The following is an excerpt from the book: *Revit Essentials for Architecture* by Paul F. Aubin.

In order to follow along in the exercise, please download the following file:

http://bit.ly/ShapeEdit

This download contains both an imperial and metric version of the file needed for the exercise. You are free to use whichever version of the file you like. The excerpt is from Chapter 9 of Revit Essentials for Architecture and starts on Page 398. The version of the file provided above is complete up to this point in the text.

If you want to learn more about the book or purchase a copy, please visit:

https://paulaubin.com/books/revit-essentials-for-architecture/

EDIT VIEW RANGE

Before we complete the stair tower roof, let's adjust the roof plan a little. The primary view range only displays elements at the Roof level to the cut plane. This is the default behavior. And as we noted previously, the new roof does not display in the *Roof* plan currently because it is above the cut plane.

1. On the Project Browser, double-click to open the *Roof* plan view (or just click its tab if you left it open).

⇨ Make sure that you have no objects selected, then on the Properties palette, edit the View Range (or press VR).

2. Change offsets of both the Primary Range Bottom and the View Depth to: **-1'-0"** [**-300**].

⇨ Change the Offset of the Cut Plane and the Top to: **20'-0"** [**6000**] and then click OK.

These adjustments give a generous range for the geometry on the roof and allow some flexibility in future edits. Notice that the core roof now displays in the plan view.

> **NOTE:** With the settings this way, we do not have a plan that shows the upper level of the stair tower. If you wish to create such a plan, make a duplicate of your *Roof* plan before making the previous edit.

USING SHAPE EDITING TOOLS

The final exercise in this chapter will be to add drainage sloping to the commercial project flat roof. To accomplish this, we will look at the third and final way that you can apply slope to a Roof: Shape Editing tools. When you have a flat roof or floor element in your model (no edges sloped and no slope arrows), you will see the Shape Editing panel on the Modify | Roofs tab of the ribbon when the roof or floor is selected. If even one edge of the roof or floor is set to slope defining, the tools will not appear (see Figure 9.52).

Please note that if you are using Revit LT, you will not have access to the shape editing tools. Please skip this topic.

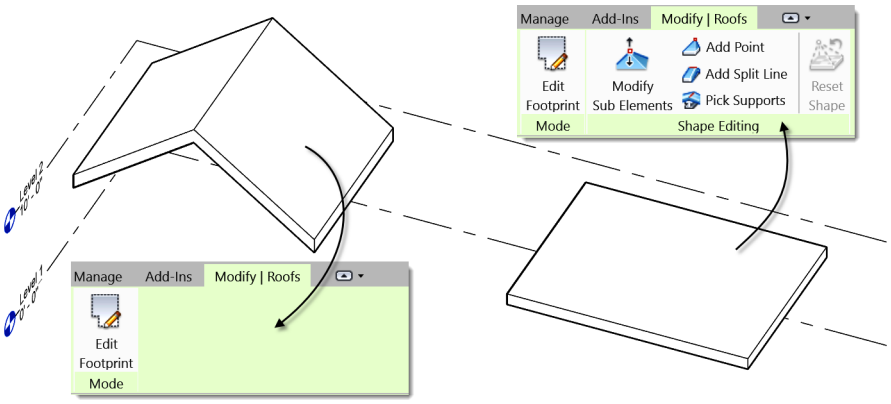

FIGURE 9.52 *Roofs or floors with no sloping edges in their sketch have access to the shape editing tools*

Continue in the *Roof* plan view.

1. Select the flat roof element. (Use the TAB key as necessary.)

   Notice the collection of Shape Editing tools appears on the ribbon as shown on the left side of Figure 9.52.

Moving left to right, the tools are as follows:

Modify Sub-Elements—This tool can be used to adjust the height of any points or edges of the shape edited element.

Add Point—Use this tool to add points to the surface of the roof or floor. Each point has a height that you can adjust to either a negative or positive offset from the roof or floor level. The roof form will conform to the shape of the edited points.

