



BEST PRArchiCADTICES COURSE – WEEK 17 – Complex Modeling PART 8B- Shell Tool Advanced

Welcome everyone to the ArchiCAD Best Practices course training lesson on the Shell tool basics. This is Eric Bobrow from San Rafael, California. So the Shell tool was introduced into ArchiCAD 15. It's directly underneath the Roof tool in the palette. To some extent, it could be used as a roof. In fact, I remember many years ago when I was visiting Graphisoft's headquarters in 2001, they showed the idea of taking a vaulted roof that was traditionally done in segments and having a way that you could have a smooth curve. I thought, 'Oh, that would be really useful.' [0:00:44]

Well, they did a lot more than that. They created a tool that has a lot of power to create smooth shapes that are curved or follow some extrusion path. There are quite a variety of shapes that can be derived from the Shell tool. So let's draw a box of walls to give some context. I will switch to the Shell tool, and we'll look at the basic choices here. So we have a choice of creating an extruded shape. That means that there is some shape that is extended along a line in space. [0:01:24]

This could be used for a vaulted roof or a molding. Since it can be tilted in many directions, you could use it in place of a complex profile for a column or a piece of steel. So any profile that you want, you can send in a certain direction. Now the next one up here - let's move away and come back - is revolved. So what is revolve form? It's like a lathe. Something where you have a central axis, and some shape that is swept around in a full or partial circle. So you could use that for balusters and certain ornate shapes such as a vase or conical forms. [0:02:12]

So there are a variety of things with the revolved one. This final one, which has an interesting little shape, is called a Swept form. It basically has two lines in space, and it connects between them in a smooth way. So you can get some warped surfaces with this. There is a fair amount of flexibility with it, but it does follow certain regular rules. So it's not the ultimate organic modeling tool by any means. The Morph tool has much more flexibility, but there are some real advantages to the Shell tool with certain geometries. [0:02:51]

One of the core things about this is that when you create a shell, it's made up of either a single building material or fill. If you are before ArchiCAD 17, it's composite with multiple ones. So it has a uniform thickness. So while you could make it with zero thickness, in general it's going to have some thickness. So it is a shape that has a uniform profile throughout whatever you are drawing. That is something similar to the Roof tool, of course, but different than say the Morph tool, which is just surfaces and possibly encloses of volume. [0:03:38]

So a rather different setup. Now when I hover over this - and you can see it's extruded - it gives me two options to the right here. That means that I can do extruded ones in either one or two different ways.



This is a simple construction, and this one is the detailed construction. So let's start out by drawing a simple extruded shell. If I click in space and draw a line, you will see that I have my usual pencil. I can draw it on any angle. When I click, it then is waiting for me to draw a line perpendicular. No matter where I move the mouse, it's going to draw something perpendicular. [0:04:20]

I will take it a certain distance. I can type in with the tracker what size I want. I have created something that looks like a rectangular piece. But actually, this is a half circle or half of a tube that had the length that I first specified and a diameter of whatever I next specified. If I select it in 3D, you are going to see that there are some handles at the end points, which are no big surprise. But there are some interesting things such as a blue line here that represents the profile. Then this other blue line represents the extrusion axis. [0:05:09]

So you remember that I drew a straight line and then I went sideways and defined the diameter. And it did a half circle here. Now that's just the simple construction method. So it would actually be possible to do this along the top of this wall. If I draw from one end to the other, and then go to the other end here and go to 3D, we are going to see something that almost is a vaulted roof. The height is a little bit low. I can change it to the top of the wall. And you can see how it fits up there. [0:05:46]

Now what changes could we make in this simple one? One is I can go to the edge of the profile, press down where I have the Mercedes, and you can see the pet palette has a lot of different choices. The most basic one in this case would be to change the vault by changing the curvature. So you will notice that the pet palette is very similar to what we have in 2D cases dealing with polygons, poly lines, or curved elements. So here I can change the curvature. You can see as I move this around that there's a little ghost line. [0:06:20]

