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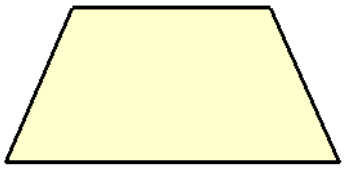
Push/Pull

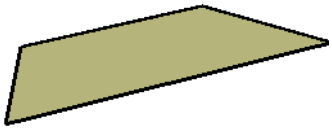
While not exactly a 2D drawing tool, **Push/Pull** it is so crucial to working in Google SketchUp that it's important to cover it before moving on to other tools.

Push/Pull is what makes Google SketchUp so unique and easy to use. Simply put, it takes a face and makes a 3D assembly of faces. In CAD terms, it's basically an extrude tool but much more flexible and intuitive.

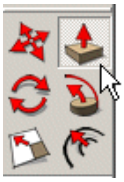
1. Start in top view, and use **Line** to make a trapezoid.



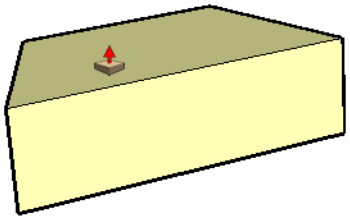
2. Orbit to an isometric view.



3. Click **Push/Pull** (or select **Tools / Push/Pull**).



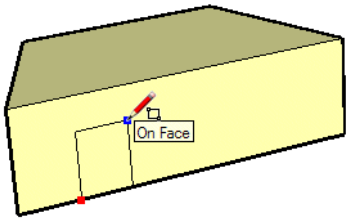
4. To use this tool, you can click on the face and drag the face up or down. But a better way is click-move-click: first click the face, then click the point (above or below the face) to set the height. Either way, the face updates dynamically while you move the mouse.



NOTE: *For the **Push/Pull** cursor, the tip of the red arrow is where you select or highlight.*

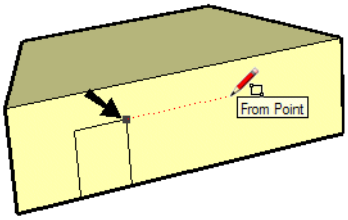
Push/Pull always pushes or pulls a face in a direction *perpendicular to the face*. It also creates a prismatic form - the start and end faces are the same size.

5. Use **Rectangle** (or **Line**) to draw a rectangle from the bottom edge of the front face.

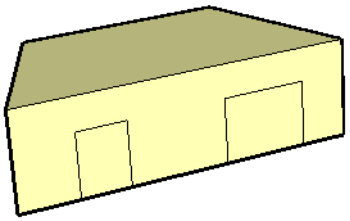


When you use a 2D drawing tool on a face, the object automatically aligns to that face.

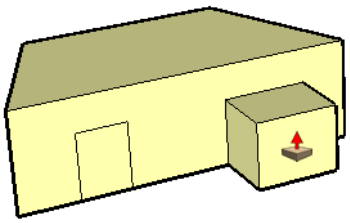
6. We want another rectangle on this face that has the same height. Hover over the corner point shown and move the cursor to the right to place the first corner point.



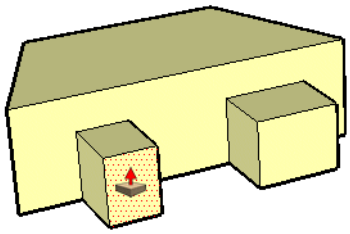
7. Click along the bottom edge to complete this rectangle.



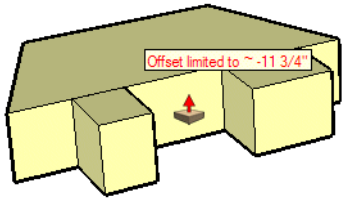
8. Use **Push/Pull** to pull out one of the rectangles.



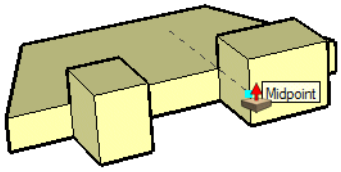
9. Double-click on the other rectangle - this pulls it out by the same distance you just used.



10. Now push the top of the trapezoid down. You can only go as far as the top of the box forms.

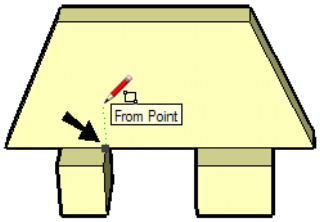


11. Use another **Push/Pull** to continue pushing this face past the boxes. You can use inferences while using **Push/Pull** - stop at the midpoint of the edge shown (or any similar edge).

