THE Best Practices™ COURSE Training Lesson TRANSCRIPT

Helping ArchiCAD users get the most out of their software

BEST PRACTICES COURSE – WEEK 12 – PART 5
Advanced Site Creation: Working with Roads, Paths and Paved Areas

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Hello, this is Eric Bobrow. In this lesson, we will continue from the previous one and look at advanced modeling techniques for doing site work: regrading and modifications for improvements such as roads, paths, and paved areas.

Now, in the previous lesson we used regrading, we actually modified the terrain mesh, and then did some cut and fill calculations using Solid Element Operations. Now we can use Solid Element Operations for other things, including making road work and paths really quick and easy to accomplish. And one of the advantages of this approach is that you don't have to modify the terrain mesh. You are leaving the data intact in case you want to move things around afterward; the data is still there. [0:00:50]

So let's see how this works. We will start out by creating some new layers just for this training exercise. You will notice that in the Layer Dialog box that I have a layer for the site, and I have another layer that I had created previously for a new version of the site. Now I am going to create additional ones. Now these might not be what you would use for a real project, but for training purposes I am going to create a number of them to make it quick to show and hide different things. [0:01:22]

So I am going to create one for roads, and then create another one, and I have just copied the first part of the name so I can paste it in and create a path, and then another one for paved areas. And so I can very quickly create these undercut, complex lines and fills. Okay, so now that I have created those extra layers, I am going to set the Slab tool, which I am going to use to delineate the boundary of the road, I am going to set it to use the layer that I have created for that purpose, the site road layer. Now, it's going to have a material, I will just set this material up for something contrasting. Perhaps we'll use the one that is called "Asphalt Dark", so it will be a dark road paving. And let's look at the height of it. [0:02:34]

I need to set this to be above the uppermost point of the site, so I will set it to 905' above sea level, and I will make it thick enough, say that it goes through the entire terrain mesh. At this point, I can just start drawing it. The Slab tool has a uniform thickness, so it won't follow the grade, but I will be able to very quickly tell it to follow the grade using Solid Element Operations. So I am going to click a series of points matching, finding where the checkmarks are, or the black handle. So I am actually going to match the points that are in this mesh. You can see how I can do that, even when I am zoomed out, but let's zoom in a little bit, so I can see where the road extends. [0:03:32]

And I will take this down to here. Now I could do a curve directly while I am working using this pet palette here to switch between straight segments and curved ones, but I find it actually a little bit easier to just do it after the fact. So let me go up here and we'll close this up. So now if I go to 3D, we are going to see that I've got a slab that sticks up above the terrain mesh. And I am going to use a trick to modify this so that it actually is forced to stay within the boundaries of the mesh. So I will use the Design menu, Solid Element Operations. So in ArchiCAD 15, it is under the Connect submenu, solid element operations. In ArchiCAD 14 and earlier, it's directly under the Design menu. [0:04:38]

And I am going to go and select this slab and tell it that it should be the target or be modified. And then I will select the terrain and I will make it the operator. And the first action I will do will be "Intersection", which is something that we don't do a whole lot of, but for this purpose it is exactly what we need. I will execute it, and you will see that the slab has all of the sudden been reduced to the area only where it intersects within the terrain mesh. And I will go and select the slab again, or actually let's make sure that I select it here. Sometimes it's a little hard to select in 3D, you have to find one of the points that ArchiCAD recognizes. [0:05:21]

I will make it the operator so it's going to control the action again, and then tell the terrain mesh that it is going to be modified, that it is going to be the target, because they are right now sharing the same space, and I would like to subtract out the area that the occupy together so that the road work is visible. So now you can see how beautifully clean this renders in 3D. Now I will actually go and curve it here, and we will see in 3d how that curvature just instantly updates. So I will go and use the pet palette to curve this, and we'll take it around within some approximation for training purposes. We could get a little more detailed, but I'm going to go back to 3D, we're going to see how beautifully this updates. [0:06:15]

