ArcGIS 10 – 3D Analyst Extension
Creating 3D Textured Buildings from 2D Footprints

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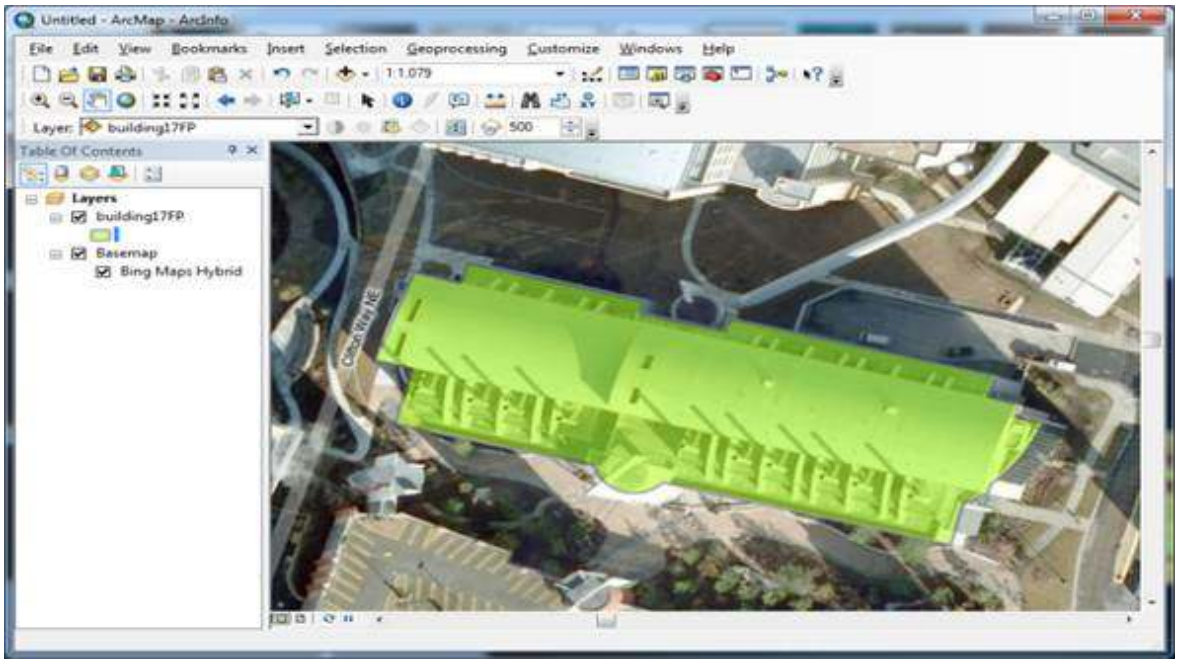
There are five main topics to be covered for creating a 3D building with textures.

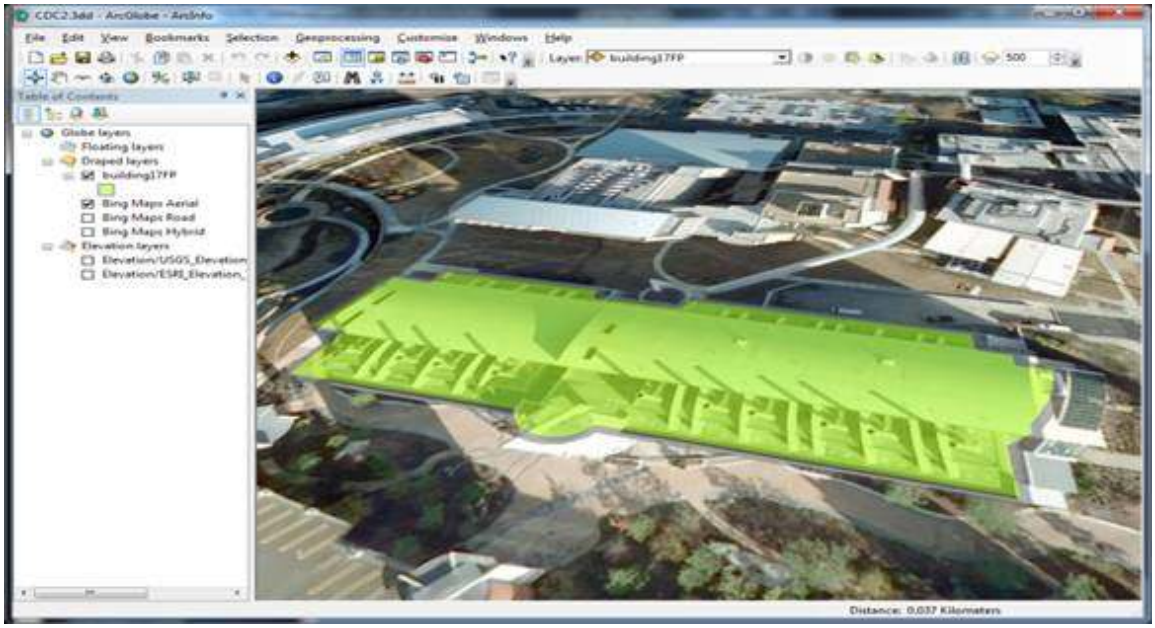
A. **Convert a 2D Footprint in ArcGIS to a Sketchup Model.**
B. **Research the building by gathering building measurements and information about the building.**
C. **Model the building in Sketchup.**
D. **Create building textures.**
E. **Replace the ArcGIS multipatch's geometry with the new Sketchup model's geometry.**

A - Convert a 2D Footprint in ArcGIS to a Sketchup Model.

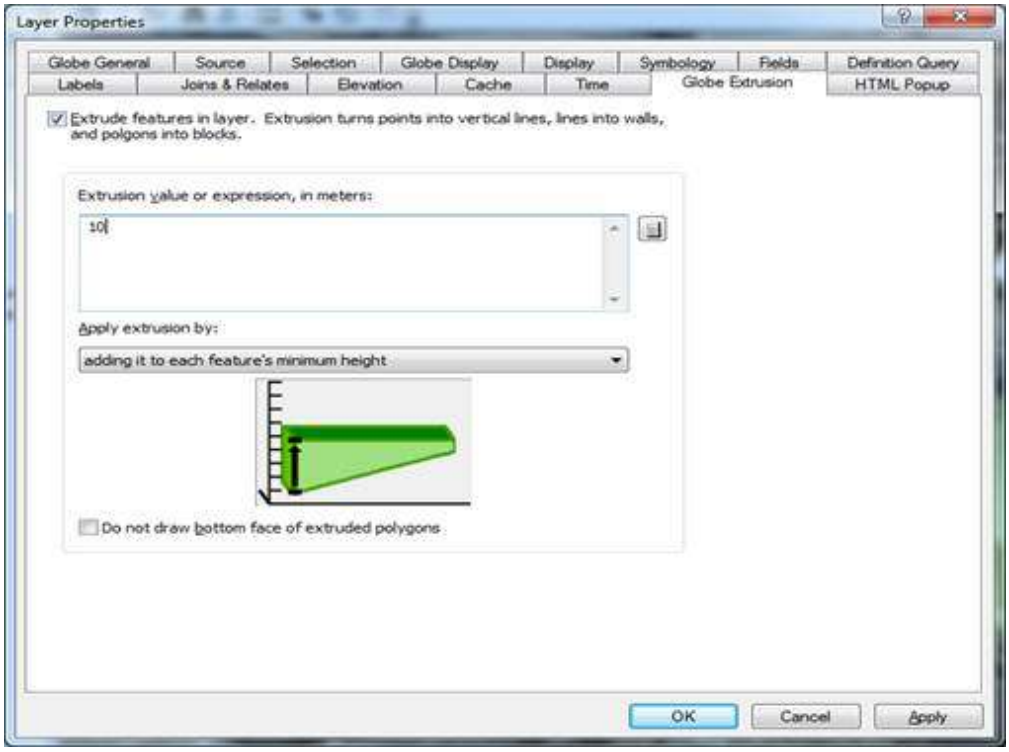
Digitize the 2D footprint in ArcMap. Its highly recommended to use a coordinate system that has the same units for X, Y, and Z (ie a UTM zone with Z's in meters). Imagery can be used as reference. Note – In ArcGIS 10, you could now could also edit in 3D in ArcScene or ArcGlobe. For multiple buildings, keep them as separate features in the same featureclass.