So I could specify a different radius by visual means, or I could type in a radius if I knew what the radius would be here. So if I wanted it to be an 8 foot radius, I could type that in. and it will create something that has that 8 foot radius down to here. When I hover over it, you'll notice that also there is a little hotspot here. So it must be 8 feet from there to there; or 8 feet to any of the outer points. Now the thickness of this is specified by the structural material, which would be the fill before ArchiCAD 17, and the thickness is specified here. [0:06:56]

If I wanted it to be thinner, let's say four inches, I can type that in. you can see how it instantly got thinner. If I were to switch this to a composite - in ArchiCAD 17 this is the way you would switch. In ArchiCAD 15 and 16, it would be from the same main popup but you would choose a composite. But here you can see it says 'Shingles'. These would be the ones that would be specified for use for roofs or shells. So if I say 'Standing Seam Metal Roof', you can see how it has created something that has a standing seam pattern on it, and it has a thickness that is designed for a standing seam structure. [0:07:38]



So I have drawn a line across to say, 'How long does it extend?' Then I either use the simple thing, which is the half dome, or I adjust this shape. Now I can actually go from an elevation. Let's say the east elevation here. And you can see that I can select it. And if I go to an edge, there's the same curvature. So I can - I went to the wrong one here. I have this selected, and I think it's this theoretical line that I would be choosing. [0:08:17]

If I select this, I can change the curvature. You can see the arc radius here. It's interesting that it says 10 foot here, as opposed to the 8 foot. Maybe I did that, I can't remember. Let's just type in the 8 foot. You can see it looks like the center of the curvature is down here. So that's a little bit of a mystery. But one thing is you can definitely get it to be whatever height you want. So you can adjust this in a section or an elevation and get a precise result. [0:08:56]

Now you will notice that it has some segmentation here. Let's just see if there is an option for changing the segmentation. So if I open up that shell, you will see that it has a starting angle and an ending angle. Does it cut off straight or on an angle? We'll take a look at what those do. There is also a possibility of a distortion angle. So we'll look at those. We've already looked at changing the material, the fill, and the cross section. Let's see if we have a resolution. It doesn't look like we do. But there is this thing about downward extrusion I want to show. [0:09:37]

Let's say that I put this back to a thicker one and make it 6" thick. So I have that there. Now there is a choice in this of whether the reference line is essentially the top or the bottom. If you rotate it around in space, it may not be the top or the bottom, but we could change this to a different extrusion. So if I say 'Upward Extrusion' - actually, that's not it. If I say minus 6" here, no, it's not doing it. Where is it? So I have to say 'Trimming Body'. I was picking the wrong thing there. So where is that? I know we have a choice here of how it is extruded. Oh, here is the flip. [0:10:30]

So I think when you first create it, there is an option for changing that. If I click on flip, that reverses the shell body and the membrane. So there is a concept of the shell body, which would be the surface you are defining by the line that you first draw, the extrusion vector, and the profile. So that is the membrane. And the shell body would be how thick it is and which side. So if I flip we can go and see. So if you wanted to do it different way, you could do that. Let me undo that. [0:11:08]

So those are some of the changes there. Let's look in 3D space, and take this and look at the settings here for the end angle. Let's say 45°, what does that do? You can see how the end angle now has been cut off at 45°. In fact, we can go to this edge here and I can change the end angle here. I can go and change it this way and rotate this around. So you can see how I can make it extend. And this can be done numerically. You can see the ending tilt. If I turn it back to 90°, it's going to be a nice vertical shape. [0:11:48]



So there are a lot of different controls that you can do visually or in the dialog box. Now let's take a look at the beginning angle. It would be the opposite side. So the starting angle, if we were to say 45° here, you can see how that changed it. Let me undo that. And let's look at the distortion angle. Let's say 45° here. Now what that does, notice that the blue profile is perpendicular to the extrusion vector. And this is going to tilt that. So you can see it kept the same shape, but it rotated in space, and that made this a little bit shallower. [0:12:33]