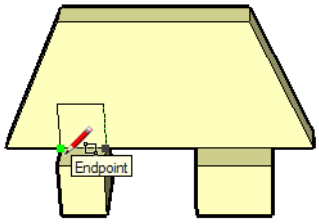


NOTE: *This is one example in which click-move-click is easier than dragging.*

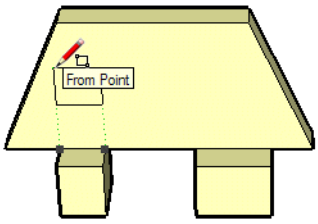
12. We will now draw two rectangles on the top of the trapezoid. Click to place the first corner in the green direction from the corner shown.



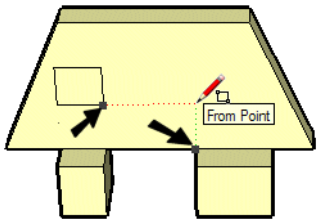
13. Hover over the other corner . . .



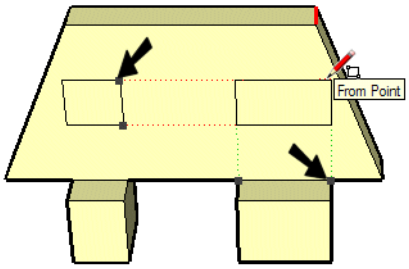
14. . . . and place the second corner point.



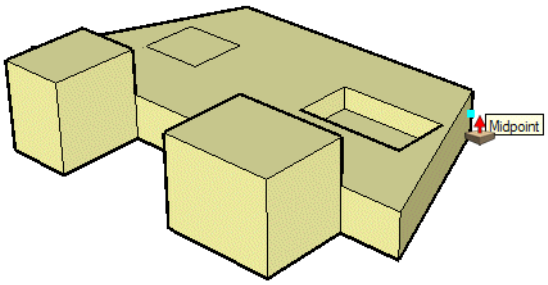
15. The second rectangle will use inferences from two existing lines. Hover over the two points shown, and click at their intersection.



16. Hover over the two points indicated to get inference lines for the second corner point of the rectangle.



17. Use **Push/Pull** to push in one of the rectangles.

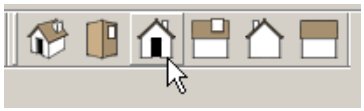


To push the other rectangle in by the same distance, you could double-click it. But this can only be done when you want to use the distance of the last **Push/Pull**. If you used **Push/Pull** somewhere else, then came back to the second rectangle, the distance you want is no longer stored.

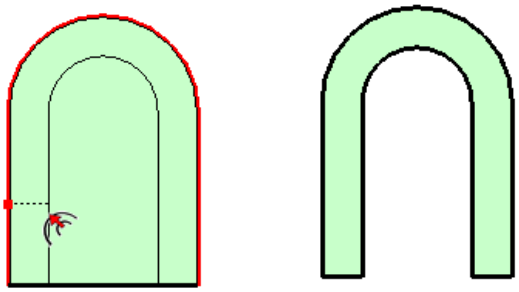
Intersecting Arches

This exercise is pretty straightforward - intersecting two arches that meet at a 90-degree angle.

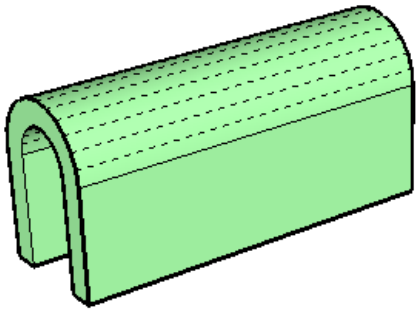
1. Start in a new file in **Front** view.



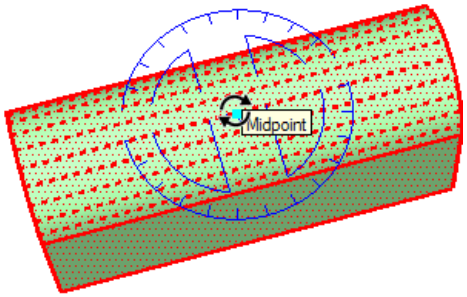
2. Use **Rectangle** and **Arc** to draw an arch. Select all edges except for the bottom one, and use **Offset** to create an inner arc. Then erase the bottom edge.