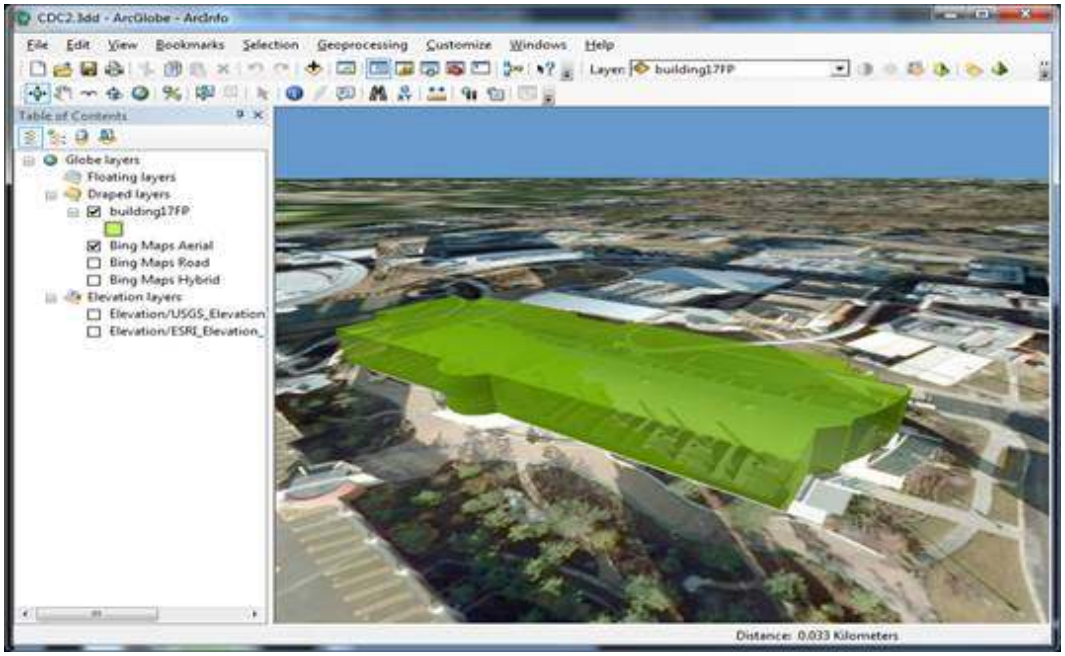


Add the 2D polygon to ArcGlobe.

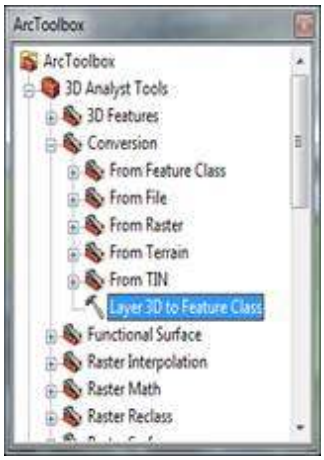


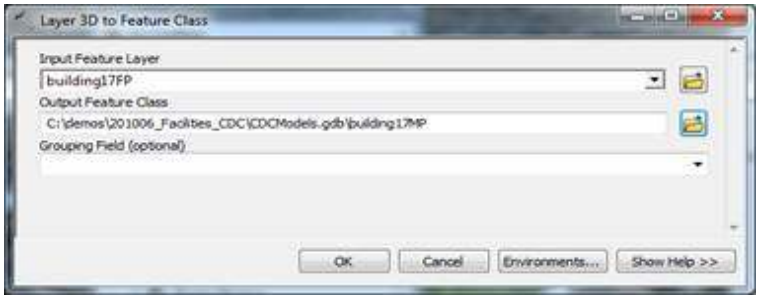
Set the symbology to extrude by a height in meters. Ideally, if you already know the building height or number of floors you could use that as a reasonable approximation.