Now here it would not make sense to do that. There's no point in rotating it. But there are times you want this shell to pass through some profile, and go at a different angle. Not go perpendicular to it, but go on an angle. So we'll take a look at that in a different context. Let me undo that here. So those are some of the basic controls. Now this shape here is right now an arc shape. If I go to this point here, there's an option when I'm at either end of the profile to add more lines to essentially extend this. [0:13:19]

So if I go and draw - I'll just use the X axis to extend it - and click twice, what you see is that this profile now follows the curve and a straight segment. So I can do this and have as many pieces as I want. Let's take a look at this in the elevation. So I have this shape here. I will select it and go to the end. And you can see the same option is available. I will draw a couple of things here arbitrarily. I just clicked on a series of points. I could draft or measure these precisely. But you get the idea that this profile shape can be not just an arc form, but a more complex shape. [0:14:08]

If I go to 3D you will see the obvious result here. Let me undo that. So we have the ability to draw this and create whatever shape we want that is going to be passing through. So remember when we are drawing that in this first case of creating an extruded shell, there was a simple, and there was the detailed method. When I do the detailed method, if I am in the plan, it's going to expect me to click on a series of points. Possibly a series of curved points that I do. And when I am ready to finish, I click another time on the last point. I guess I am in this mode here. [0:14:57]

So I have completed my shape, this arbitrary shape on the plan. And it says, 'Give me the extrusion length.' So basically what it's going to do is take this shape and extrude it up or down. This is where you can have a negative value. That's where I was getting confused. Let's say extrude it up 10 feet. We are going to have - oops. It looks like I ended up with this other point there. So let me go and correct that. So you can see that I have this extra point. Let me bring this point back. You notice that these points are fully editable using the pet palette, just like any polygon. [0:15:38]

So I have this polygon shape here. If I go to 3D, you will see the shape that I created. There is that other shape that I had drawn initially nearby. That one was up on the second floor, the upper story, that's why we weren't seeing it. I am guessing, if we go to the second floor here, we are seeing that up on the second floor. So this shell, because I raised it up from 9 feet to 10 feet, is now fully up on the second story. I could choose to show it on the floor plan on just relevant stories, which would be the upper



story in this case. Or all stories or a different one. So this is just like the Roof tool with the same controls. [0:16:24]

I will say on all stories. Now if I go back down to the lower story, we are seeing that in this position. So let's look at how we can rotate things. That would be a very important part of this. If I look in 3D, we can see these things are floating in space. If I select this, in addition to the other manipulations that I've shown you, I can press down on a point and there's a 'Rotation' option here. So how would I rotate this? I rotate this say around this point, and take this line. Now this is essentially just rotating this on the plan. If I go to the floor plan, you can see how I've rotated it. [0:17:11]

I just undid that. If I wanted to rotate this vertically, then what I can do is say I'd like to rotate this. And you'll notice as I move my mouse around the compass indicator changes from horizontal to perpendicular to whatever surface I indicate. So if I say that I go to this edge, now I can say I would like to rotate it around something vertically. So I have just rotated it 90° in a circle. Maybe that's not what we want though. Maybe we want to rotate it vertically. So how would we do that? If I go down here and say I'd like to rotate it, perhaps I go perpendicular to this surface. [0:18:05]

And now you can see the guidelines. I can take this up here. So what I have done is specified that the rotation of this element was around this particular line in space. That was a funny line in space; it was way off to the side. Let's say that we had this element next to a shape that we wanted to put it in. we could rotate it around. We could even draw a temporary element next to it, such as a beam across here. And you can see that this beam is set right near the edge. I could put this and drag it down here. So I am just using this as a guideline. Then if I select this element, and say I want to rotate here, then I can go perpendicular to this surface and take this snap to the X and snap to the Y. [0:19:13]

So you can see how that stayed up there. One of the special things about the shell tool is that you can rotate it freely in space to create different forms. Now what I have created right now is a simple extrusion. We can have a more complex shape, but we can do more complex forms and follow multiple paths. We will take a look at that a little later. Let me show you some of the other shell tool elements so that we can see the range of what this tool is able to do. Let me get rid of these guys here. And let's look at the shell tool for a rotated or revolved form. [0:20:13]