Add Split Line—This tool adds elevation changes using lines instead of points. Like the Draw Point tool, each line has a height that you can adjust to either a negative or positive offset from the roof or floor level. You can also edit the height of the line's endpoints independently.

Pick Supports—If you have structural supports set at accurate levels, you can use them to indicate the level changes of the roof or floor.

Reset Shape—The button (grayed out in Figure 9.52) is used to remove all edits and return the shape of the roof or floor to flat with no slopes.

We'll perform a simple edit to our roof's surface using a few split lines and points.

2. On the Shape Editing panel, click the Add Split Line tool.

This enables a special shape editing mode which is like other sketch modes but has some unique features as well. The main difference is that there is no finish edit mode and cancel buttons. To exit this mode, simply click the Modify tool as you would any other command. The existing edge of the roof outlines in a dashed green line. New points or lines you add will be blue. Gray lines appear when required. They are auto-calculated from the other lines and points. These turn out to be trickiest part of using these tools. If you want to avoid many unnecessary gray lines that make the shape of the roof overly complex, you need to be strategic with your use of split lines and points.

3. Click a point at the intersection of Grid 2 and the vertical green line on the left.

⇨ Draw straight across along Grid 2 and snap to the opposite green line on the right (see the left side of Figure 9.53).

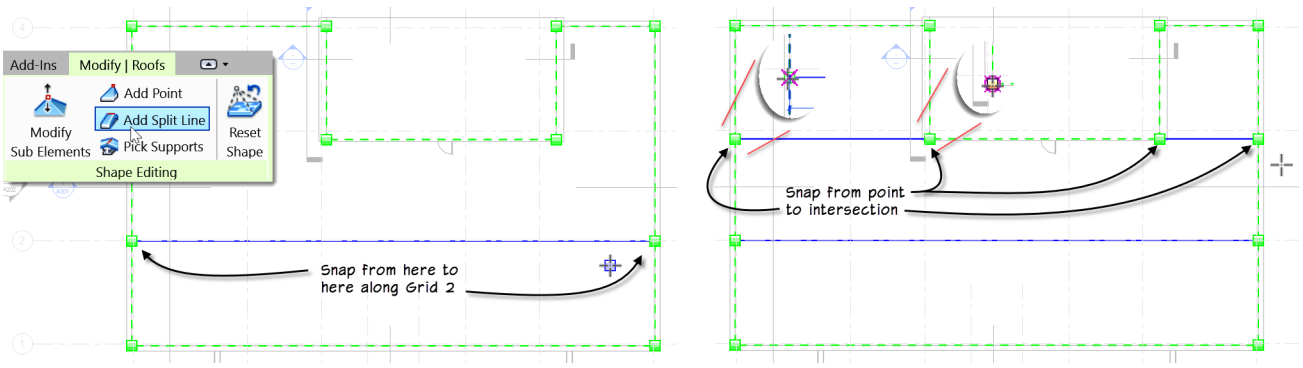

FIGURE 9.53 *Add split lines to divide the roof into three zones*

4. Remaining in the Split Line tool, click the green corner point at the lower left side of the stair tower area.

⇨ Draw horizontally to the left and snap at the intersection of the vertical green line.

⇨ Repeat on the other side (see the right side of Figure 9.53).

This divides the roof into three horizontal bands, with the top band being separated into two sections by the stair core in the middle. Let's slope each of these areas.

5. On the Shape Editing panel, click the Modify Sub Elements tool.

⇨ Select the horizontal dashed green line at the bottom of the plan (along Grid 1).

A temporary dimension will appear at the midpoint.

⇨ Click in this temporary dimension and input: **6"** [**150**] and the press ENTER (see the left side of Figure 9.54).

