



## BEST PRACTICES COURSE – WEEK 12 – PART 4

### Advanced Site Creation: Level Dimensions, Regrading, Cut and Fill Calculations

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Hello. This is Eric Bobrow, and in this lesson we'll take a look at how you can build up a terrain model for this site and building, and do some more advanced manipulation in terms of road work and site improvements and calculate cut and fill measurements. [0:00:20]

So here we see the survey that had been worked on in the previous lesson. I've got the line work that is actually based on the survey measurements, and we have a PDF of the survey that has been brought in. Now let me go to the floor plan, and you can see that when I go to the floor plan here, that I had set up the worksheet as a trace reference. So in order to do that, I simply right click on the worksheet and say, "Show as Trace Reference" here. [0:00:58]

Now, the worksheet is setup in its original location and orientation, and I might want to rotate that. I had demonstrated that briefly in the previous lesson as one of the options. So what I will do is say "Rotate" and zoom in on this and click on one point, click on another point. And by the way, I am snapping not to the PDF but to the line work that had been drawn in this worksheet. You can't snap to a PDF. So I am rotating it around, and you can see the guideline that I'm now snapping it to. So I am making the back end of the property line horizontal. Now I'm going to go and also perhaps move it up, because the building is set in this area, and I'm going to actually move this into position for my elevation marker. So I will just move this into some convenient location here. And you can see now my elevation markers that were preset in the file are in a reasonably good position. [0:02:06]

Now you can always move these elevation markers, and you definitely should fine tune them. But this is one option that you can do is move the survey into a convenient location, and it will remember this in all of the plan references to this worksheet; the location and orientation or rotation of the trace reference will be constant. Okay, so now I'm going to go and start to build up the mesh, but before I do that I'm going to look at the elevation information. Now as I look at this file, I have noticed that the lowest point on the site is, in this area here, you can see that it says "886'". So that would be not quite 300 m, maybe 275 m. [0:02:58]

So 886' above the datum point, which in the United States would be sea level. And in other parts of the world, it might have a different reference. I know in Australia it is called the "Australian Height Datum" or AHD. So whatever that reference is, this survey is giving elevations in relationship to that. So what I need to do is go and set up the sea level or the height datum reference in relationship to my main story

or to the stories that I am working on. Now the other thing that I am going to look at is there is a reference here to the two different stories. It is a two story building, and the two stories are indicated as 895 and 903 in terms of height. [0:03:47]

So what I'll do is first of all, I'm going to rename the stories. I will highlight the story here and change this lower one to "LFE", just to match that for convenience. And I will change the upper one to "FFE". So I'm just using that terminology that is found on this survey. You can of course name it whatever you need to or prefer. [0:04:11]

Now the heights of these, if I look at the story settings, I can set this up. And I've actually already set up the difference. The difference between the 895.90 and the 903.80 is 7.9'. So, that is I guess about two and half meters roughly. So that is the distance here that I have set up. And I am leaving the lower story elevation at zero. So basically, the project zero is the height of the main story. This is one way that you could do it. It used to be that I would recommend that you place this perhaps at 895.90. You would actually modify the elevation. But in recent years, with ArchiCAD having reference heights and reference relationships for level dimensioning set up in a more sophisticated way, it is actually easier just use a project zero as the zero elevation, and then we're going to actually go to the Options, Project Preferences, Levels and Project North. [0:05:26]

And here is where we will set up that the sea level or if it's the Australian Height Datum or some other height preference, you can name it that. This is going to be "-895.90". So basically, this is saying that when I'm referring to the project zero and this height, which is my main floor, the LFE story, that that is going to be in this relationship 895.90' above the height datum called sea level. Now we can use the second height datum if we want, perhaps there is something related to an existing terrain, a nearby building, some grade, street level, anything else you could do. You have a limit of just two external references and that can work. [0:06:16]

Now remember that the project north is set here, and this is the relationship of the actual magnetic north to the way that we are building this particular building. So we want to make sure that that coordinates as well. So at this point, if I go to the Wall tool, just as a quick check, and open up the wall settings, you'll see that the wall settings say that just as normal, it starts at zero relative to the current story, and that is also zero relative to project zero. But if I were to say how high is it above sea level, it would say oh, you're starting at this particular 895.90. So by having set the project level for sea level here, I now can relate building elements either to the story, to the project zero, which would be the main story finished floor level, or I can relate it to the sea level. [0:07:16]