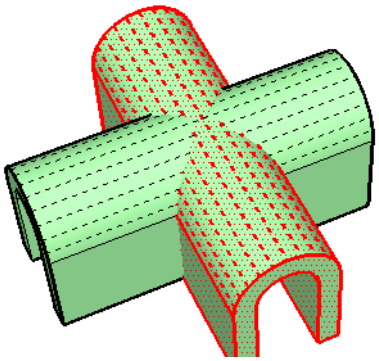
3. **Push/Pull** it out and display the hidden edges (**View / Hidden Geometry**). This is so that we will have a reference for copying and rotating.



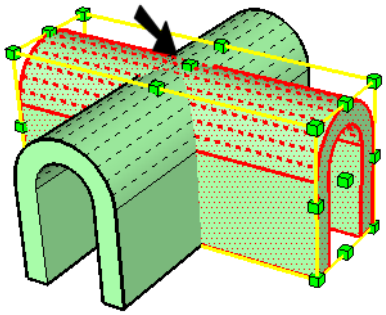
4. Select the arch and activate **Rotate**. Shift-lock the protractor to the red-green plane and place it at the midpoint of the top (hidden) edge of the arch.



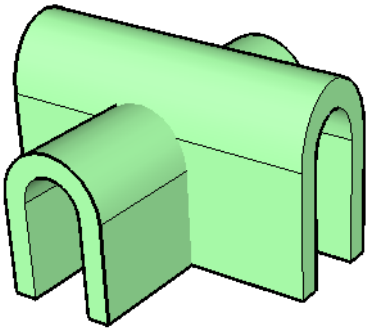
5. Press Ctrl/*Option* for copying, and set the rotation axis anywhere. Enter, or snap to, a 90-degree angle.



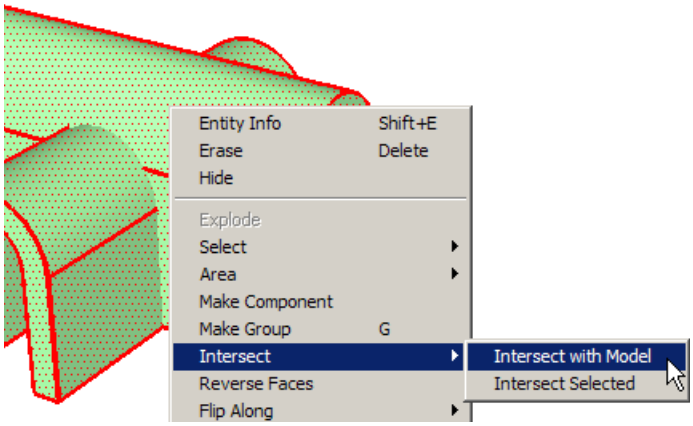
6. With the copied arch still selected, activate **Scale**. Drag the top center handle upward to create a higher arch.



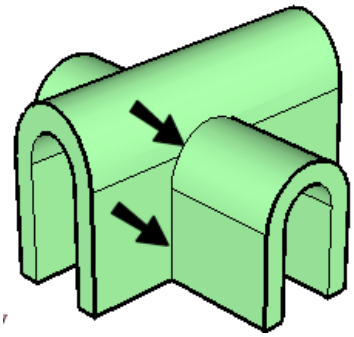
7. Deselect everything and hide the hidden edges. We want to cut the arch openings, but first we need the intersection edges.



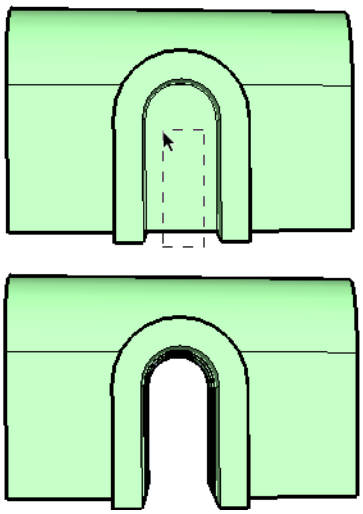
8. Select both arches, and right-click and select **Intersect with Model**.



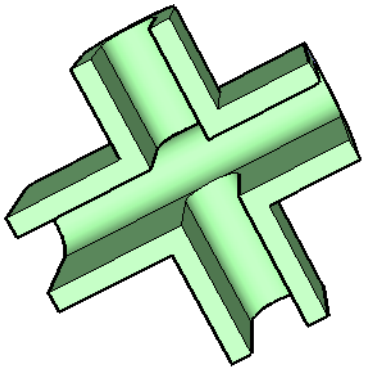
This creates edges where one object intersects with another.