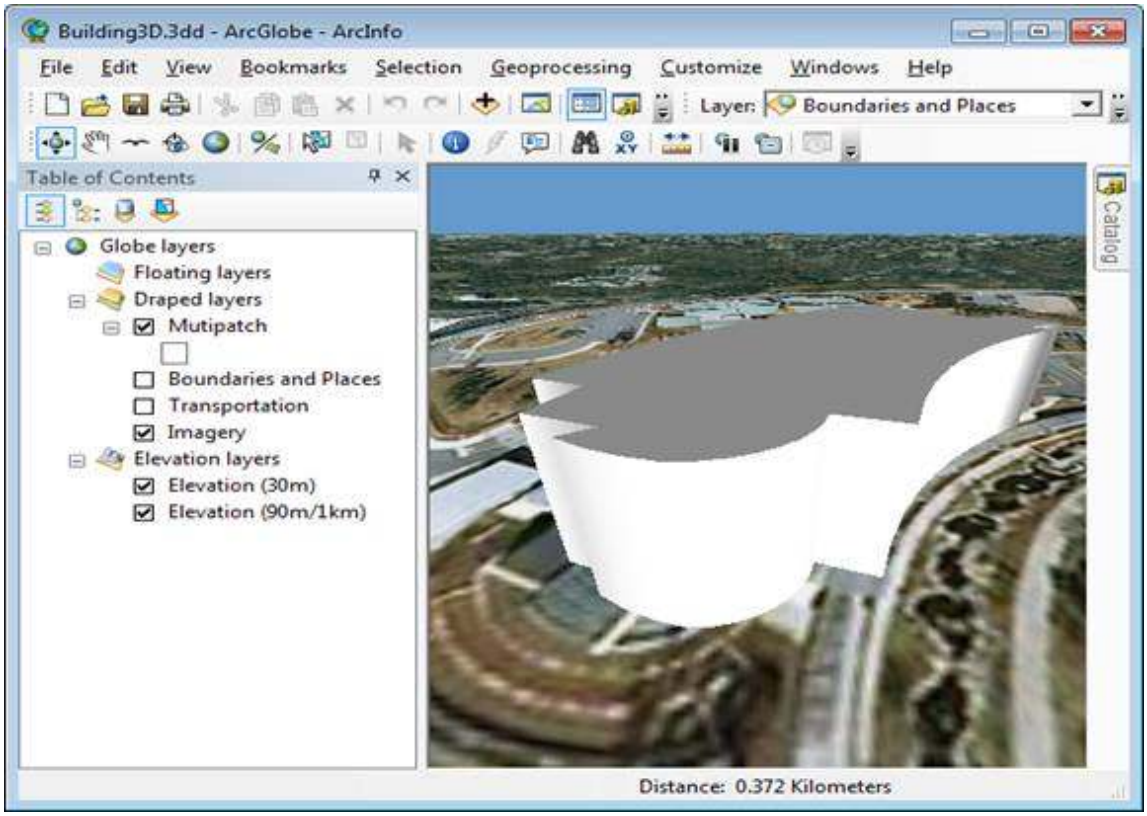


Convert to Multipatch with the 'Layer to 3D Feature Class' Tool. This is a new tool at ArcGIS 10.



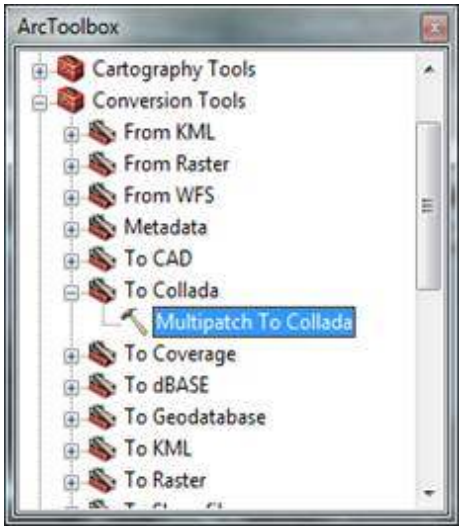


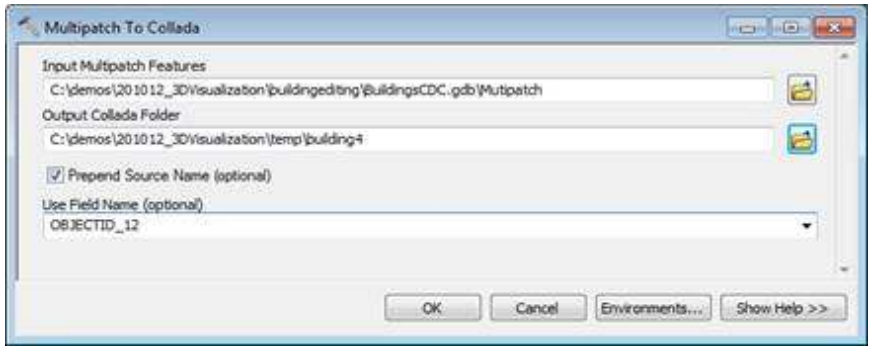
The output Feature Class should be in a file geodatabase. This tool creates a multipatch type of Feature Class, which is a true volumetric shape. If you do not see the multipatch in ArcGlobe go the layer type view in the ArcGlobe table of contents and change the type for the new multipatch to 'draped'. Then right click on the multipatch and refresh it – it should now appear. Although it looks just like the extruded polygon, you can optionally confirm it is a multipatch by going to the source datatype property. Note – we will edit this multipatch later….



Convert the Multipatch to a Collada file using the 'Multipatch to Collada' tool.

The output is a folder containing a kml pointer to a dae collada model. Check off 'Prepend Source Name' to make the collada name easy to understand.

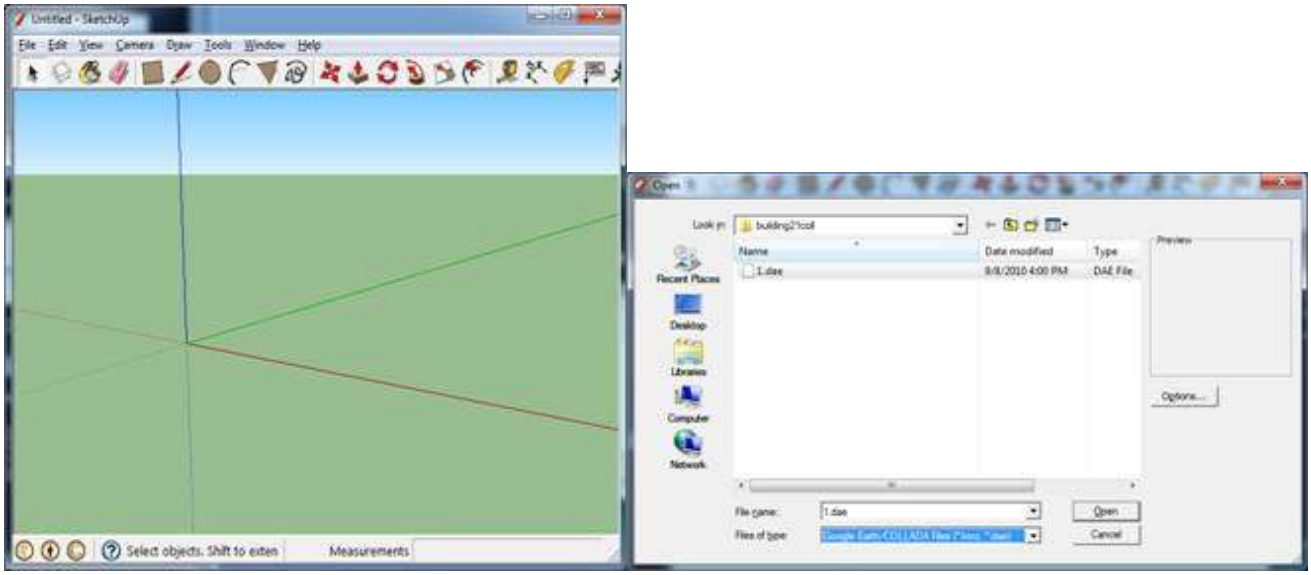




A note on Collada (.dae) files. Collada is a 3D format compatible with Google Earth and Google Sketchup. They can be opened, edited , and exported with Google Sketchup. Textures can be added to them. They can replace an existing multipatch within a 3D Edit session in ArcGlobe. Many .KMZ files are of 3D buildings that are zipped containers with a .dae file inside.