Now I will go ahead and add some paved area behind the building that illustrates a slightly different mechanism for doing it. So when I zoom in on this area, you can see that there is a two story building here, and there's an area behind it. I'm going to, for my purposes, and make it paved. So I will go to the poly line tool, and I will actually draw in the lines. Now I need to put it onto the layer that I need, so I'm going to put it onto the line layer that I created. And this is just one option for doing it. I'm actually drawing the lines ahead of time. And I'm simplifying, I'm not going to follow the exact detail, complex outline. [0:07:08]

But this is now, if I select it, you can see just a series of lines. And, now I can go to the slab tool and use the magic wand and go over a corner for example and click. And it's now created a slab, you can see in this area. And we'll put the slab on the layer that I've got for paved segments. And now let's go to 3D, and again we'll see that this paved area sits up above, so I need to make it the target, make the terrain mesh the operator, and do intersection, and that cuts it down. And then I will need to select the slab and make it the operator, and the terrain as the target, and do subtraction. And you can see how it now fits in very nicely. [0:08:07]

So let's go to the floor plan and we'll put in a path. So we're going to put in a path between the road and the building. And just to illustrate a slightly different approach, I will use the Spline tool. So I will

draw a spline here from the road, and we'll cover it around and tell it meets the corner there. And then I'll draw another piece that's going to curve and meet the building in its corner. So this delineates the boundaries here, but I need to go in and to create some lines that will go from the paved area down along the face of the building here, and along where the road is. And now I've created a closed boundary, and I can go again and use the Slab tool, perhaps setting it to the layer that I have for the path. [0:09:12]

And I will use the Magic Wand within this. So when I click there, it actually finds the boundary, and it's now approximated this spline with a series of arc segments that are the boundary of the slab. And again in 3D - it's often easiest to in 3D, although you can do it in 2D - I will select the slab, make it the target, and go through this process one more time. So do the intersection and then make the slab the operator, the terrain the target, and do the subtraction. So I've now created pretty easily a representation of the road work, the terrain, and some site improvements with a paved area and a path. [0:10:25]

Now what are some of the limitations here? Well, one of them has to do with the section that you would see when you cut through it. So let's just cut through a section here. So I will draw a section here through this area. And I will select the section and say, "Open it". And when I cut through that, we're going to see the grade is moving as it should, smoothly through this area. We can see the paved section receded, going up to the face of the building beyond it. But there is a problem in that it really shouldn't be that thick, it shouldn't go all the way down. [0:11:14]

Now I can go and change the thickness of this, either using the dialog box or the pet palette to make it thin. Perhaps as thin as it needs to be carried and you can see that because it's a Solid Element Operation, the terrain fills right underneath it, which is beautiful. But when I go to 3D, we will see a little problem, and that is because the grade dropped so much, the slab now is not sticking down into the grade properly. So let me go and undo that, and go and split this slab into two pieces. So what I'll do is, with the slab selected, I will go and use the Split option here, this hatchet icon, and perhaps just split it across here. [0:12:10]

And now, if I go do this, let's just take a look in 3D and see that what we've got. Okay, we have a little problem here, and that is that after I split it, this piece needs to be trimmed to the terrain. So again, we will make it the target, and repeat the operation. So if we had done is at the beginning, or thought about it, then we could have done it all in one go. And we might need more than two pieces to get this effect. So finishing up the basic setup. [0:12:57]

So what we can do now is in that section, go and change the height of this piece, which now is independent of the other piece in terms of its depth. And we can go and make it thin here, and then look in 3D, and it all should be well. You can see just barely the underlay showing that. But if we cut a section through it the other way, we're going to see there's still a serious limitation with this approach. If I go and cut a section like this, that each of these is stepped. And of course I could go and make this one not quite so deep. So I can create a series of steps. And I could create as many of these as I need. [0:14:12]