9. To cut the openings, switch to a front or side view and use a right-to-left window to select and delete everything inside the shorter arch.



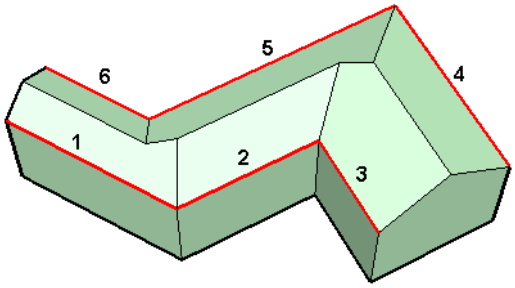
10. Do the same for the higher arch. This is how the model should look from the bottom (some cleanup may be needed).



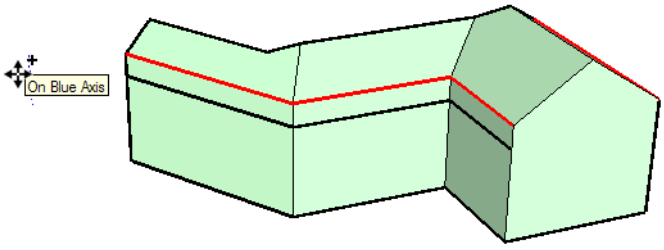
Overhangs by Moving Faces

Here's an easier and faster way to achieve similar results. This method works when all slopes are uniform.

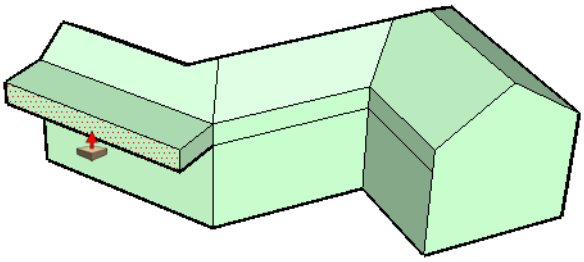
1. Open the saved file "RoofIntersections.skp." Select all six roof edges.



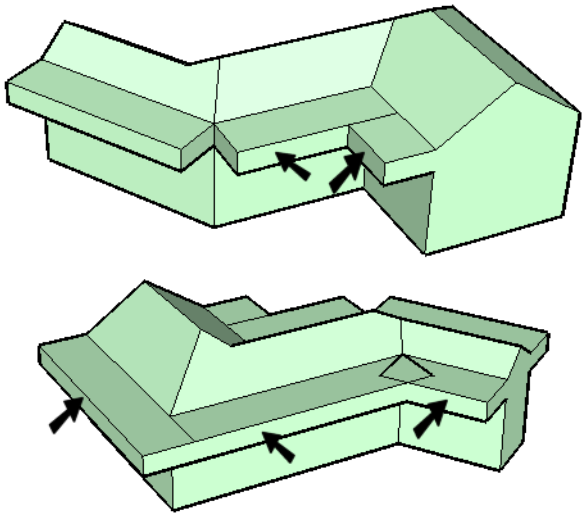
2. Copy the six lines down slightly.



3. **Push/Pull** one of the new faces outward.

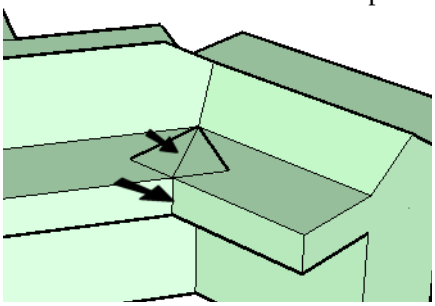


4. In **Push/Pull**, double-click the other five faces to pull them out the same distance.

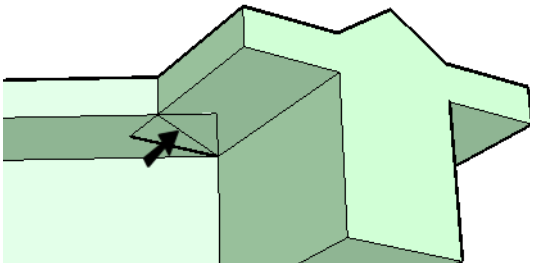


The 90-degree corners don't need to be fixed, but the diagonal ones do. We can either fix the corners now or later, so let's fix one now. Look at the inside corner - the one that overlaps.

