the style palette. Down here are the roads. These are-- planning roads and design roads can be controlled by this, and generally their appearance. If I choose to design a component road, it's a little bit different and it uses this collection.

And these are-- think of them like a subassemblies in AutoCAD Civil 3D, right? So there are full blown subassemblies of roads, four lane, undivided highway. I can specify this. It is a 60 mile per hour, so let's make that as flat a radius component road, here, here. You can see, at 60 miles an hour, it's got to be pretty flat to get to that ultimately.

But if I choose, I'm going to right click on this, and gosh I can't see the-- there's my super elevation zones. Right click, I've got to look up here. Show a cross-section view. And this is only possible with the component road, so it's giving me yet another level of control on this. And you can see that as I slide through, the super elevation is going from a typical crown section through my rollover into full super and back out the other end into my typical crown back at the other end, right?

So component roads would allow you to do that. Now the last thing about component roads

that are possible is that, if I turn that off, if I turn off my super elevation views, I can right click here and say that, depending upon what I'm selecting, I have this lane. And everything about that lane, I have control-- the width of that lane only, the slope of that lane only, right?

If I want curb on the outside, I can right click here and say, let's try that again. Right click here, there we go. I want to-- gosh, I can't read that resolution-- Insert Rode Component.

And then I can specify where do I want that road component. Interior to a lane, do I want to have an interior median in here? Do I want to have curb and gutter on the outside? And then what is it? Curb on the outside from to where? From the beginning only to a certain point maybe, from there to there.

And once I'm done, we will see that I only have curb, rolled curb, in-- no, regular curb-- just in that zone. So this is the nth degree of control over that road, including super elevations. Thank you for asking the question.

I'm going to give you one other thing. I don't-- I know this is not solid gold. It's a little key chain someone manufactured of the icon for-- thank you for asking that very important question. Would have missed it. As part of the session, I didn't intend to miss that.

OK, now some of the things that are possible above and beyond that are the analytical capabilities. So I mentioned that the squares allow me to do certain types of analysis, and we'd already done terrain theming. When it comes to road, there's also what's called traffic simulation. So let me come back over here, and wherever I have design roads-- and these are design roads here-- I have the ability to do a traffic simulation.

Now, what I'm going to do here-- there's already one present, and just for the sake of speed, I'm not going to recreate it. But basically, you define your boundary. Everywhere that that boundary crosses a design road, you will have an input for cars. So right here is zone one. Right over there is zone six. Right over here is zone five, et cetera, zone four, and zone three. That means cars can enter.

Now there is what's called a traffic analyst panel. And within that traffic analyst panel, I have the ability to control how many cars. Is it light traffic? Is it super heavy traffic?

Is that a highway? Is that a rural road? What are the traffic counts for that area? And we can simulate actual existing conditions or actual proposed conditions.

Now once that traffic analyst panel is up there, and I'll point out where it is. It's basically called demands. Demands, that brings up the table that tells me how many cars per hour in which direction.

And if I pick on a direction, it shows me-- move that over here-- in that direction versus in this direction, coming in here and going out there, right? Coming in here and going out there, two cars. And this just evenly distributing to cars for every possible direction. But you have complete control over that, right?

Ultimately, if I save that, we can then run the simulation. I'm going to close that, actually, and hit run the simulation. It does take Cloud Credit sometimes to do that, one cloud credit in this case. It's doing a quick simulation, and then we will be able to play, right in the Infracore environment, that traffic movement. All the traffic that it's allowable per the table that I just specified, or pointed out, that those cars will be visible there, again within the model.

Now, I cannot control nor remove the shading of that zone. So if I wanted to capture a visualization, sometimes I have to get creative with the perspective so I don't see that curtain. Basically it's a curtain around which it's not studying within this environment.

OK, the other person I talked to from SSFM, T-shirt, thank you very much. Thank you for passing it along. Prior to the class, we had a little conversation that was helpful.

OK, I have one more T-shirt, so if someone points something out really good, I have two of those little icon things still to go. OK, so it's doing a quick simulation. It says created, and so forth. I can press play. Play the animation. Where is it?