But that may be good for certain applications, but I think that sometimes you'll want to have a uniform depth for the path. For example, if you're putting in brick pavers and sand and gravel underneath, you might want to have it a uniform depth as it changes grade. So how would you do that? Well, the simplest thing to do is to take the actual terrain mesh, this element here, and make a copy of it that is down the specific distance. And then use it to carve out those slabs on the underside. So instead of intersecting to get the top to the right height, we'll use a subtraction operation to take the undersides. So let's see how we do that. [0:14:57]

So I will go back to 3D where we can do this very quickly. And I will go and select the terrain mesh. And then I'm going to go and make a new copy of it. So I'll drag a copy. And when I do this, I'll click twice in the same location, so that it's actually exactly in the same place. Now you notice that this copy is sticking through the road work, etc. It hasn't been affected, or it didn't retain the relationship with the Solid Element Operations, but we don't really have to worry about that right now, because I'm only going to use it as a cutting tool. [0:15:38]

What I'll do is I'll put it onto the layer that I've set up for this purpose for undercut. So I'm going to cut underneath things, and then go in and change its height. Let's just take this down a couple of feet. It normally wouldn't be as much of a difference as that, but let's just say to make it clear in our video that it's two feet down. Now having done that, we're going to see that it now sits, as I zoom into this corner, it now sits 2' below the grade. You can see the grade for the road and this element that I've got selected is down below that. [0:16:20]

And what I'll do now is go perhaps in the section. And this is quite nice to know that you can do Solid Element Operations in a section. We're going to see that the new element appears there. And I will go and select the two slabs here. I have to be careful that I'm actually selecting the slab each time. So now I've selected the two slabs as targets, and then I'll select the lower terrain mesh as an operator, and I'll use subtraction and execute. And you will see that now this slab, when I hover over it, we'll see it more cleanly, it has a uniform thickness. [0:17:11]

Now, we're not getting a clean result with these extra lines. Why? Because the main terrain mesh that was put in was carved out or was subtracted in a different order. So in other words, the slab was used to cut it before the slab lost its underside. So what we need to do is actually do it in a different order to get the desired result in this case. So let's go to 3D, and I'll just undo for the slabs. I'll take these two slabs and start over with their relationship to everything else. And so having selected them, I will go to the Maintain Operations here, and cancel their effects on all targets. So that means it will forget that they're affecting other ones. So in other words, it's not subtracting out anymore. [0:18:17]

So if we go back to that window for the section, having done that, we will see that the terrain mesh now is sitting in this area. Now we actually might want to also take the - let me just go back to 3D. We might want to actually make sure that we're starting fresh with these slabs. So I will go and select the two slabs and also remove their effect on all operators. So they're going to be back as if they haven't been modified at all. Now having done that, we can do it in the proper sequence to get the result. So I will

select these two slabs and I'm going to make them the target. But in this case, I'm going to start with the lower terrain mesh. [0:19:19]

So I am going to select the terrain mesh that is lower. If you look closely, you can see that it is below that. You can also see that the layer is the undercut layer. So I've got the correct one, and I'm going to do the subtraction of this first. Actually, I didn't tell it to be the operator, so that was my mistake there. So I need to select the slabs, make them the target, and then I'm going to go and select this mesh that is in the undercut layer and make it the operator, and then subtract. And that will cut off the bottom of these paved elements. And then I can actually tell them after that to intersect with the normal terrain mesh. [0:20:13]

So I can follow the process from here on the way I usually would. I will make them the target; select the normal terrain which is on top of the other one, so it is easily selectable. I will make it the operator, and I'll do the intersection. Remember, this is how we start all the time. And then I'll go and do the other operation. And you have to be careful what you're selecting. I've got now the two slabs as the operator, and then we can select this terrain mesh as the target and do the subtraction. And in this case, they will only subtract out the thickness that they had that was left after the initial subtraction. So I will go and select that undercut element and tell it to hide that layer. So that now disappears. [0:21:20]