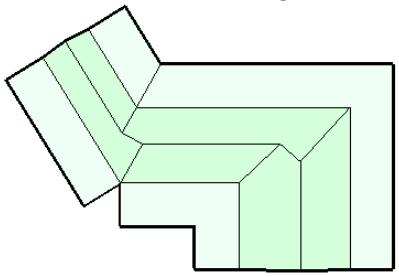
5. Draw two intersection lines on the top . . .



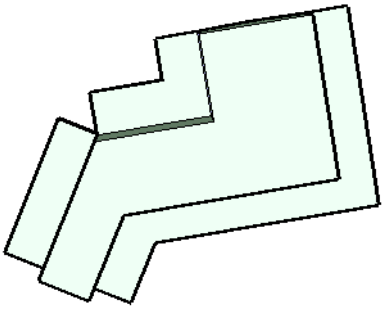
6. . . . and one on the underside.



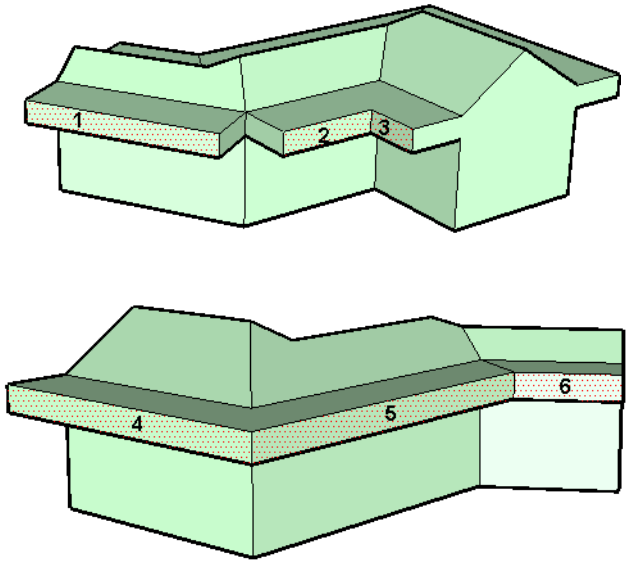
7. Switch to **Top** view and erase all extra lines. If a face is deleted, redraw one of its edges to recreate it.



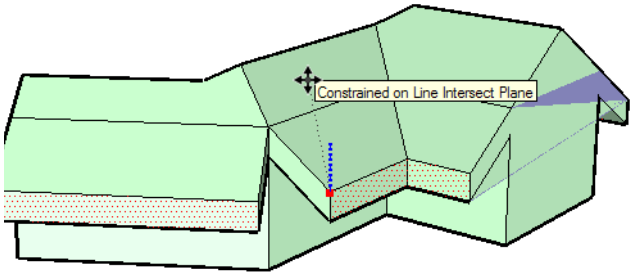
8. Erase extra lines on the underside as well. (Or switch to **X-Ray** mode so that you can see all extra lines without switching views.)



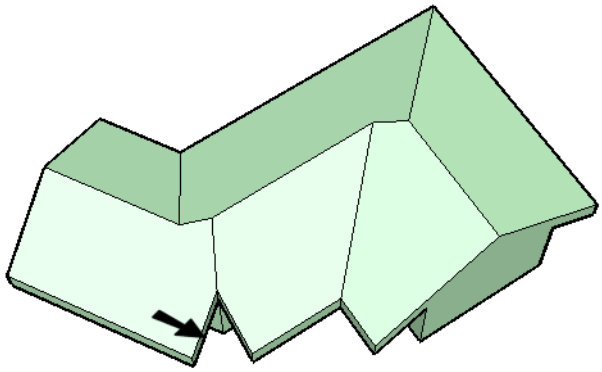
9. Now select the six vertical fascias.



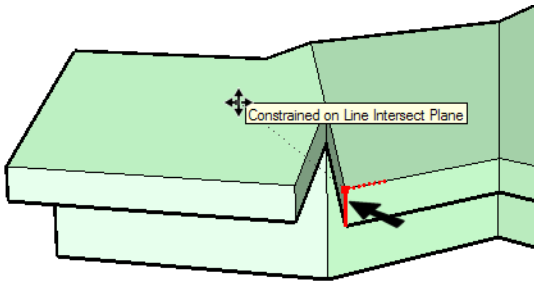
10. Activate **Move**, and click any point along the top edge of one of the fascias. Move the fascias in the blue direction, pressing Shift or the Up arrow key to lock them, and constrain them to the slope of the adjacent roof face.