Now, and let's start putting in a mesh or a terrain. So I'll go to the Mesh tool. And as I mentioned earlier, the lowest point is 886. That is the lowest point on this property that I can see. So I'm going to make my mesh settings here. I will make this relative to, let's see if it says project here, if I go to sea level, I will say that the top of it is going to be 885. So basically, I am setting the initial height of the mesh just below the lowest point of the property as far as I can see. And I can give it any thickness. I will leave it as a very thin slab, so that as I build on top of it, it becomes very obvious how I'm adding to

the thickness. This is arbitrary; it's just how thick the base is before you start to raise any of the individual points. [0:08:16]

And I will leave the other settings alone here and start to build this. So I'll zoom out here. And because this is training, and I want to work quickly, I'm going to do this very sort of roughly, but of course you would want to zoom in a little bit more than I am. I'm going to click on the two points here that are the rough boundaries of the road, and go up here. Let's see, I'll zoom in a little bit here. Now, I will talk about the curve. We can make the site boundary curved. In fact, the road does follow a curve. But there are some benefits to doing as a series of straight segments, and I will explain that in a minute. [0:09:04]

So I'm going to take this up say just arbitrarily to about here, and then go across to where I have some height information, and I'll close this up. So I have now created, if I look in 3D and take this in an axonometric view, I've now created just a simple flat slab with a uniform thickness of 3' or about 1 m. Now let's go and start adding in some height information. And I made a very simple outline at first, because I want to basically quickly delineate the prevailing grade. So for example, if I press down on this point and change its height, I will say that it should be 886, and this one up here as well, 886. Now as I zoom in on it, we can see that the high reference is, this is 890. So perhaps I'm actually going to cancel this. I will move this to that end point here, and then set the height to the 890. And if this is 890, and this is 894.6, I think this is about 900. So we will put this at 900. [0:10:45]

Of course you would want to be very careful about this to be precise, but for training purposes I simply want to get the basic idea going. So let me just select it again. If I press down here, this would be 898, and this would be I will say 897. And this here is 888 let's call it, and 887. And now at this point, I believe I have done all of the main points here, and we'll take a look in 3D. And you can see that the prevailing grade is to get higher up in this upper right area, and that is the main place where we have a slope. [0:11:47]

Now you'll notice that we are seeing these lines that are the ridge lines that ArchiCAD is creating to create that shape. We can turn that off or on at any time, but I wanted to leave it on at first to demonstrate something to you. If I take this edge here and I curve it like this, which would match the road, notice how all of a sudden the terrain model, the mesh, has a lot more segments. In other words, it's going to be adding a lot more polygons. Now, this is not a big site, and you probably could do just fine with that, but a nice way to approach this instead to simplify your polygons is - I will just undo that - and I am going to go and just add in individual points. So instead of curving it, I will add in individual points and say, "put this at each one of these points that I have height references". So I'm basically just making a faceted polygon as opposed to a curved edge one. [0:12:54]

Perhaps I will adjust these as I need to here. So now it's following the curve pretty closely. If I look in 3D, one nice thing is that it's not actually putting in any facet lines, so it still looks pretty smoothly curved. Now, what I will need to do is look at the heights of each of these points and change their heights or set them. So 890 for example, 892, 894 and 896. So this will now, if I look in 3D, we will see that when I select this, each one of these points has the proper elevation. [0:13:47]

So that's a good tip in terms of keeping your polygon count down is to avoid curved edges wherever you can. And for example, on this edge, I can just add one or more points to this to follow that curve. Now since we are not really focusing on building a true road, we could just have a handful of points on this side. And they are more than close enough for visualization purposes. So I will just make sure that this height is 886. You can see that it actually was very close to the right height anyway. So it would have been just fine. [0:14:30]

Alright, so now let's build up the internal points, the contour lines. And so I will just start with the 900 one here. And remember that when you want to put interior ones, you need to click inside as opposed to on the edge. If you do it on the edge, you're going to be then creating some additional exterior points. So this contour line stops here in the original, but before the building was built, this would have gone through and the building would have been cut out. But since the building already exists in terms of this survey, the contour line has stopped. I will say, "Add new points", and I will just allow it to fit the user ridges. And then after I have created it, I will press down and change the height, and this should be the 900. And here we will say, "Apply to All". So this will make sure that all of the points in this particular group are at that level. [0:15:34]