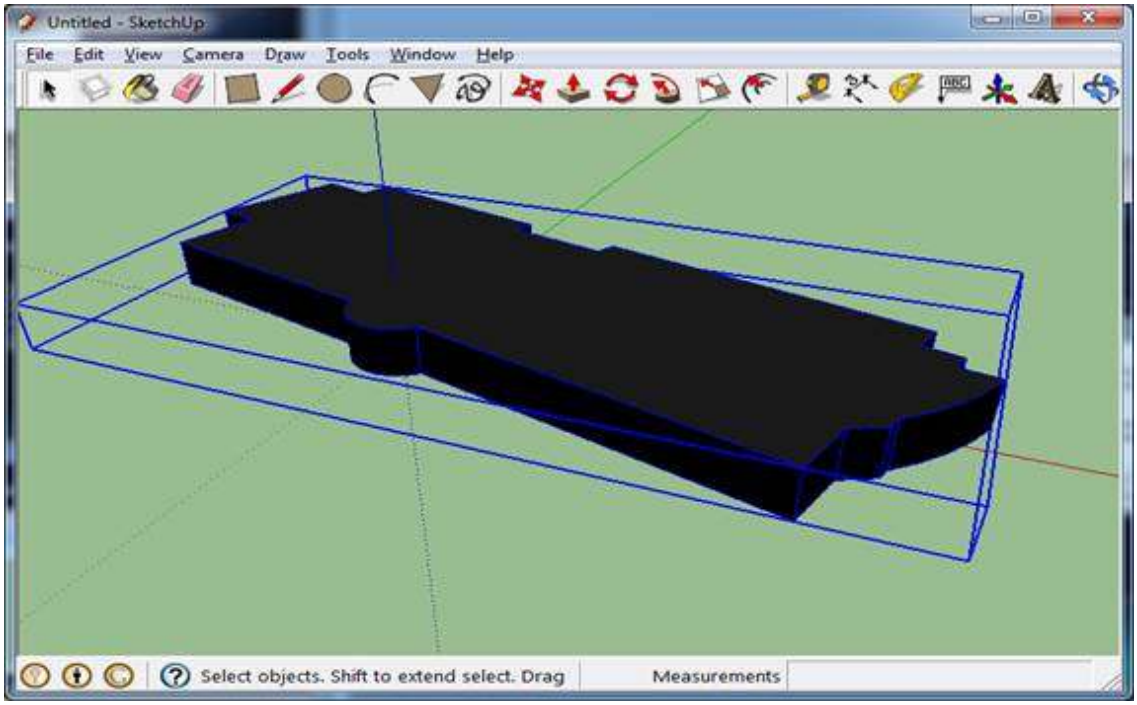
Open Sketchup 8 and Import the Collada Model.

In Sketchup use file / import to bring it in.

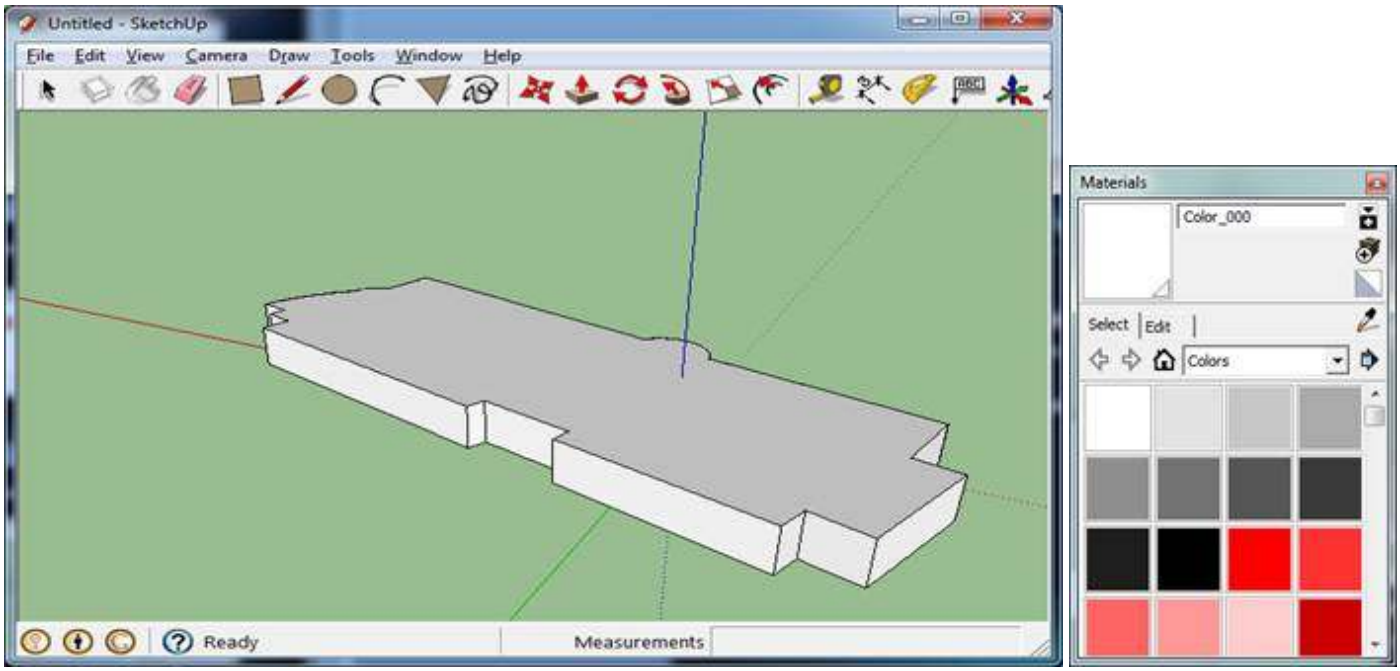


If you get an error like below, click past it.

The Result is a new Sketchup Model. It is actually a single “component “ (a sketchup concept). The faces are colored black by default.