So when we choose this, there is the simple and detailed method. So the same idea here. So what is simple? If I click two points, and then rotate or move my mouse around, you will see what it's going to do. It's going to create a dome or part of a dome. I select it, and you will notice it does not appear to have any segments; it's not a faceted dome, although internally it's clear that there is some approximation of the shape across here. You can just tell that there are 36 segments in a circle, so nine segments going across here. [0:21:04]



Now that we have explored this previously, we can recognize some of the similarities. For example, there is this profile here, and there is an extrusion vector. Now the extrusion vector, remember when we had the simple extrusion, was the sweep, how far it went. In this case, this shape is top to bottom. Actually, if we go to an end here, there are some options to change the curvature around. So you can see how I can extend this more or less. Let's see if I can - so this is the center point. I can't move the center point, although I can drag this around. But I can probably edit this and change some of the shapes here. [0:21:55]

Now I am not really an expert on the shell tool. So frankly, sometimes I have to figure out what these shapes are doing. But if we hover over them, without the mouse being pulled down, it says, 'Distort axis' or 'Slant axis'. So if I distort axis, you can see as I move this around its creating a tilted shape. This is probably not something you would use in construction, because it is rather distorted here; but it might be something you use for sculptural forms that you want to do for an ornament. Now I will undo that. If I instead go here and tilt the axis, this is something that we might actually do, because this is a regular form. [0:22:39]

You can see that I have now rotated this whole axis a certain amount. Let's undo that and say that if I do this tilt axis, you can see there is a slant angle. If I typed in 45° , you can see that this is now rotated on a 45° angle. Here is where you can tell what that is doing. So this is one swept form. Let's take a look at the more detailed one that we can create. So if I were to use the detailed shape here, it now says 'Enter next note of profile polygon.' So the profile is the shape that is going to be swept. So I will just create an ornamental shape. Let's take this up here. [0:23:38]

We'll take this back. I am going to take this straight in line with this. So this is a shape. Now it's asking for the center point. So I will take that here. And what is the axis? So I will draw it up this way. So what I have done is defined a shape that is going to be swept around in a certain amount of revolutions. We can tell it initially what revolution. We can always change that revolution later. Let's just say 180. So now if I go to 3D, we are going to see that the shape that I created, which is clearly indicated by the blue line, and the axis that I created, made this form. [0:24:33]

Now it is editable. If I go here, I can change the sweep. So I could rotate this. So this is angle, zero, just trying to see how we - if I go to this point here, change this, okay. So on this particular point, the revolution angle, I could change this to zero, which would probably be 360. So you can see how I can change that. So each of these points has many different options including being able to change or extend a line. Let's draw a line in space here. So what did that do? It created another shape that became part of the profile. [0:25:25]

So by extending it, I basically was able to modify the profile. If I go in here, I can change the shape. So this is a poly line that I can edit. So one of the things about the shell tool is that it's based on some simple geometry elements that you can modify after the fact. And the complex form is being generated



from a rule that says, 'Follow this shape and make the form.' This is in contrast to the morph tool, which can be a complex shape, but once it's done, it's harder to edit in a systematic way. [0:26:13]

What if we wanted to create a baluster here, a railing? Let's go to an elevation. I will go and create something of a certain height, 1x4, and take this. I am going to go and curve this. Let me create another node point here. I will curve this. I will make this much thinner. So I have a shape that I want. Let's see if we can draw that shell tool right here. If I say Revolve, Complex, can I magic wand this? No. So I am going to have to actually copy this fill and go back to the floor plan and paste it. [0:27:29]

Then I can go with the shell tool. And this complex shape, I can magic wand this and say I want to revolve it around these two points 360. Let's make this thin shape here. If I look in 3D, this is not what I would call a baluster, but it is a shape that I defined, and created from a fill. If we wanted to rotate that up 90°, how would we do that? So let's see. If I take this and press down here and use the rotation and go to this edge, you can see it's horizontal. Now I can enter rotation center point around here, enter rotations arc. It looks like I have multiple elements selected. I think that was part of the issue here. [0:28:40]