And I will go ahead and do the 890 level which is the other main contour line here. So again, I will start inside, [long series of clicks] and I'll just click on as many points as I need. As it doesn't have to be super precise following every little nook and cranny, it just has to follow the general rules so that it will get the prevailing grade outside the building cleanly. When you get close to the building, touching the building, then you want to be as precise as possible so that your grade measurements, in terms of the section, are correct. Now here, I can finish inside the boundary, or I can go out to the end, or I can go further. While we have to start inside, we can end on the endpoint. So I'm going to click on this point and then click one more time to conclude it. And of course, it is creating new ones. And now, I'm going to go in and tell it to be at the 890 level for all of them. [0:16:56]

So now if we look in 3D, we will see the grade. Now one little trick that I have found is that when you're working on this, it's nice to have the terrain grade lines in a color that is not too obtrusive, but when you are first working on it you may want to change it. You may want to actually have this in a color. So for example, if I scroll down here, I might make the uncut line pen a red. And this will make all of the lines here red. So now it's a little bit easier to see as I'm working or moving around on this where those lines are. And you can see, as I zoom in on it, where those levels are being created. So of course, I could go in and make a lot more detail, but for purposes of the training right now, I'm going to stop at that point. [0:17:59]

Now, we are seeing all these extra lines here. Aside from being able to check whether I have built up a lot of polygons, and I was demonstrating that as I made the curve, I normally don't want to see that. So let me go to the Floor Plan and Section option and change the Ridge Selection from Showing All Ridges to just Show User Defined Ridges. And now, you can see that it's a much simpler look. And we are seeing basically just the contour lines and the outline as opposed to all of the triangles that are being created by ArchiCAD. [0:18:35]

Okay, so now I'm going to start talking about doing some level dimensions. So if we go in here and we want to put some dimensions in, this is the 890 level, so we're not relying on the survey, but we actually want to indicate that. We're going to use the Level Dimension tool. Now the Level Dimension tool is like the normal Dimension tool, just an annotation element. However, when we are doing the level dimensions, we have the option of making this gravitate to something. So in other words, I can have the level dimension pay attention to the roof, shell, slab or mesh that it sits on top of. Now if I don't have that clicked, then when I place this dimension here, you can see that it says zero. So it is paying no attention to whatever is below it. [0:19:40]

But I do have this set to pay attention to the mesh, and I click in a similar way, you can see that it says it that it is -5'4". So that is about 1½ m below the zero level of the project. Now that is really not very useful in terms of a number, but it is showing accurately. If I go over to a different location, you can see that it's got a different number. So it is paying attention to where it is. Now it turns out that if I select the number here, I can change this from showing the measured value to custom text. Now, custom text, if it was just literally typing in a value, would be very tedious or really impractical. But what I can do is I can ask for it to say "show me the height to whichever datum point I want". So right now it's up to the project zero. You can see it says "to PZ value". And I'm going to put "to sea level", which is the datum point I care about. [0:20:44]

Now instead of replacing it, it actually has put it in next to it. And we could put in some extra text. So you can see whatever I type in here is showing up there. But really, what I want is just the sea level information, so I will just delete that. And you can see now it's showing that number. Now I can use the eyedropper here, but it turns out that when using the eyedropper, if I try to inject it into this neighboring one, it doesn't work. So the eyedropper unfortunately, while it may change the color or the size of the text, it won't actually give us information that we want for the sea level. So I will show you a way that we can put in a number of these points and then change them all very quickly, as opposed to having to do them one by one like I just did. [0:21:44]

So let me just zoom out here, and I will put in a few points. So I am going to go and put the level dimension. It is still set to be gravitating to the mesh, that is very important. And it is on whatever layer is appropriate. In this case, there is a layer in the standard template for level dimensions. So you want to make sure that of course it is going on the correct one. And I'll just click on a series of points, let's say here, zoom over to these, and maybe do some points at the outside boundaries. Now these items are very small, and the reason is that we are right now set at a scale appropriate to the floor plan, not to a survey. So right now we're in the Project Map looking at this lower floor. If I go into the View Map, we probably want to have a view setup for the site plan. [0:22:50]