**AUDIENCE:** [INAUDIBLE]

**ANGEL  
ESPINOZA:** There we are, thank you. Didn't see it. Press play, and now what it's going to do-- and I can speed it up, and it's going 30 times speed. Let's bring this down to one times speed. See where's my cars?

Two times speed, 10 times speed, I don't see any cars here. There we are. Now there's only two cars per hour, right? But we get the point here. And it will simulate these vehicles-- oop, there went one really quickly, right? So we can then simulate the environment.

And if there is a significant change, and we're adding lanes or adding on a new project, a new condominium complex which is going to add hundreds of trips per hour, that can be simulated.

Question here and then there's another question in the back. Yes, sir.

**AUDIENCE:** [INAUDIBLE]

**ANGEL** Potholes, that-- no, that's an interesting idea though. Got my wheels turning. There was a  
**ESPINOZA:** gentleman back here first.

**AUDIENCE:** [INAUDIBLE]

**ANGEL** Pardon me?

**ESPINOZA:**

**AUDIENCE:** [INAUDIBLE]

**ANGEL** The traffic simulation is built into Infracore. It's called simply-- the icon is over there on the  
**ESPINOZA:** left. It's called traffic simulation, right there. And then there's another simulation that's similar. And there's a couple of other questions which, if you can hold those questions for just a moment, I just want to point out.

So here is this-- so this is traffic simulation. Separately, I'm going to close that, untoggle that, brings back my entire model. We have underneath this other icon-- which, what is an icon titled-- review and modify. It instead of traffic simulation, which is also here, just below it is mobility simulation.

And mobility simulation is similar, but when I run mobility simulation, it brings up another interface and loads up that model into the mobility simulation environment. Allows me to do somewhat similar with the traffic counts et cetera, but extends it beyond just vehicles on the road. Here you can simulate people, bicyclists.

You can have public transportation in the form of buses and trains. People will queue. If they're transferring from pedestrian to a bus, they will queue at the bus stops. And it is a very detailed analysis of an environment above and beyond traffic.

Now the difference is it always exists within this environment. There's no way to display those people walking, the bicyclists riding, the public transportation bus, or the people queuing inside of the model, right? It's always here.

The other thing is, technically to launch mobility simulation, I needed to be inside of Infracore launch it, but I have access to any and all models that I've ever created here. I can go back in



and file open and browse to those models irrespective of the fact that I'm in Skywalker Ranch, right? It could be any model from anywhere else, I just needed to be in it to launch it, and then you can run it and produce your reports.

And very simply, I'll just say, come over here and choose-- what am I looking at? It had similar with demands, the demands of the vehicles and so forth. I'm very simply going to press Play, zoom down in here, and expect to see cars zooming by.

Put it in fast forward. There we go. I saw one go across the top. This didn't have any pedestrians. I didn't-- there goes another one, right? But so it takes traffic simulation to a whole other level of including all of these other forms of transportation. Again, inside of InfraWorks, there's no added purchase for either of those capabilities.

Now if I wanted to-- I'm going to close that, close that, come over here to drainage. There is some drainage analysis that I can do. I'm going to create a watershed. Where is it? I've got to turn around, because it literally pixillated my screen of the resolution that it's set at. We'll talk about flood simulation in just a moment.

**AUDIENCE:** Second from the top on the left.

**ANGEL**  
**ESPINOZA:** Thank you, create watershed up near the top. I'm going to create a watershed and it says it's going to use my-- it requires 360 account, may use Cloud Credits. It's seeing all the roads. What I was able to see is that there is these ravines that are contributing here to potential little stream that's coming into maybe the lake.

I blocked it with some roads. So what happens if I were to say, well, what water collects at that point right there? And it says press Enter to do the analysis. So it's now sending this information, preparing the data.

This is the 360 part, right? Some of that stuff gets calculated in the Cloud and happens very quickly. So all I did was I picked that point. I did create some crossing roads. So it is updating the data up into the Cloud, running the analysis in what Jeff Kowalski calls that infinite computing power of the Cloud, and then we'll come back with that watershed analysis really quickly defining both the watershed to that area and any potential streams are these little black lines right through there.