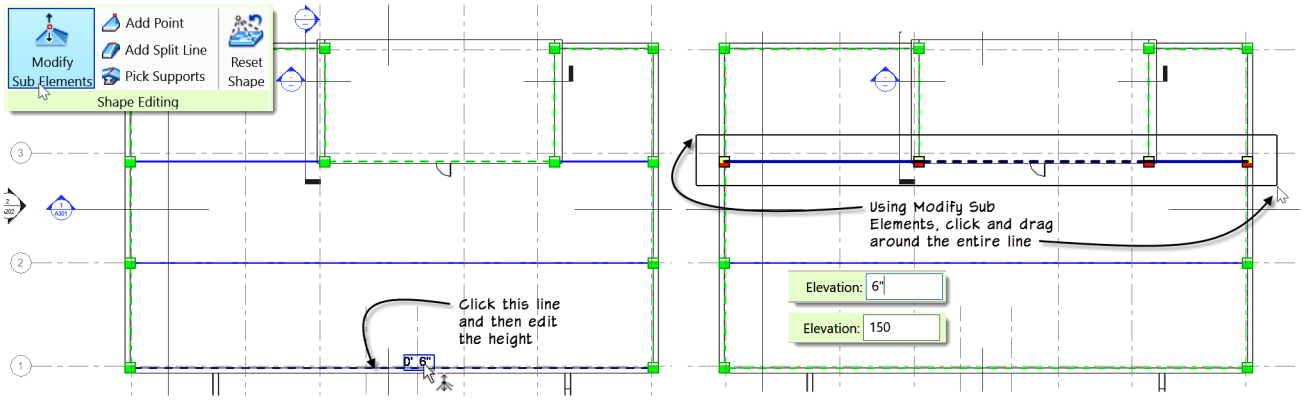

FIGURE 9.54 *Edit the height of the split lines*

6. Remaining in the Modify Sub Elements tool, drag a selection window around all three lines near Grid 3 (two blue and one green).

⇨ On the Options bar, change the Elevation to: **6"** [**150**] and then press ENTER.

Alternatively you can do the two blues lines one at a time. The green will end up in the same spot once you change both blue ones.

If you want to see the results of this change, you can create a section running vertically cutting through all three zones. When you do, you will see the roof has a slight zig-zag shape to it now (see Figure 9.55).

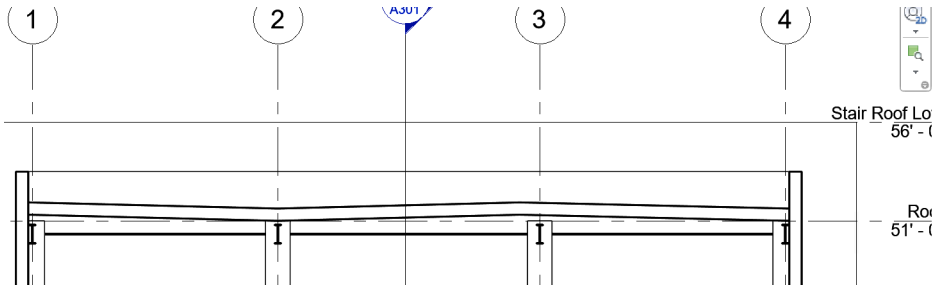

FIGURE 9.55 *View the results of the Modify Sub Elements edits in a new section*

To Ensure we have proper drainage, let's add some crickets to the roof. This can be done by adding and editing additional points and split lines.

Continue in the *Roof* plan view.

7. On the Architecture tab, on the Work Plane panel, click the Reference Plane button (or press RP).

⇨ On the Draw panel, click the Pick Lines tool. On the Options Bar, set the Offset to: **7'-0"** [**2100**].

⇨ Offset two reference planes from Grid 2, one above it and one below and then click the Modify tool or press ESC twice to finish.

8. Select the roof again. (Clicking on the split line is the easiest way to select it).

⇨ On the Shape Editing panel, click the Add Split Line button.

⇨ Snap to the intersection of Grid C and the reference plane and draw to the intersection of the other reference plane.

⇨ Repeat at Grid E (see Figure 9.56).