Now there may not be something in this particular template already set up. So what I'll do is I will set up my scale. Remember that I had determined that the appropriate scale for this was 1 inch equals 30' or 1:360. So I will set that up. And now, you can see that these dimension markers are showing information at a reasonable size that you can read. Now having done that, I want to also look at what layer combination, here is a layer combination for site plan, let's see. Okay, so the layer combination called site plan does not have the level dimensions turned on. So I'm going to go open the Layer Dialog box

and say the site plan layer combination should have the level dimensions turned on, so I will update it. And perhaps I don't need the markers. I think that the markers were set up for showing - okay, so it's not showing those anymore, so that's fine. [0:23:49]

So now I will go and create a new view. So I'm going to click on the Save Current View, and we will call the name of the view "Site Plan". So I've now got this view, and I can drag it into any position in the list. Let me just put it up in the construction documents but above the floor plans, because it's going to be a unique one. We don't need to have a clone folder, because there's only going to be one site plan rather than one of these types of plans for each story. So if I zoom out and then zoom in just in the area where I've drawn a few of these dimensions here, you can see that they are set up related to project zero. So in other words, this corner is two feet above project zero. This is one foot, this is four feet, etc. With the one exception of the one that I had fixed here. [0:24:50]

So what I'll do to fix this, to make them all show the correct relationship, in his case to sea level, it will select them all. I'll go to the Level Dimension tool, go and say "Select All Level Dims" or I can just do Command+A or CTRL+A. And then, I will select one of the text items separately. Right now you can see that with these dimension elements selected, if I go into the settings, there is no place here that I can actually put in the level information, the relationship. There is no place to edit that text. There's nothing in the Info box that has that information. There's actually no place to do it. But if I Shift+click and select one of the text items, now you can see that it's indicating that I am able to edit the text value. [0:25:50]

And here, I can go ahead and say "Put in custom text" and change the custom text to sea level, and get rid of the extra stuff that is the project zero value, and you can see that instantly all of these values have updated. So let me just undo this. So I'm going to undo back and just show you that again.

I have the Level Dimension tool active. I go to Edit, Select All Level Dims. Shift+click on one of them, and then go and change this to custom text, and I put in, let's just clear this out and put in the sea level one, and you can see how these all come up. So that is how you can set those very quickly to show the right relationship. [0:26:41]

Now when we are doing grading for the site, the most common thing is to use the survey and to create contour lines. But there are going to be sometimes when you want to actually change the height of points in the mesh individually. There are sometimes you will have a survey or grading plan where instead of it being contour lines, you've just got individual points. So what I'll do is I will select the mesh, activate the Mesh tool, and I'm going to click on a point. One point. And instead of starting to draw another point I will click again on it. And you can see that it allows me to just create a new point, and there is a dot there. And I can do this as many times as I want. [0:27:26]

So I've just created two of these and I'll just create one more. So I've now created three individual points. Now these points originally are set up just to match the prevailing grade. In other words, they don't have a height; I can't set the height value while I am creating them. But I can press down on it afterward and change the Z height. And so this is going to be 896, and this one 894. And this one 892. So I can put these individual points in. And if I go to 3D, we will see that they don't show up as contour

lines, but when I select the mesh, you do see each these points indicated. So they are points that could be moved around, up or down or sideways. So in fact, if I take this point and I change its Z height, I could make this a little hill so to speak. Let me take it really high and we will see what it's doing. [0:28:37]

So at this point I have made that be sort of like a peak of a mountain. So let me just undo the two changes, and now it's back at the original height. So you can do that as part of your original building of the mesh, or you can do it as part of regrading. And let's take a look at regrading of the terrain, and see how that can be done with getting cut and fill measurements at the same time. So in order to get cut and fill measurements, we need to have a base. In other words, how much earth is there in the original contour, the original grades? So if I go to the Window menu and open up under the Palettes, there is a palette called Element Information. When I open up Element Information, it tells me about either everything that is selected or just the last element that was selected. [0:29:41]

Right now it says there is one mesh. If I click on these points here, and I will just resize this so we have more space, you can see it talks about the circumference or the perimeter here or it adds the area. So as I click on each one of these, it will give me more and more information. Now actually, I don't need to look at all of the information. I can turn off some of the intermediate ones. And the only one I really care about for this is the volume. And you can see the volume indicated is 559,000 cubic feet. And it goes down to multiple decimal points. But it's 559,197 right now. [0:30:27]