And that watershed, if I were to touch it, it does have properties. So I can say that's no longer-- I'm going to put that in edit mode-- that's no longer user definable. But let's say it's going to

use the regression method for California for which area, northern California.

And the annual waterfall in that area is I think 31 inches maximum annual precipitation, right? Mean annual, yeah mean annual, sorry, 31 inches, which gives me the 10 year storm, the 50 year storm, the 100 year storm, CFS. I can then use these values in other ways.

**AUDIENCE:** How does it know [INAUDIBLE]

**ANGEL**  
**ESPINOZA:** It's using a default mean for land, which you can change, absolutely user definable. So if I were to go back-- so it did calculate the slope, the length of the streams, et cetera. But coverage objects also can be used as-- for the next topic, we're going to talk about the flooding simulation. Things like coverage objects can have the runoff coefficient and et cetera assigned to them as well.

OK, so the last thing I want to do on this part is-- I have five minutes left. I'm going to grab this road. I'm in a right click, Drainage, add culverts. Everywhere that the stream crosses the road, it will design a culvert.

And I may have to ultimately-- so here's a culvert right there. It picks it up there and it's coming out-- where is it coming out? Let me pick on it. I pick on that there. Wow it's way over here. Unfortunately, I went right along the-- right along the road, but there you see the culvert.

And information about that culvert, I can specify a CFS in that culvert, which was-- I forgot what some of those values-- 60 for the 10 year I thought I saw. And then that culvert will, try based on it's-- interesting, I didn't-- it should have resized itself. It came up out of the ground.

You can see the analytics of that. Did I-- oh, did I change-- I changed-- let's change that back. Let's make that a double barrel box culvert, redesign yourself, and you can see now that's a-- did I not change that to two? Nope, double barrel, there we go, box culvert, redesign. And you can see the analysis of that culvert up above, which gives me things like the headwater elevation, tailwater elevation, velocity, so forth all gets calced on the fly based on that. I'm going to want to raise my road or you can certainly decide whether it's going to be culverts or bridges as a part of this process.

Now, when all is said and done, what I'm going to do one last flooding simulation, I want to point that out. So under drainage, we have flood simulation. I have one already present here, and I'm just going to go ahead and run it. So run the simulation.

Again, this is a third party add-on to Infracore. It's the one and only one that I have included that I'm talking about. Created by Hydronia LLC, and it does 2D flood analysis both for inland and coastal flooding. Reinaldo happens to be sitting here with us. He can explain this way, way better than I can.

I know he has tremendous knowledge in this area, and I'm sure I'm not going to state things properly. But what it's going to then do, based on the different types we specify-- and I didn't point that out-- the boundary, an inflow there somewhere down there, and outflow, the type of ultimately the mannings, the roughness, and when we talked about some of the coefficients involved, what's your interval of study. Oh and very important at the top, on the inflow type, what type of information is being fed into it? In this case it's static or constant.

It is doing the calculation. We'll allow that to finish. And after that's done, we're going to be able to-- this should have happened a little bit faster, but unfortunately with the internet connection speed, taking a little bit longer. I have two minutes.

We're going to then create an image and we're going to create a video. Is it possible to create a video in under two minutes? Anybody going to guess? I may have to pause this, and I apologize Reinaldo for not being able to-- oh, it's jumping. And it's clearly the internet connection speed here that it's doing something poorly there. Yes, sir?

**AUDIENCE:** When you changed terrain with the [INAUDIBLE]

**ANGEL** It had to--

**ESPINOZA:**

**AUDIENCE:** --surface is taking into account the [INAUDIBLE]?

**ANGEL** Yes, so--

**ESPINOZA:**

**AUDIENCE:** [INAUDIBLE]

**ANGEL** Yep, so when I changed it, it has to recalculate. So the flooding will come here and say, wait, timeout, there's a road here. And I didn't put a culvert or anything here, no bridge, because it'll go underneath the bridge, but it'll start to spill around some of these roads.

It's absolutely taking the terrain into account. And the water that I've specified based on the

rain event will start here at the inflow and then start to matriculate through the system. Ultimately you will see it pool into Lake Ewok, and then ultimately as it starts to spill out, continue back down through the natural stream that exists there.