11. Erase the extra lines on the now-continuous roof. There is only one corner left to be fixed

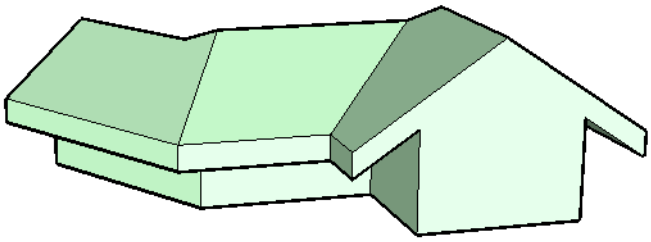


12. Select the edge shown and activate **Move**. Drag any point of this edge along the axis, and press Shift. Then constraint the point to the adjacent roof face.



13. Move the other edge of this corner to meet the corrected edge.

    Here's the whole house - fixed corner and all.

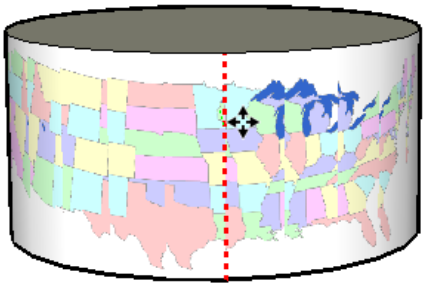


You have now created a continuous overhanging roof using a pretty small number of steps. The difference with the result here is that the fascias are all vertical; in the previous exercise the fascias are at right angles to the roof planes.

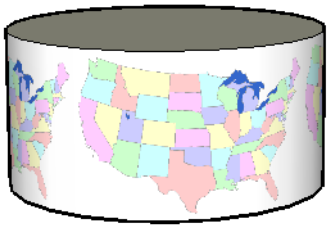
Curved Faces

1. Continue in the same file. Draw a cylinder and apply the picture to it. (Use the thumbnail from the **In Model** tab of the **Materials** window, not the sampled skewed texture from the cube.) The image wraps smoothly.

2. Use **Move** to resize the cylinder. Now the image is no longer smooth. This is because the image is actually applied to each planar segment separately.

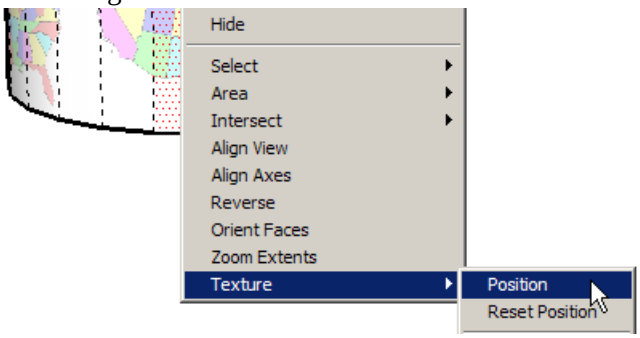


3. It's easy to fix this - just remove the image by painting the cylinder with the Default paint, then reapply the image.

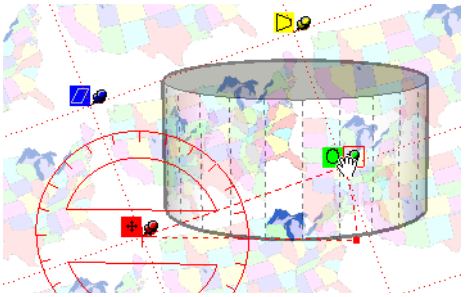


The picture wraps smoothly, but you cannot right-click on the face to access texture positioning.

4. To change the orientation or scale of the image on a curved face, first display hidden edges (**View / Hidden Geometry**). Then right-click on any of the face segments and select **Texture / Position**.

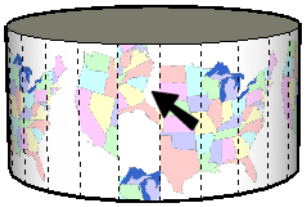


5. You should see four pins, each with a different color (this is **Fixed pin** mode). If you are in **Free pin** mode (four yellow pins), switch modes by right-clicking and selecting **Fixed pins**. Drag the green pin to rotate the picture.



NOTE: *Texture positioning is covered in-depth in* Google SketchUp 6: Advanced Exercises.

Right-click and select **Done**. Only the edited segment has the rotated picture.



6. Sample the rotated image, and turn off the hidden lines. Then apply the texture to the cylinder - the rotated picture wraps around the whole cylinder.