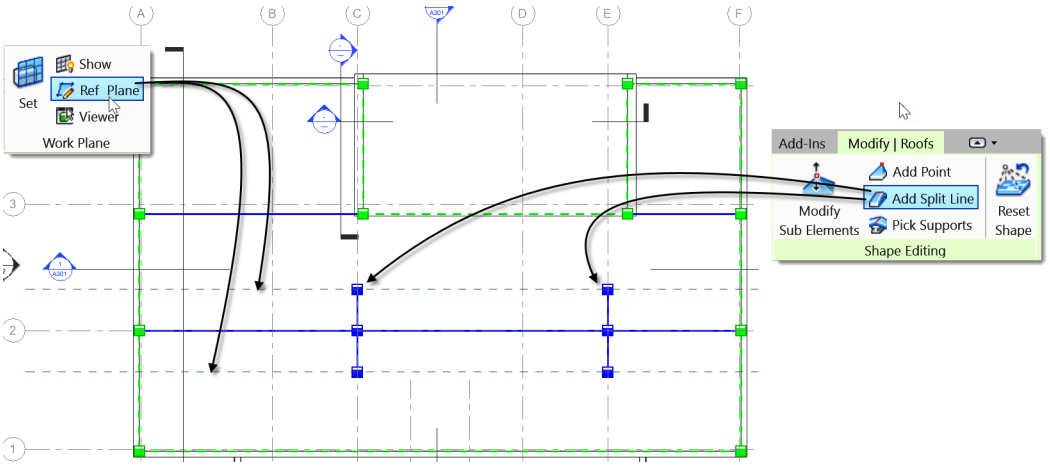

FIGURE 9.56 *Add split lines for crickets*

9. On the Shape Editing panel, click the Add Point button.

⇨ Snap to the midpoints of each of the three blue segments along Grid 2.

⇨ Repeat at each location shown on the left side of Figure 9.57. Snap to midpoints at all locations.

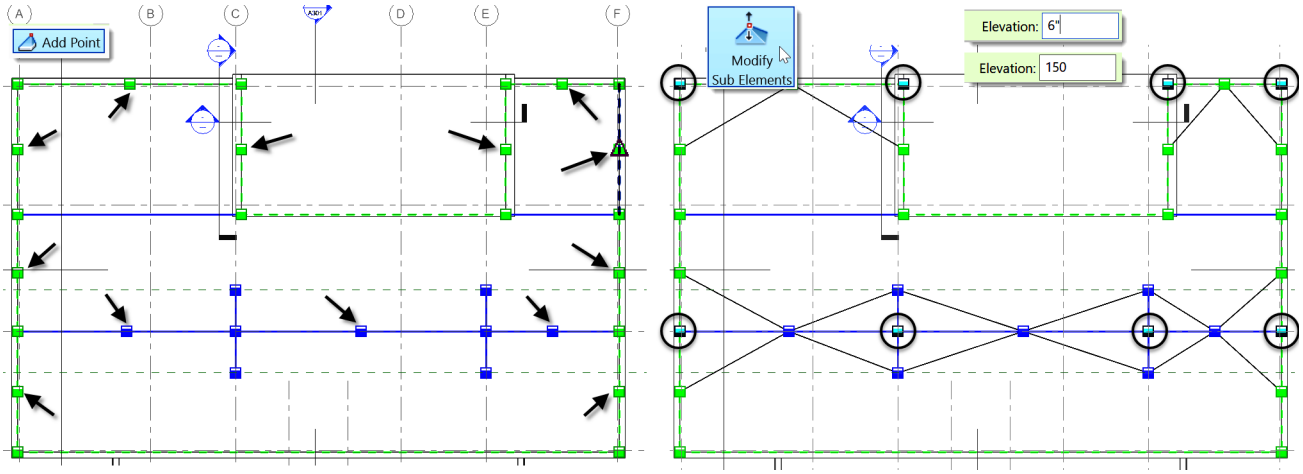

FIGURE 9.57 *Add points at several midpoints*

10. On the Shape Editing panel, click the Modify Sub-Elements button.

⇨ Select each point circled on the right side of Figure 9.57 and edit the Elevation to: **6"** [**150**].