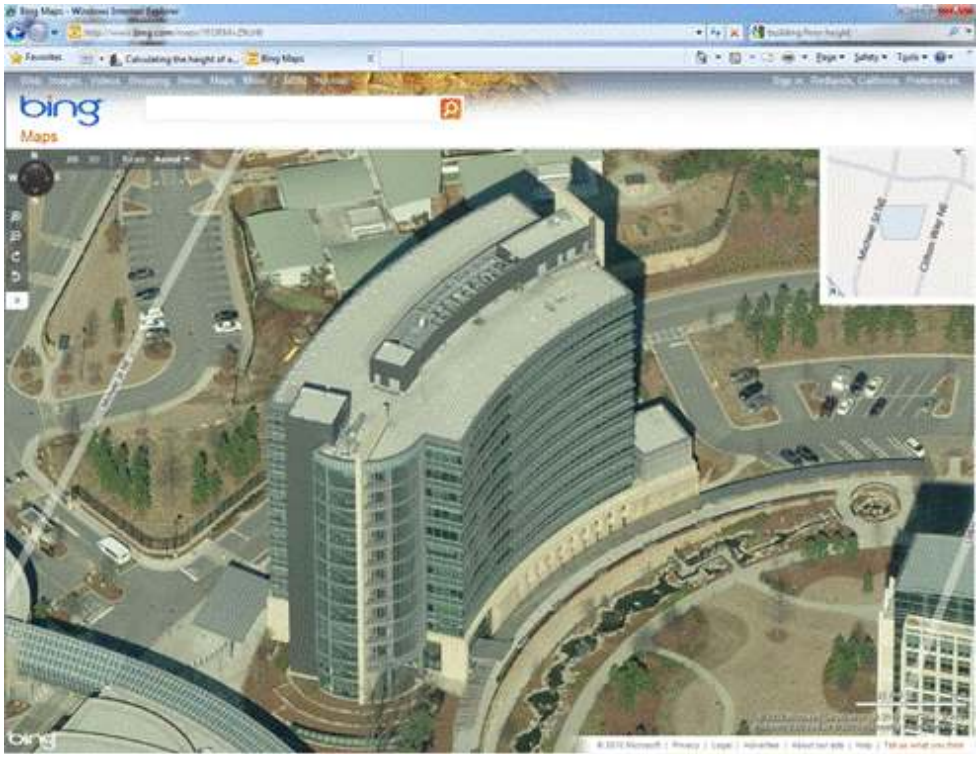


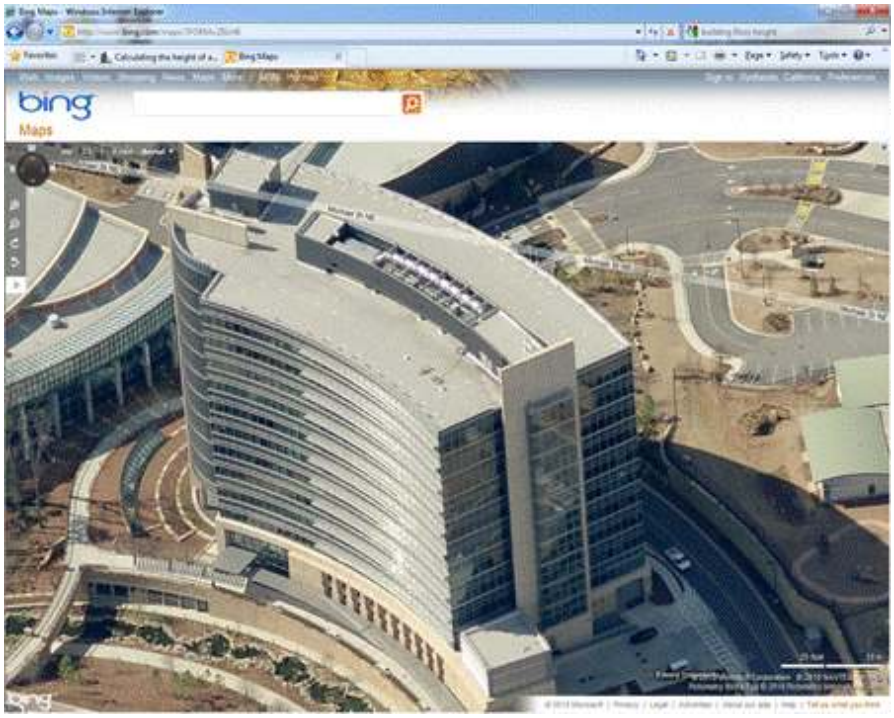
Explode the model and color the faces. Right click the component to select it, and choose explode so you can edit the faces. Use the paint bucket tool to color each face white so you can see them.



B - Research the building by gathering building measurements and information about the building.

For example, here is BING oblique imagery for two sides of building we want to model at the CDC in Atlanta.



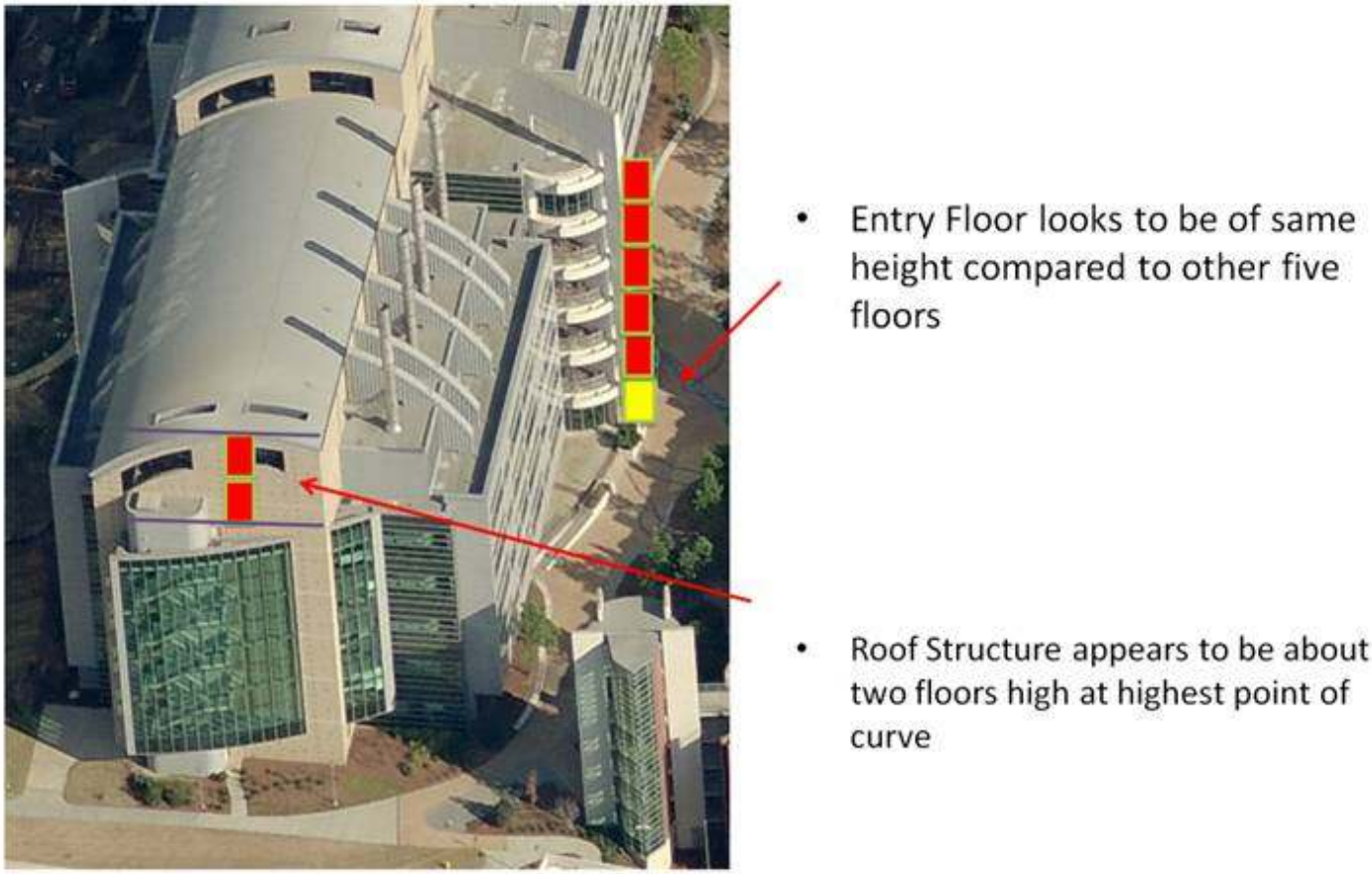


We need to understand out building and the shapes and surfaces that it is comprised of. We need to determine the real world size of the building. We have a 2D footprint already. We need to also know the Z height of each section, as well as the 3D shapes that come together to comprise the shape. Think beyond a simple 2D extrusion and consider shapes like arches, towers, tunnels, roof variations, balconies, and domes. Also, note that each surface can be a different texture or color such as gray concrete, green windows, or brown brick.