Now what happens if I were to change this? Let me just go and take that point again, and I will take this and change its height. And I'm going to make it much taller. And you can see that it changed instantly to say 600,8000. So let me undo it and take a look at that. And you can see now it says 559. So basically, as I change this, I can get feedback on it. So, one a simple way that you could do cut and fill or at least some type of measurements is to make some changes to the grade, maybe make it where you would have to add some earth, and then just look at the volume. And of course you could make some separate changes where you reduce the earth down, and then you could see the volume and measure that and just make a note of it. So that would be one manual way. [0:31:27]

But often, a change to regarding will affect both cut and fill. You will be doing a bunch of stuff and some things will need to be refilled, and some will need to be cut. So how do you handle that? It turns out there is a very elegant way that you can do it using Solid Element Operations. So to do this, what I would start with is I would create a copy of this mesh. So in other words, this mesh here, I am going to go and I will just do it on the floor plan where it is a little easier to see what I'm doing. I will say I'm going to drag a copy of it. Now when I drag a copy of the mesh, of course I can move it into a new position. But if I move it exactly on top of itself, now I have two of them. [0:32:12]

Now this new one, I'm going to put on a different layer. Now, I could use an existing layer, but I'm going to actually create a new layer. So I will just create a new layer here that will be called "L-Site.new". Now, you can see that the prefix here is the same as the one up above, but I now have an extension. So the extension is a part of the layer name that is optional. You can see in the standard template that Graphisoft supplies in the U.S., there are no extensions. But you can put in extensions like new, old,



existing, etc. or 2D, 3D, or any type of the attribute that you like. You sometimes might want to identify layers that are coming in from a consultant with an extension. There are various ideas that you use for the extension. [0:33:07]

But for now, I will just designate that really it's the same information. It's the site, but it's a new version of it. And sometimes of course I will show one, and sometimes I will show the other. So what I'm going to do now is just change the one that I've got selected to that new layer, and you can see that I can select that new layer here. And then I will go to the Layer Dialog and I will hide the original one. So now I will only have one mesh there. So let's go and I will just collapse this element information down a bit, because all we need is the volume. And I will turn off the Trace and Reference palette and I'll move this over. [0:33:53]

So suppose that we were regarding this so that it had, let's say this contour, the 900 foot contour was pulled out a bit so there was more level space. In other words, I am going to have it come up higher, further away from the building. So I will cancel this and I will move this point over. So this is a very crude example of basically adding more earth out in this area and therefore having a flatter perhaps boundary where the house is. So let me go to 3D, and we will see the difference. And this contour line has come out much further and there is going to be more earth in here. So if I select this here in 3D you can see 577. So it has gone up from 559 to 577. [0:35:02]

So we can make a note of that obviously, and I already have some useful information. But here is how you can get a more precise value. And regardless of what changes you've made, it's using Solid Element Operations. So I am going to go to the layer settings and turn on the original site layer. And you can see that the red line for the contour of the other site, the original site, is in its original position. Now, I will go ahead and open up the Design menu Solid Element Operations. It's either under the Connect sub menu or in versions before ArchiCAD 15 it's just under the main Design menu. And the Solid Element Operation, I'm just going to experiment with this. I will make this new mesh the target, and then I will select the existing mesh here as the operator. And I'm going to do subtraction. [0:36:11]

And when I do subtraction, we see a subtle change here. What happens is the new message here is only the 18,000, only the difference. Now, it's a little hard to tell but what I'm going to do is actually go and change the material on the new mesh, so that the top material is something else. We'll just give it a color. And now this new mesh - that is interesting, color is showing on all of that. We should just have a volume. Let me go and hide the other layer, and see if ArchiCAD updates the visual effect. So I'm going to hide the layer for the site and you can see, yes. So there was a little bit of a visual artifact. In other words, it wasn't showing correctly. Here is the new mesh which has been cut back by wherever the existing terrain was. So in other words all I am seeing is the positive difference between them. [0:37:26]

So this is of course correctly showing 18,000 cubic feet was added in terms of earth. Now I am going to go and use the option to turn off the Solid Element Operation relationship. We can do that in ArchiCAD 15 by clicking the little X here or very specifically if there were multiple operations, we can click the X there. If you are in earlier versions of ArchiCAD, you can select this and you will see that you can cancel



the operations of the selected element, which is a target on all operators. So in other words, basically forget about it being operated on by anything else, and that would do the same thing. You can see that now it's up to the 577. [0:38:14]