So I go and say that I would like to rotate this along this and zoom out; get it up here. And I have just turned it upright. So there is some practice that will help in terms of being able to rotate. But what you are going to look at is finding an edge that is perpendicular to the rotation that you want to make and then flipping it up. Let's see here, we've got the extruded form, the revolved form here. And we have the swept form as well. Let's see if there are any questions on what I've done so far. I made a royal mess of the screen. [0:29:35]

I showed some basic shapes that perhaps are somewhat confusing, but hopefully I have been able to explain some of the key areas that you need to be aware of in terms of extrusion profiles and extrusion vectors and things like that. So I see a question from Joe Archibald. "Is it possible to extrude these horizontally like for molding?" Okay, good question. Let me create a shape like a molding. So if I go to the Object tool, it might be good to get a molding shape. I will go in the U.S. library to the moldings. These are shapes that we can put in, and they do have some possible shapes that you can do. [0:30:31]

This is a nice tool. But I want to get a 2D element. I will go to one of the casing folders and then go back to looking here. We'll see that's wood here, so let's look at crown molding, like this. We'll take something ornate. This is a 2D shape. And of course, you could bring this in a variety of ways, but this is a shape. So if I press down on it, it's just a 2D form. And you can see that when I select it, it's an object that has some hotspots or handles. I am going to go and take that 2D object and explode it into the current view. [0:31:26]

I will say 'Keep original elements.' What that will do is make a copy. So if I drag this over, you can see that this here is the object, whereas this is the exploded copy that was made of lines. So let me go and



select all of these and get rid of them. Now this was a shape, and you can see how it's just a number of lines here. I will go to the Shell tool, and we'll magic wand it. When I magic wand it, it has a spacebar held down to do it, and then instantly it started putting in the spaces here. I will just make this 3 feet, so it's a short little piece. [0:32:13]

Now that piece here has a uniform thickness. This is something that is a little different. Let me just make this 1/8 inch here. What you will see is this outlined it and took it out a certain distance. Now let me flip it and put it outside or inside. You can see this is a hollow piece. So it's really like a tube, a piece of piping or something like that. And of course I could make this thinner, like 1/16 or something even smaller so that it doesn't show up in a section drawing. It just looks like a solid line. [0:33:07]

So it's not a solid volume in this case. That's one of the things about the Shell tool is it's defining an outline as a solid. It may not be the ideal thing to do for this, but it would be good for something that is actually a piece of steel or formed shape. If I go now to 3D, and let's just get rid of some of these other shapes. Here is the shape that I just created. And you can see that it's like a piece of formed steel in that shape. So we could create that and extend it. I know there is an option to rotate, if we click. This is rotate profile. No, let's see. Offset, drag profile. That's not going to give me what I want. [0:34:17]

So I might have to go to 3D to be able to do this the way it would be ideal. Let me take this extrusion vector down, because I want to make it a little easier. This extrusion vector, which is the blue line, I am going to say that I would like to shorten it. So here you can see some options that we haven't explored. This allows me to shorten or lengthen it, and this allows me to offset it. So if I say shorten or lengthen it, and make it one foot, so it's now a little piece, then we can stretch it later. I could go in here and zoom in on it. I will rotate this around this angle. [0:35:14]

I just undid that and I am zooming in tight. So I am going to go and say 'Rotate' perpendicular to this point. And if I rotate this around - this is just more awkward than any of us would want it to be. Okay, here is the X axis. That's what I was looking for. But it's not allowing me to snap to it there. I am rotating around to try to find that snapping. So what I am going to do is cancel out of that and drag this down until it's next to the wall. So now it should be a lot easier if I say I want to rotate this here perpendicular to this wall; and now I can go from the X to the Y there. [0:36:37]

So now you can see how I have it horizontal here. If I want to put it up at the top of the wall, I can drag it from one of these points up to the top. Then I can extend it. Now here, if I look at it on the floor plan, I should be able to see it. It is sitting here now. It's a bit easier for me to see what's going on. So I will drag this into position here. This is an extruded form. When I go to any of the end points here, there is an option to extend it longer or shorter. So that's easy enough to do here from any of those points. [0:37:29]