As you make these edits, you will see gray lines appearing automatically as the shape of the roof adjusts.

Changing views will terminate the sub-element editing mode. You can also click the Modify tool first if you prefer. Notice that the roof now displays the edges of the ridges and valleys for the sloping planes (see Figure 9.58).

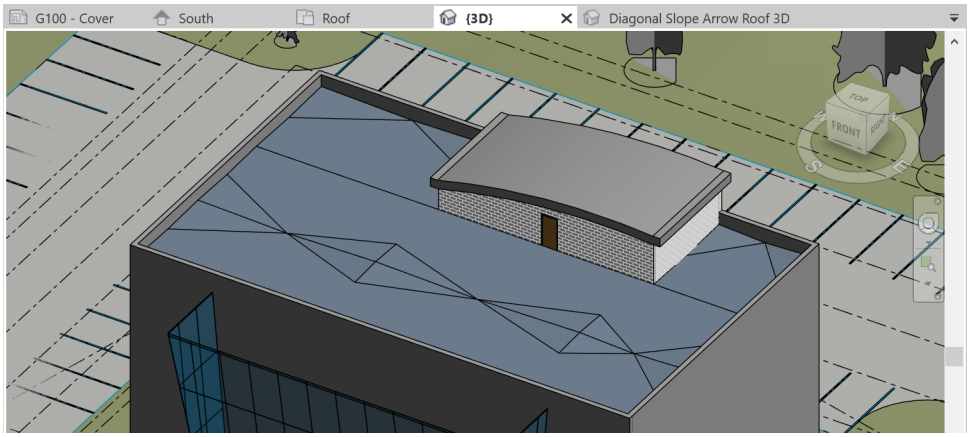

FIGURE 9.58 *Study the results in 3D*

ADJUSTING SLOPE

When designing a flat roof, there is often a minimum slope required by code for drainage. While we cannot input this directly in the shape editing tools, we can use a simple technique to measure the slope that results from our edits and then make appropriate adjustments.

1. Return to the *Roof* plan.
2. On the Annotate tab, on the Dimension panel, click the Spot Slope tool.

⇨ Move your mouse around the various surfaces of the roof.

The spot slope annotation symbol will appear on your cursor and will read the slope of each surface as you mouse over them. Use this moussing technique for quick measurements or click to place the permanent annotations in the view.

3. Click to place one or more spot slope symbols.

⇨ On the ribbon, click the Modify tool or press the ESC key twice.

If you discover a slope that is too shallow, simply select the roof, click the Modify Sub Elements button and then adjust the height of some of the points or lines to adjust the slope. You will get immediate feedback from the annotation as you make changes to the heights of the lines or points. In some cases, you may need to add new points or lines to achieve positive drainage at all points on the roof.

USING VARIABLE THICKNESS LAYERS

The default behavior in the sub-element editing mode is for the entire roof slab to be affected by the slope. If you prefer, you can edit the structure of the roof type applied to the roof element and make one of its material layer thicknesses variable. When doing so, the bottom surface of the roof will remain flat, while the top surface slopes according to the split lines and elevation points added above. This is an effective way to represent tapered rigid insulation in the construction (see the next few steps). The best way to see these sometimes subtle variations is in a section view. Let's use the one we created earlier.

1. On the Project Browser, locate Section 1.

⇨ Right-click it and choose: **Rename**. Call it: **Section at Roof**. Stretch the bottom of the crop region up so that it only shows us the roof, cropping out the levels below.

Take a close look at the roof element. Notice that both the top and bottom surfaces are sloped (maintaining a uniform thickness). We can designate one of the layers in the roof type structure as a variable thickness. When doing so, the

bottom layers will remain flat, the variable layer will have a flat bottom and sloping top surface, and any layers on top of the variable one will follow the slope (with uniform thickness).