Now one of the things, we can do this subtraction anytime we want to get a report, but we won't be able to retain it in terms of data without making a copy. So one option that you might consider is creating a copy every so often or whenever you need this of the new terrain, and then subtracting the existing terrain from the copy. So now the copy is just used to get the data for the new, for in this case the fill. Whereas the actual new terrain of course you leave undisturbed in terms of being able to visualize and work with it. [0:38:59]

Now let's look at how we can do cut. It's going to be very much the same sort of thing. So I will go and let's say that I wanted to cut out an area. So if there is a building here, let me go back to the floor plan. Now in this case, the building already exists. But let's just imagine that we're going to be putting in the building, and it's going to have a hole in the ground down to a certain depth, and maybe that some of the earth is going to be excavated, and that earth we're going to be moving around on the site. So how much are we excavating out? So I will go ahead and create a slab, and I will go with the Slab tool and I will just outline this roughly. It says, this layer is hidden; do I want to show the layer for floors or choose the layer? I will just choose the layer, because really in this case it might be more appropriate to put this on a site layer. [0:40:06]

This could be done either way. Let me just put into the site layer for convenience now for the site new layer here. And this slab, I will just very quickly click these points. And for training purposes, I will take a few shortcuts. But this particular slab I'm going to set what height it is going to be. Let me open up the dialog box. And so in relationship to the current story, let's just make it 10 feet thick. So it is going to be an extra thick slab that is going to be cutting itself out. In relationship to sea level, it's at 895, so it will go down to 885 approximately here. So let's go into 3D and take a look. And I don't see the slab at all. [0:41:09]

But if I say select all slabs, you will see that it is buried inside here. So what I'm going to do now is I will go ahead and, with the Solid Element Operations, make it the operator and then select the new terrain and make it the target. And I will go ahead and say subtraction with upward extrusion. So that will cut out the slab wherever it is in the earth and everything above it. And I'll execute. And you can see now the slab is visible and there has been a hole cut out for it. So of course, when I select the terrain, it says now is down to 560. So remember, it was at 559 when we started. So actually by cut and fill are going to be very similar, which is good. You want to ideally manage that to have a minimum of earth that you need to bring in or take away from the site. [0:42:09]

But let's just see what the cut relationship would be. So in order to do that, I'll turn back on the site layer here. And let me just make sure the - oh, I see what happened is that I changed the material for both of them at the same time. Let me change the one that is on the site back to the green. I will just give it a green color here. There we go. Alright, so we are seeing the two terrain models competing with each other or overlapping each other. That is fine. I am going to now go and say let's select the

existing terrain, and let's make it the target. And then we're going to select the new terrain and make it the operator. And we will make a simple subtraction, just like we did before. And this will give us, when we do it, I will execute. [0:43:13]

Now, we can see the part that I'm selecting is the existing site with the other stuff reduced, and it says that we took out 16,000 cubic feet. So that is actually what it was reduced by. Now to be able to visualize that better and understand it better, I can turn off all the other layers. So I actually would have found it more useful for layer manipulation to use the Quick Layers palette which I have talked about in other parts of the course. And in the Quick Layers palette I might say hide all the other layers, and now you can see this is what was reduced. This is not a slab, this is, if I spin around it, you can see this is the terrain. This is a piece of mesh that if I select it, you can see a bunch of dots outside of it, but this is just what is left. This is basically what has been cut out. [0:44:13]

So essentially, to get a cut measurement, you take the existing terrain as the target, you take the new terrain as the operator and you subtract. And that basically says what you had to get rid of to do the cut. And the fill, which I had done earlier, you to the inverse, you take the new terrain as the target, the existing as the operator and you subtract, and then you see what you have to add. So that is that fill. And if you want to retain these for perhaps putting into an interactive schedule or just for reference, you would want to make copies of the existing and the new terrain and do the subtraction on those. In this case, I'm just doing it as a temporary check here, and I can either undo or remember I can use the option here to say turn off the Solid Element Operation. [0:45:15]

You can see how that now has restored the original terrain to its original contour lines. So that ends the lesson that we have on creating a terrain model and doing regarding; looking at cut and fill calculations. In the next and final lesson of this module of the course we will look at some of the ways that you can handle roadwork. So this has been Eric Bobrow, I look forward to getting your comments and questions on the page down below, thanks for watching. [END OF AUDIO, 0:44:33]