It might help to look at the website for the Council on Tall Buildings and Urban Habitat:

http://www.ctbuh.org/HighRiseInfo/TallestDatabase/Criteria/HeightCalculator/tabid/1007/language/en-US/Default.aspx

There are several charts for calculating the bulding height in relation to the number and type of floors.

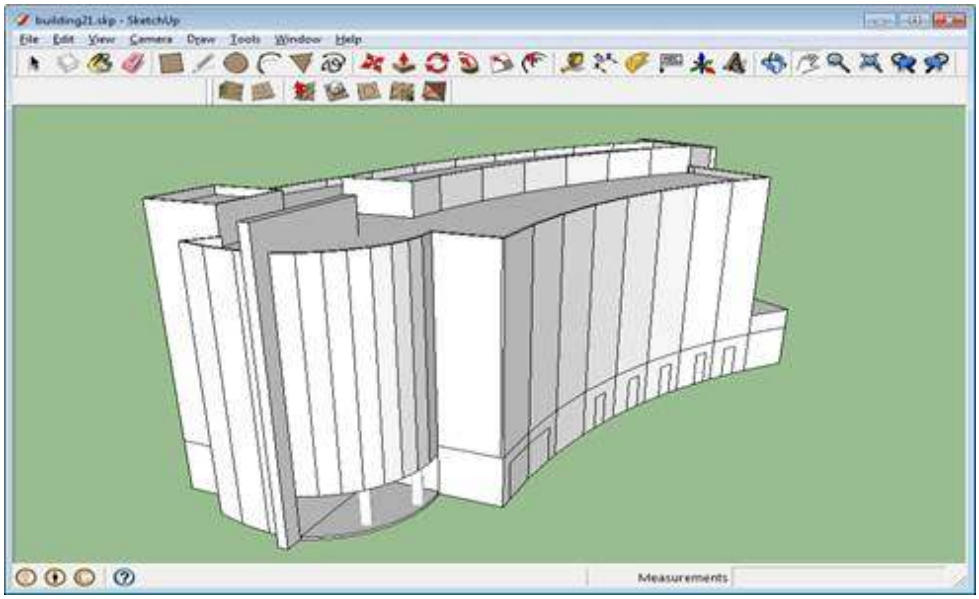


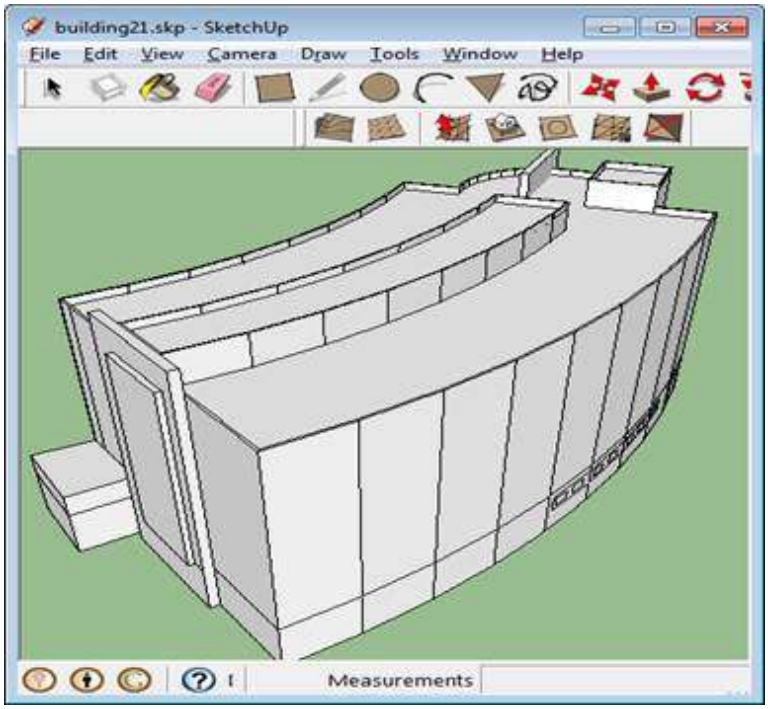
In sketchup create “construction lines” (Sketchup concept) to show height breakpoints.

Consider all the sides of the building to fully understand the geometry and components that will need to be modeled. For example, the green wedge shape below could be extruded horizontally for create a roof component, and the blue face face could be extruded vertically to create the wing on the end of the building.

C - Model the building in Sketchup.

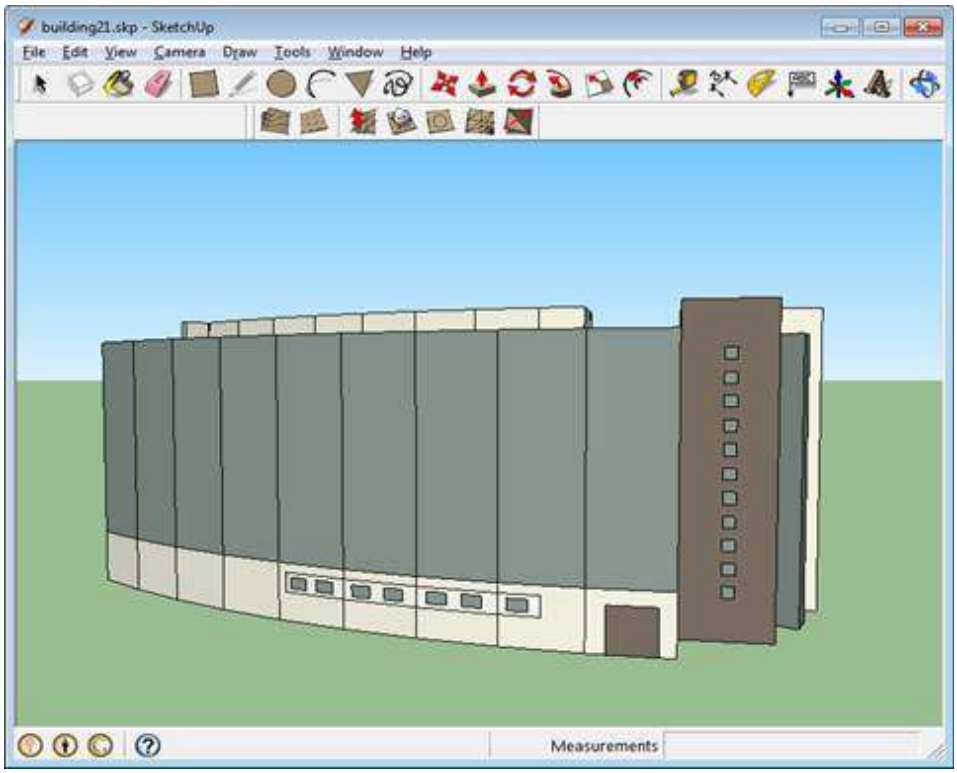
Learn how to use Sketchup, especially the strategy of using components, using construction lines, extrusion, and inference. There are many instruction videos on the sketchup website. Extrude and create buildings using separate components using correct heights and distances for realism. Assemble components into the final building. Here is a completed model that has yet to be textured.