Whoops, I think I had the other mesh selected as well. So let me go and just select the undercut layer. So I've only got the one element selected, and I will hide it. And now you can see we have a very beautiful result in 3D. And when I go to the section, we have - let's just see if we can rebuild this. Oh, I know. This slab, I need to have it a little thicker. Basically, I had cut it too short. So I need to just stretch this down. And when I stretch it down, I can stretch it any arbitrary amount, because it's going to be limited by the undercut. So I just have to have it low enough so that it to reach beyond the undercut. [0:22:20]

So you can see what a beautiful section we can get for this. And of course, this could have a fill; it could have gravel or whatever type of graphic result you want. So that is a more sophisticated process than we had done before. We were actually using a copy of the terrain mesh that is offset down some distance, and then that is being used to cut the bottom off of the slabs before you then follow the normal process of intersecting and then subtracting to make them fit the prevailing grade. [0:22:54]

So let's proceed on to another option that you might find useful, which is to actually create multiple mesh pieces. Instead of one mesh piece that has different slabs to create appearance of color, sometimes we want to be able to regrade. In other words, we want the road to stand up above the grade or perhaps the paved area to have its own independent grading for drainage purposes. And so we don't want it to follow the original grade. So how would we do that? Well, what I'm going to do is select this terrain mesh here and I'm going to make a couple of copies of it. [0:23:34]

Because what I would like to do is create - one of those copies will become the earth area, the site area, and the other will become the road, and there will be two separate pieces rather than one virtual piece that is the slab and one site model that has been removed with the Solid Element Operations for the

road. So it will become clearer when I do this in a minute. I will go and use, instead of during one copy, I will multiply say two copies here. And I will go and just click twice in the same location. So now these are two new copies that will appear in that location here. [0:24:25]

So the new copies I'm going to put here on the layer for complex site work. And I will go ahead and hide the layer for the site model itself, the original one that I had. So we will scroll down here and hide the original site layer so that we only have the two new copies. And it's going to look like a little bit of a mess because the Solid Element Operations haven't been retained. So let's just go for now and hide the layers for the paved and the path. So what I want to do is actually take one of these terrain pieces and remove the area that is actually enclosed by the road slab. So I'm actually, instead of using Solid Element Operations, I'm going to use Boolean subtraction. And let's do this on the plan where we might be able to see a little bit more clearly. [0:25:38]

And to make it clear, I'm just going to actually turn off the Trace and Reference. And I will even turn off the layer for the section markers. So now it's going to be a lot easier to see what's going on. So I'll go and select one of the terrain meshes that I've just recently created, and I will press down on it and use the Boolean subtraction option. And the Boolean subtraction option, I can remove space from it. Now if you haven't worked with this, basically you can click anywhere inside or outside and click, create a series of points like this, and close it at the end. And when I do this, what will happen is everywhere where this shape overlaps will be notched out. So it actually just simply cut that out. [0:26:32]

And I will undo this, because that was just for demonstration. So I will again do this with the minus, the Boolean subtraction. But now I'm going to tell it to trace this slab. So you can see the road slab. I will just use the magic wand and tell it to trace that. And you can see that it removed everywhere where the road was. So now, we have a separate piece of mesh that does not have any of the road work. This is destructive modification. So you can't recover it. Although of course, I have a copy of the original one in case I need it. [0:27:07]

Now, I still actually have, if I press down here and I tab, you will see that there is still another copy. That's why I made two of them, because I want this one to actually be reduced to give me the space of only the road work. So what I will do is again tell it to subtract, and then with the magic wand, I'll go and trace this other mesh that is right here. And you can see that when I magic wanded the other mesh, now I have one mesh here one mesh there. And when I go to 3D, we won't see a whole lot of difference, but let's now make it visually clear. I'm going to go to the Layer Dialog and I'm going to hide the layer for the road, the road that I had created with the slab. [0:28:04]