OK, I'm going to pause that for just a moment. I'm going to cancel, even though it is so close and I apologize Reinaldo for not allowing enough time for that to complete. 14 seconds, OK we'll allow that. Because you sat closest, and you two gentlemen were next closest.

OK, we're going to create an image and a video. There it goes. So now we press play. It can display this information both on water surface elevation, depth, and velocity. We can also turn on velocity arrows.

It's generating the animation. It's starting to spill water you can see there. It's collecting into Lake Ewok. It's starting to spill over, and you can see where this flooding will occur based on that particular storm event, right?

I did a very poor job of describing this entire process, but you can see the ease and the power that something like this can provide you, right? If I didn't create a bridge-- like this road clearly back there is blocking, I probably want to create a bridge or some sort of way for the water to get through. I don't believe that it recognizes culverts at the moment, but I can artificially created surface through there or simulate a culvert and allow that to happen.

OK, now we have hit the bottom of the hour. How easy-- or how difficult is it to create an image? I'm going to turn off the flooding simulation. Where are we? I'll just close this here. There we go. Create an image.

I'm going to-- oh by the way, I have another that is my vision of how it looks. I'm going to bring up that proposal, because this is a little bit more realistic to what I envision this to look like, which would include things like there's just going to X-wings just sitting randomly around, and Tie-- perhaps Tie fighters or ships. And there's going to be a statue to Darth Vader that C-3PO and R2-D2 are going to be admiring. There's going to be Walkers just randomly placed around.

If I wanted to look-- we already had that view, but somewhere in space there will be the Death Star. You will be able to see it from the tour bus, right? They're going to be filming somewhere in a secret studio. Like I said, there will be tours and tour buses around that you will be able to see, the Han in carbonite, et cetera.

So depending upon what view I ultimately want of the entire site and the entire project, I can very simply come to this display screen and then choose Create Snapshot. The Create Snapshot allows me to specify the resolution. I'll use the viewport resolution.

The type of file or the location of the file, I'll put it on my desktop. And very simply say save that, and that image was created that quickly. So if I were to-- whoops, I launched Outlook. That's definitely not what I want to do.

If I look on my desktop, the last file created was that snapshot, which was just created literally seconds ago. If I wanted to bring in my-- bring out my inner George Lucas and create an animation, I can say I want to animate. Let me come over here and start over here. We'll allow that to start.

So create a storyboard. I'll create a new storyboard that will have this view, this current view, as the very first path, the very first scene. Let's create that way. And then I'm going to fly around at whatever speed I want.

For the sake of not running too much overboard, 300 miles an hour, and I want to then get this view. I create a keyframe which will take me to about-- what's at about-- five seconds. And then maybe I want to come over here to where I'm looking at the-- I did have the Stormtroopers in there having their target practice right on there next to the AT-AT Walker.

I was going to place a barn to show that they couldn't hit the side of a barn, but they're still practicing here. I'll create that. And then say create my animation. So from that perspective flying around to that other view, and then ultimately coming down about 11 seconds of video.

This last icon right down here allows me to export that out to various file formats. I use Windows Media and say record, and that will then be generating in the background. It can be that simple.

You can choose design roads, and it'll drive down the design road at the speed of the design road. You can say I'm to the right or to the left. I'm above the center line by a certain amount. That's certainly all possible. And I will finish off my PowerPoint.

We did the build it yourself, start the model, sketching, you design, dynamic duo. We did the analysis. You can present images and videos. The working together was a collaboration. We answered questions throughout.

So we learned how easy it is to use InfraWorks 360, how easy it is to learn, how easy it is to use, how powerful it is for design, and how it integrates with other products. Certainly then to creation of all of these different types of models for, depending on scale and size, definitely very doable. I will answer questions, and happy to stick around while the next instructor is coming in.

But there's my model of Disneyland, for planning situations, for Giza what it might have looked like 2,000 or 4,000 years ago, what I envision the new Ram stadium to look like in Los Angeles, for heavy rail, for light rail, for sea ports, for airports. It can be used for practically any sort of design. Take your infrastructure data, take your architectural data, start with model builder.

Build it up and do more. So with that, I want to thank you for this morning. Hopefully you found this informational and have a great rest of your stay here at Autodesk University.