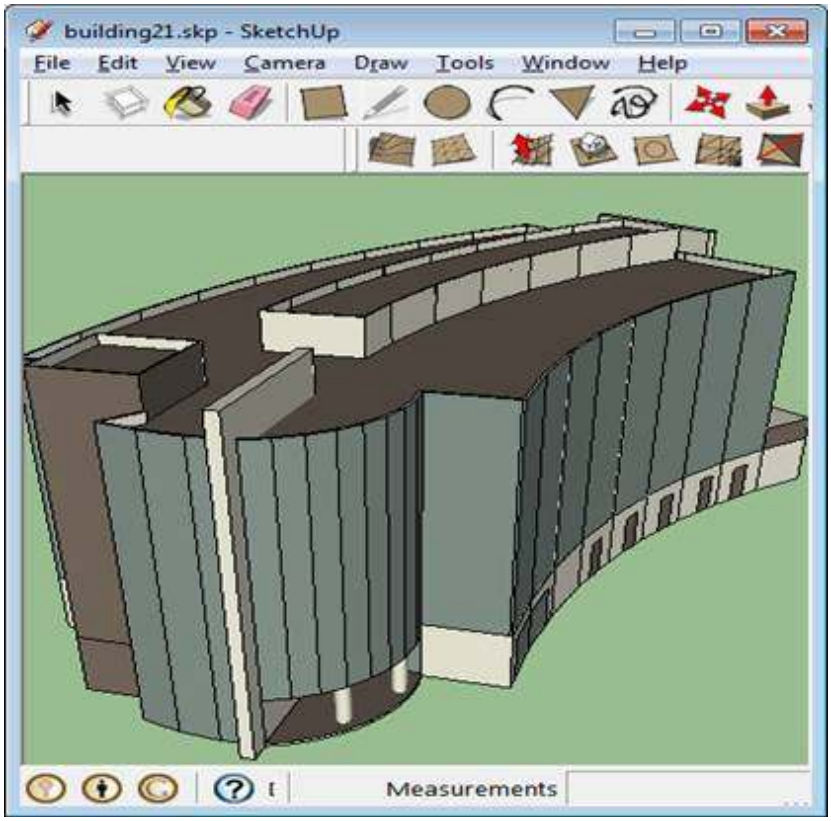




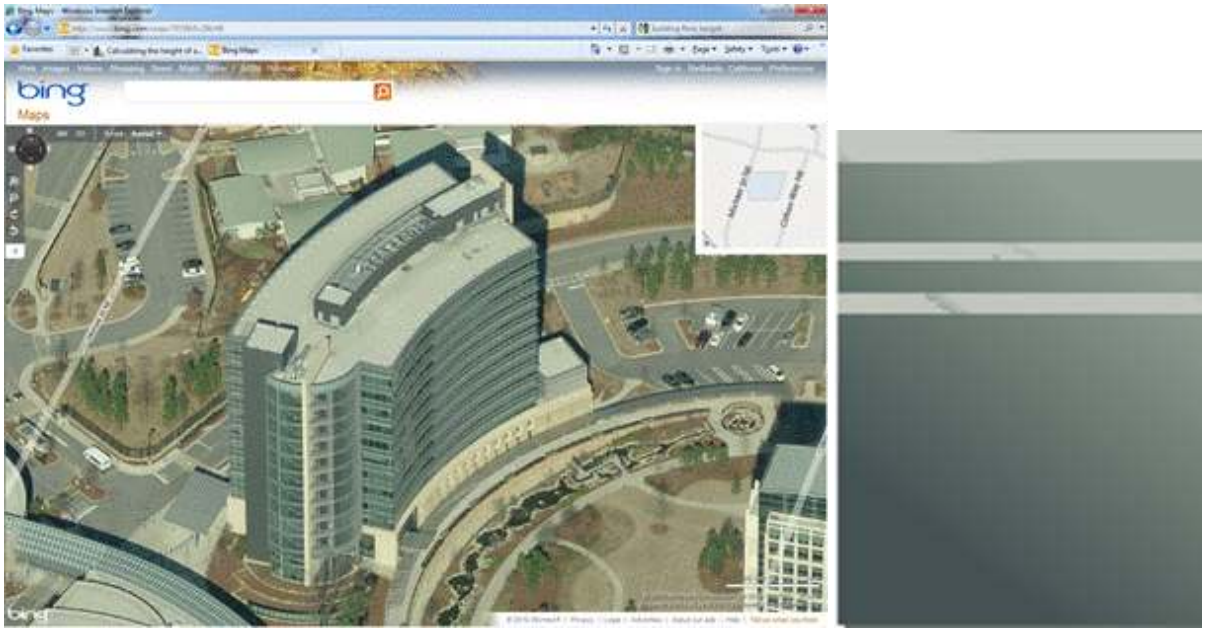
D - Create building textures.

View Imagery to determine non-solid surface patterns. Color all solid surfaces with the Paint tool.