And now you can see that it’s a little bit clearer, and I will take this mesh that is the road one here and I will give it different materials. So I will put its top material in that asphalt color. So now why would we want to go through that extra step? Because now we can actually modify these things independently of each other. So let's just zoom in around a place where we can see their intersection. Perhaps if I zoom in on it, what if I were to take this road and change its height overall? I could go into the settings, and in the Settings Dialog, I could make it just a little taller. Let's say that I make it 2' taller. [0:28:51]

So now that is actually a rather dramatic change, but you can see instantly that it is floating up above. So I actually have total independent controls over it. Now on the other hand, I could make it more subtle. I could undo that and simply go to a point and use the Z Height option and take it up. And if I use the Tracker, oh here's the elevation thing, it was floating far there. And let's say make it 2', so that is going to raise this up 2' here. And you can see that I can go to individual points and raise that up. So I can so go and regrade these things any way that I need. So it could go above the prevailing grade, or it could go below the prevailing grade. [0:29:43]

And sometimes the road needs to go independent of the property. So I can take this down and so you can see if I zoom in on this, I have now actually independently modified the grade in these different places. So by having two different terrain pieces, I can do that. Now, the same thing, we might want to have that happen with the paved area. So the paved area might need to be graded for drainage purposes. So let's go back in here and take this piece of terrain here. And in order to do this, I'm going to actually create two more copies and this mesh. Actually, I will just create one more that I will use for this. [0:30:34]

So I will go and create here, drag a copy, and I will just leave it on top or just put it exactly in place. So now I have two copies there. And for one of them, I am going to go to the Boolean subtraction here. I will cancel the mesh point height and saying that I want to use the Boolean subtraction here. And then I will use the magic wand and trace the - now I am holding down the space bar, so it should be doing the magic wand. It's not showing me the cursor, but it did do the trace. So even though you couldn't see the magic wand, it was doing that. [0:31:13]

So this particular piece of terrain has now been carved out to create a void. But the other one that I've got, I need to now actually carve back to it. So in other words, if I hover over this, you will see that there is another terrain mesh, because I made two copies, that is fitting around the whole outside. And so what I need to do here is find a way to carve it back to that. So I could go and use the Boolean subtraction manually. And so for example, I can just click on a series of points here like this, and perhaps I'll just go out. Remember, I can go beyond it without a problem. [0:31:58]

And you can see how it's now removed that. And I can go very easily and do this repeatedly until I have the shape that I want. What I've found generally is that you will want to do this in as few operations as you're able to, because the mesh may get approximated in a different way each time when you are carving it. So if possible, I would just take this down in just a couple of steps. Now here you can see I've got the remaining piece, and I will go and give it a color so that we can see it here. Perhaps we'll give it a concrete look, and we'll take a look in 3D. [0:32:52]

And you can see how this is working here. So this is working beautifully with this. Now just like the road work, I have the option of regrading it. In fact, you can see that approximation that I was referring to; it's not a perfect thing. Of course if I wanted to, and I zoomed in on this, I could regrade this point and use the Z Height option and I could take it up to where it snaps to that. So you might have to do some adjustments, but of course sometimes you may want to actually work on drainage and say that this has

to be higher than that. And perhaps in this area here, we might take it lower. And I'll just exaggerate that just so we can see the effect. [0:33:50]

So by doing what I did of creating two copies, I can actually grade them independently and get whatever effect I want. Now if you want to put in retaining walls and other things, then you'll need to do some additional work to put in more elements. But this is probably the trickiest part is just getting the terrain mesh worked out so that it actually give you the control you need for drainage and things like that. So that I think is a really good explanation of the option of creating extra pieces of mesh, which you can create from scratch or making duplicates of the original elements and carving them up. [0:34:42]