I don't have to get the main axis line here to do that. Let me take this up to the end. Now one of the issues that you are going to find is that it doesn't clean up to the corners in a simple way. So if I were to take this and mirror a copy across the corner, you can see I have two pieces now. Let's take a look in 3D at this corner. We'll just look at only that corner there. You can see the shape that I have. Now if I were to select these two, there is no intersect. [0:38:21]

'Cannot intersect these two elements.' That command is not available. So how would we make them intersect if we did want that? I will select this and extend it to here. I will extend this one to there. Now they are going to pass through each other. Let's take a look in 3D. You can see that they are passing through each other. So what I need to do is cut them off at the 45° here. One of the things that I think would be more easily demonstrated in another context is that we have the option to cut off part of the shell. [0:39:08]

So let me demonstrate that in a different context here. I will select this wall and add a new point to it and extend this one. I will select all the walls and go to this edge and extend this. I am creating a more complex shape here. I will go to the Shell tool and create a vault that goes across with a simple one here. So let's take a look at what I've just done. I drew a simple shape. Here is my wall. This is the L-shaped building. And here is the whole morph. Let's just take this up to 10. [0:40:12]

Then we'll flatten it down a little bit. If we look in 3D and what I just did, you can see that this shell is extending over - maybe this could be a patio or something like that. But if I wanted this shell to fit over the walls, here is what you would do. I can select this shell, and there is an option, if I right-click on it, to define a shell contour. So this is a very powerful thing that is very easy to define. It basically says while there is a theoretical extent to the shell, how far do I want it to extend. So I am going to define a shell contour and then I will click on a series of points. [0:41:06]

I think I can probably magic wand the wall outline as well. But let's just do this manually. Now you can see that the shell now has an extent as it did before, but it also has this extra little shape. If I go to 3D, we are going to see that the shape matches the profiles that I have there. Let's take the walls up. I am going to select the walls and change them up to be a different height, let's say 12 feet. As long as they are going up high enough. [0:42:01]

Now I can select them with the shell and connect them. Remember this 'Trim elements to roof or shell'; if you haven't been using the Shell tool, you may have just been using it with the roof. Basically this allows me to trim the walls to the roofs or shells from the current selection very quickly. So you can see how now I have created a form there. So the shell, even though it extended in theory out to the full boundary, I created a contour that cut it off. [0:42:35]

Now you may be wondering about the edge here. So for example, this edge is perpendicular. Now let's go to the edge here, and you see there's an option when I go the edge of the shell for the 'Edge Profile'.



Edge type says 'Undefined'. Surface allows us to define things for measurement purposes. If you had eave's troughs and things like that, you could define those surfaces. But it does not allow me to change the angle here. So that is one of the limitations of the Shell tool. There is a workaround. You will notice how it's nice and square on this side. [0:43:25]

We can extend it. So basically, if I take this and go here and press down on this, we are going to move this point. So I am doing this right now by eye. But I want to demonstrate the concept first. I am extending that arc slightly. And remember that I had defined a custom contour. So even though in theory it went out further, it's being trimmed off at the edge of the wall there. So if we look at this shape, I just extended it further, and then the cut is defined. [0:44:27]

So if I extend this further here, I guess we would probably need to do that. Let's go to the elevation. So you can see how that line got extended. I will take this point and move it over. So this is changing the profile of the roof, and I may need to adjust this profile a bit to do it, but I am going to extend it beyond the sides of the building. And then I should be able to have the profile match the outsides. So if we look in 3D, we are going to see how it's neatly cutting off vertically at those points. [0:45:18]

So that is an important thing to realize even for a simple vault is that if you want to have vertical sides, you need to extend the vault further. We have to do it from the floor plan. If I select it here, this is the contour polygon. Let me select it. If I right-click on this, that's where we'll find it. We were creating a contour. So it already has the contour here. If I right-click on the contour there's an option - I know we created it there. So let me draw a simple shell again to get that command going. [0:46:26]