2. Select the roof.

⇨ On the Properties palette, click the Edit Type button.

3. Click the Edit button next to Structure.

⇨ Place a checkmark in the "Variable" column next to layer 2 and then click OK two times (see Figure 9.59).

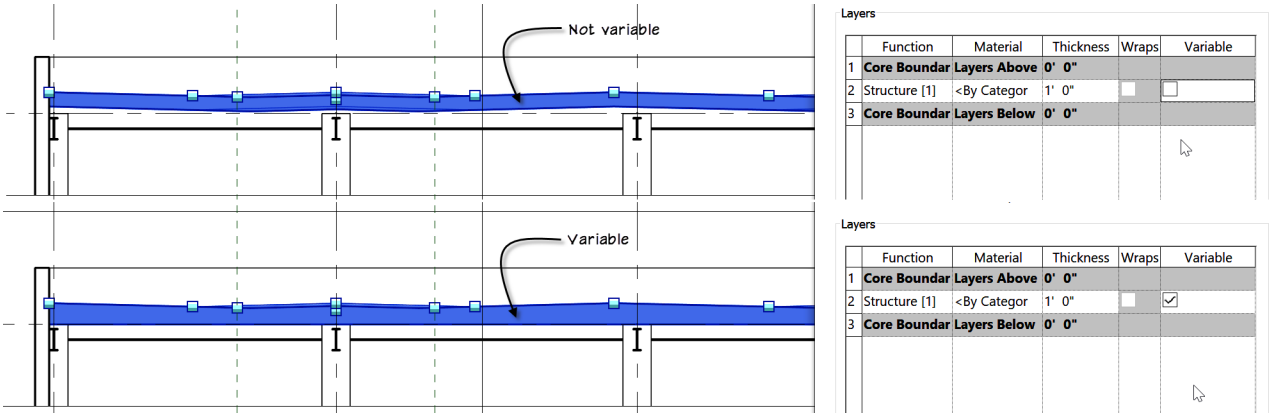

FIGURE 9.59 *Comparing the roof with and without a variable thickness layer*

Currently we are using a Generic type with only a single layer. To appreciate fully the effect of a variable component, we should assign a complex roof type.

4. With the roof still selected, from the Type Selector, choose: **Steel Truss - Insulation on Metal Deck - EPDM** [**Steel Bar Joist -Steel Deck -EPDM Membrane**].

5. Edit the "Type Properties" again and then click the Edit button next to Structure.

⇨ Place a checkmark in the "Variable" column next to layer 2 (the insulation this time) and then click OK two times.

Now that we have a more detailed structure in place you can see that we have effectively represented tapered insulation and the support structure beneath it remains level. However, this roof type's lowest layer is meant to represent the steel bar joists. This means that the entire roof structure sits too high in the model.

6. Select the roof, and on the Properties palette, in the "Base Offset From Level" field, type: **-1'-4"** [**-400**] (see Figure 9.60).

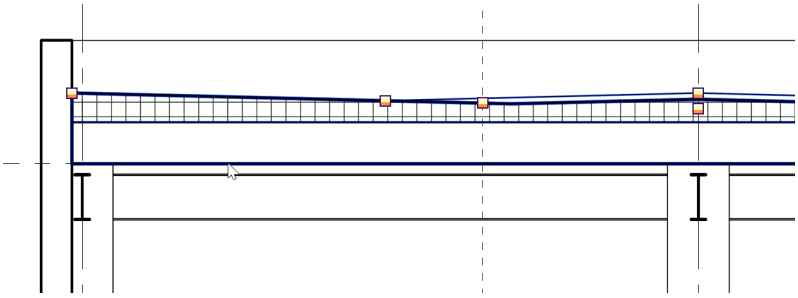

FIGURE 9.60 *Move the roof element down with a negative offset from the level*

Feel free to study the model in other views and experiment further with the roofs and floor slabs.

7. Save and Close the commercial project file.