I am going to show you one final trick which allows you to do road work in a much more detailed appearance. It works beautifully in relatively flat areas, say urban areas where the street diameter or the cross-section of the street is constant. To show you that, I'll switch over to a copy of MasterTemplate. Now you can create this on your own, but in MasterTemplate, when we're in the Wall tool, we have some interesting profiles, one of which we'll be using right now. So if I go to a profile wall right now, and I select it, you can see there are some interesting ones for rafter tails. There are some interesting ones for footings, there are some interesting ones for complex shapes, where it has notches for the slab to fit in. but the one I'm going to pick is called "28 Feet Row" or a right-of-way. [0:35:44]

And this is actually 28' across, so that's about 9 m. And when I draw with this, and I will just draw a little piece here, you'll see that it creates this very chunky thing. It's not like a normal wall. When I go to 3D, we're going to see that it has created, and I'll just zoom in on it, a profile that has a centerline here that we can draw it with. And as a roadbed, it's got a raised centerline and drainage going out to the sides, and even different materials to indicate that the curb is paved and looks different than the road. [0:36:26]

So this is something that we can use with the Wall tool to go straight or curved. And we can also use it with the Beam tool to go angled on an incline. So in order to get this into the other file that I was working in, it's very easy. I'm going to select it and copy it. Now it's in the template here, and if I had started with this template it would already exist. But because the other file is not from the template, I need to bring it in. Now the easiest way to do this is to paste it. So when we paste this into position, or into the file, it will come in and I can move it around wherever I want, like over to here. [0:37:08]

And after I click outside it, you'll see that it looks just the way it did before. And one of the things that it has done, in terms of the Wall tool, and I can just eyedrop this, is that now this is available in the Wall tool. So you see that the Wall tool has now in the complex structure area that this is added. So it's got a few things from the standard template plus this new one. Now I'll go and place this roughly, just to give you an idea. It's not going to be the exact diameter or cross-section of the road that we see here. But I'll just do sort of a very quick approximation. I'll do two straight pieces, and then I'll fill it between them. [0:37:58]

And so I'll select the two of them. And then I'll use the Fill It option here in the toolbar. And oh, 50', I think that should be good. And you can see that it has now made a smooth curve. And on the plan, it looks good. If we zoom in on it, we'll see that the representation is actually pretty clean. It may not be

perfect, but it's definitely quite respectable. And I'll select that, and I'll say just show me these things in 3D. So when I do that, you'll see it generate it. And if I zoom in on it, we'll see that it actually, and let's just hide the Solid Element Operations palette; you can see it's done a very nice job of creating that roadbed as it goes around. [0:38:58]

Now one limitation of the Wall tool is that it remains flat. So walls do not have the option of inclining. But the Beam tool can be used to incline. And the beam can be set to use this same option. So if I go to the Beam tool, I can say put it onto any layer. I will just put it onto the ArchiCAD layer for now. And I'll select a profile, and then I'll select that profile that has been imported, which is that 28 feet right-of-way, ROW. And then, let's just go here. I'm going to go back to the floor plan and Fit in Window. And let's get rid of the wall one, and I'll just draw a version with the beam there. [0:39:54]

Now it has a slightly different look. So the plan representation may not be perfect, but one of the nice things about the Beam tool is that you can actually tell it to be an incline, and then you can give it an angle. So let's just take a look in 3D at this beam and the two other walls that we had just been looking at. And well, I need to get the height of it set, so let me just move this down. And I'm just doing it very quick and dirty, but you can see that it will work this way. And then I can go slope it. So I might take it up, oh, let's just take it at a 10° angle. Now that might be a little bit steep there. Maybe I'll take it to a 4° angle. And you can see how it will slope. [0:40:52]

So this can give a reasonably good approximation of this. You might have to do some fudging in terms of the way that it connects at one end or the other. But generally it will give you a pretty quick representation of the road work, certainly in context where the road has a uniform profile as it sweeps around. So we would call this a trick, but it is certainly a powerful presentation technique. It has serious limitation, because you can't modify the profile of the road as it goes along, but it certainly is very fast for creating certain types of models. [0:41:38]

So this concludes our section on advanced site modeling and working with road work, paths and paved areas. 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, 0:41:52]