If I right-click on this, under 'Define shell contour', so the shell contour is what cut it in space. You can also create a hole in the shell. So if I wanted to create a hole here, I could right-click on this and say, 'Create hole in shell'. I will draw an arbitrary shape. If I go to 3D, you can see now it has a hole. That hole is a polygon that I can adjust. I can move these points around and you can see that. That was sort of an odd shape, but you can see how it's fully editable. [0:47:12]

If I go to the floor plan, you can see that I can also edit it directly, just like any type of pet palette editing. If I select the shell as a whole, I can edit the shape. If I hover over this, it says 'Drag contour polygon'. So the contour polygon is what I created, the cutout. I can rotate that; in some cases that might be useful. I can mirror it. So there are some options there, and we can cut out holes in this or add to it. So let's see if there are questions. So there are some questions from a while back. [0:48:05]

"Can I rotate in elevation?" and Iain Dykes was saying, 'It's already partly rotated.' Joe pointed out that I could make a gutter shape with this. Now let's see if I can - remember this issue that I had here which was that these were passing through each other. Is there a way that I can use that creating a shell contour basically to cut these off to meet nicely? Let's take a look at that. So if I take this shell here and



if I right-click on it, there is an option to define a shell contour. So to create a shell contour, it's basically 'Enter first node of cutting polygon.' [0:49:04]

So I will say from here to here. Then I need to go all the way back to the other side. And for now I will just do a square one at this end. I've just completed that operation. You can see as I zoom in on it that it's cut off at that 45°; there's a diagonal line there. Let me do the same thing with this one, right-click on it and say, 'Define shell contour'. And again, I will do this 45° and zoom out. And let's take it out to there. So now if I zoom in on it, you can see that they apparently don't pass through each other. [0:49:58]

Now the outlines of these are shown in dashed lines, because they were on the lower story and these are up higher. So we are seeing them remotely. If I go up to next floor up - I'm not quite sure why these are showing that way. Let's look at the line types on the floor plan. Here are the overhead lines, hidden lines. So let's do solid for now. And now you can see it that way. So if we go to 3D, there we go. That did a very nice, clean cutaway there. [0:50:39]

So I apologize for taking a long time to get to that. But if we look back at the basic concept that I covered, and that is, with the Shell tool, we have some forms. We have these forms that you can create following certain rules. And then you can define a contour for cutting it. So you create this theoretical shape and then cut it with a contour. Joe says, "I guess a complex profile is simpler and cleans up easier." Yes, if we compare this case to a complex profile, the complex profile would automatically clean up whereas this would not. [0:51:33]

Now I know that there are some cases where this may have some advantages. If we think about some type of roof shape, one of the things that this has is it does have a uniform thickness. So if that is a benefit to you, then you might consider that. I am trying to think in terms of a roof shape that would do this. I know that if you had a curved roof on a couple of sides of the building, you could use the Shell tool to create that and have them intersect using the contour. Just basically having them cut to each other. [0:52:25]

Now let's take a look at a simple application. Let's say we want to have a simple roof. I will do a shape here. I am going to create something that has a vaulted extension over part of the building. So if we do the basic roof tool with a gable here, then we do a shell that goes this way, that's its axis. It's going to go across. Let's take a look at this quick sketch. I have now a roof. Let me raise these both up to 10 feet so they are on top of that. Let's take this 10 feet here. I will take this one and make it much shallower. [0:54:06]

I will go to the edge of the profile and curve it down like that. Now if I want these two to meet up - this roof here was set up with shingles over 2x6 rafters. Let's do something similar here. So I will make this shingles over 2x6 rafters. So now they are similar shapes. So if I were to select this and extend this extrusion to as far as the ridge line, you can see how it's meeting up there. Let's switch this view in the



3D view options to the internal engine, which will give us a better sense of how these are intersecting or not. [0:55:05]

So you can see the hard edge lines here. And then this is where they are passing through each other. If I select the two of them and right-click and say connect these elements, then we are going to have essentially one trimming the other and we get a nice, clean result there. Now let's take that - this is beyond the elevations - let me take this elevation and extend it so that we can see this shape. You can see how it's giving a nice, clean result. [0:55:51]

Let's take this shell and we'll extend the line out a little further. We want to have some overhang. So we might want to draft something here to get this precise position. We'll just take this up. I can take this up until it snaps to that if I wanted it to be precisely going up to this same height here. Now let's go back to 3D. If we wanted to trim that shape vertically on the sides, I would select this and right-click on it and say that I would like to define a shell contour. [0:56:42]

Let me define that. So now if I go to 3D, you can see I have trimmed this off vertically. I am of course working quickly and crudely, but you can see how the ability to sketch something and create something that automatically cleans up as you work with it is quite powerful for certain types of design study. And I am just trying to get this angle down; sometimes you have to move around the angle. Now by the way, if you were wondering at all how I am maneuvering around in 3D space so quickly, I am using a keyboard shortcut. [0:57:38]

If you press down the center mouse button, you can pan. If you add the Shift key, you can orbit. So that is what I am using all the time to move around in 3D space, the center mouse button and the Shift key to orbit to get into a new position. Alright, Joe says, "I have to run to a training, but good stuff here today." I am glad that I was able to get some things working. Iain Dykes says, "Can I apply roof coverings to gutters, etc. to a shell?" Okay. [0:58:12]

So in terms of the roof coverings, Iain, are you referring to the tool, the add-on that Graphisoft provides for putting on top of a standard element like a wall or a roof, adding coverings?" Oh, Cadimage. So Cadimage. I am not quite sure, but I am guessing they have a sophisticated coverings tool, and it would work with the Shell tool as well. But frankly, I am not sure. You would have to either test it or ask Cadimage. [0:58:53]

One thing I am concerned about is you will notice that we have this segmented option here. If I go in to this edge, and go to this edge, there is no option. Right click; there is nothing here that allows me to choose the resolution. You can see the profile line is a smooth curve, in fact, as I zoom in on it, it will never have facets, because it's arbitrary. But this shape here, if I go to the Options, Magic Wand Settings, this has a deviation. [0:59:31]



Let's say what if we did deviation lower? I don't think this is going to affect it, because this is tracing with the magic wand. No, that didn't do anything there. Now interesting, in terms of the Shell tool, I am not sure how you can get this more detailed there. But there is an option if you work with the Morph tool to increase the resolution of curves. [1:00:05]

I am not sure if we would want to do it here, but let me just have this selected and I will convert this to a morph. So if you are in ArchiCAD 16 or later, there is a Morph tool. I convert this element to a morph. It's going to do that and delete the original one. So you can see now this shape has a different green boundary, so it's editable in a different way, because it's a morph. If I go to the Design menu with it selected, under Modify Morph, there is 'Modify Segmentation'. [1:00:42]

So I can double the number of segments here. Now you can see that it's much smoother now. If I undo that, you can see how it was simplified. So doubling that number of segments made it much smoother. You will notice that there is this funny shape. It's no longer straight segments; it has multiple pieces, because it has a much more complex geometry internally to get that shape done. Now let's take a look if we were to put it back into our option where we were in the 3D window with the open GL. [1:01:30]

You can see that it still actually looks pretty good. Right now it's rather dark, but it looks like the shingle pattern, whatever that is, is following that quite nicely. There are no visual artifacts. If I zoom out and rotate around where the light is facing it better, you can see it looks just fine. So as a morph, it no longer follows rules. There is no axis line or thickness that we would change. So you would want to do that only after you really have that dialed in. [1:02:07]

But that would be an option to potentially smooth things out there. Okay, so it's about ten after two. I have set up that there would be a basic shell training and a more advanced one. In the next one, I will be covering the use of the Shell tool, the one that is called a "Ruled Shell". We will look at some additional manipulations for it. I want to thank you for attending today. Please add your comments or questions on the page down below this video. This has been Eric Bobrow, thanks for watching.

[END OF AUDIO 1:02:49]