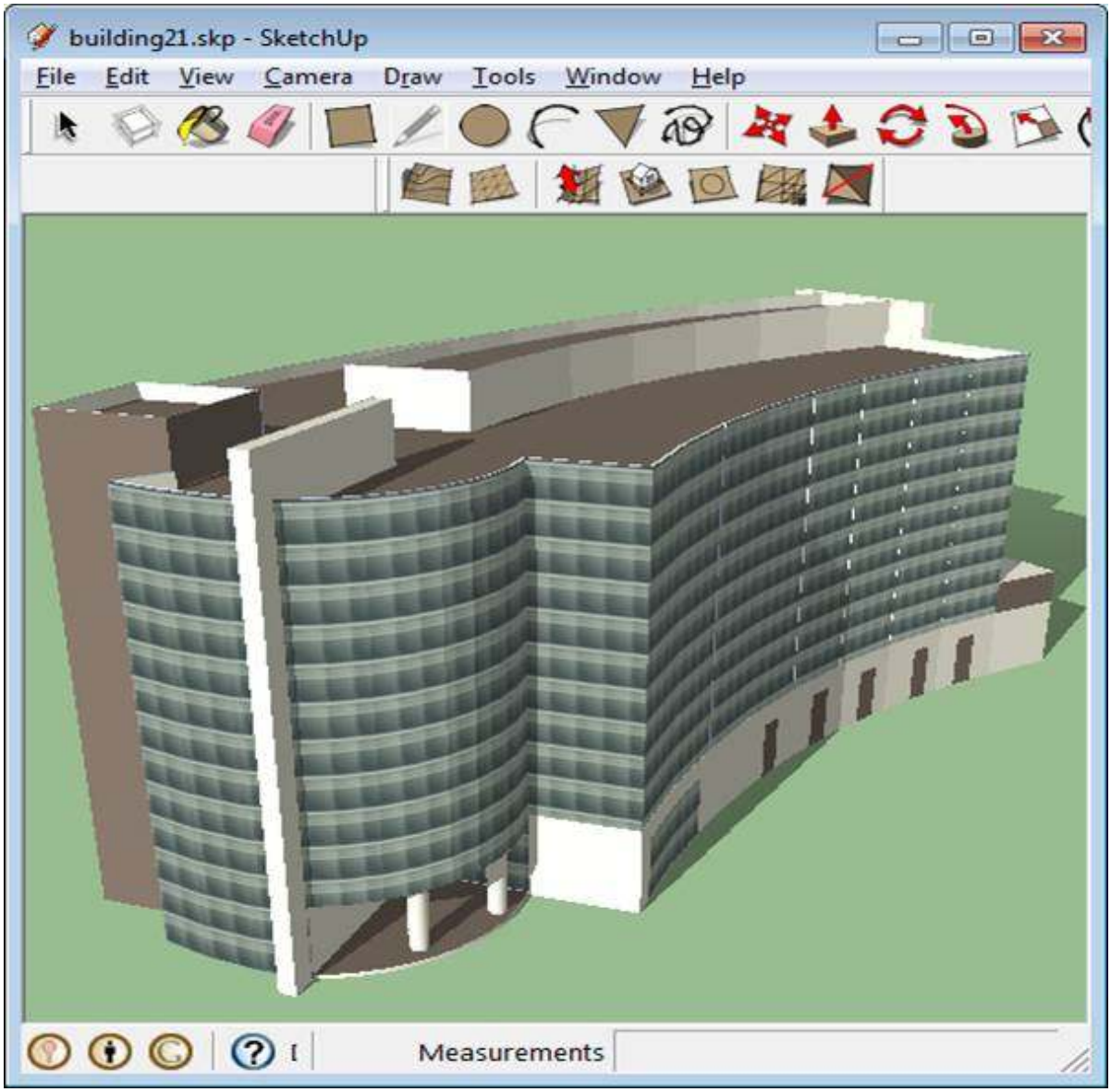


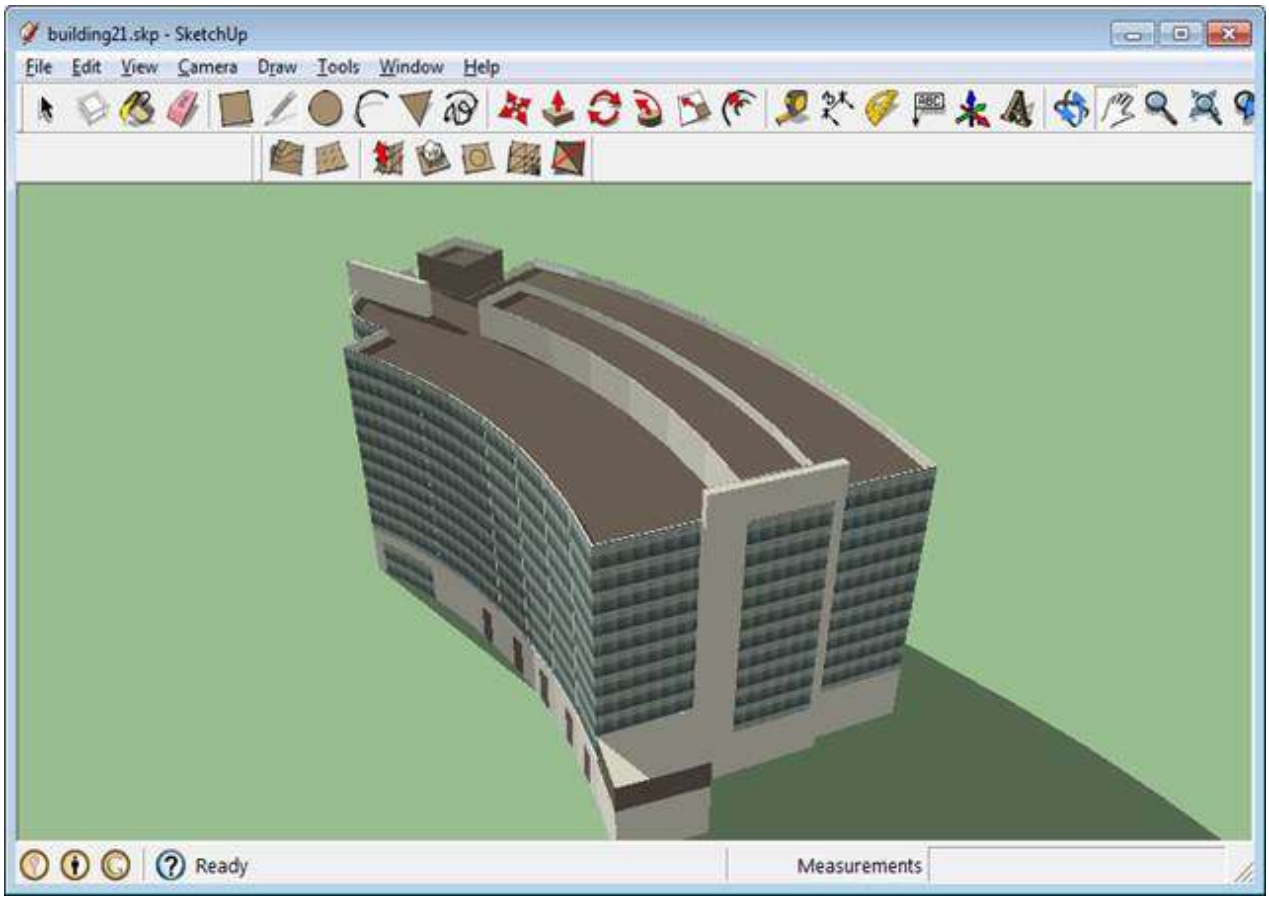
Identify as few custom textures as Needed. This building example only needs one texture for a green /gray modern window. It was drawn in GIMP by hand and inferred from a section of the building photo. This is a preferable method to photo draping for stylized buildings. Reality is simplified and cartographically presented. The file size is also smaller.



Here is the final model with the single window custom texture positioned and scaled correctly. This building took roughly 3.5 hours to model the shape, and a half hour to design the single custom texture. The modeler was an intermediate sketchup user who had made other buildings in the past.

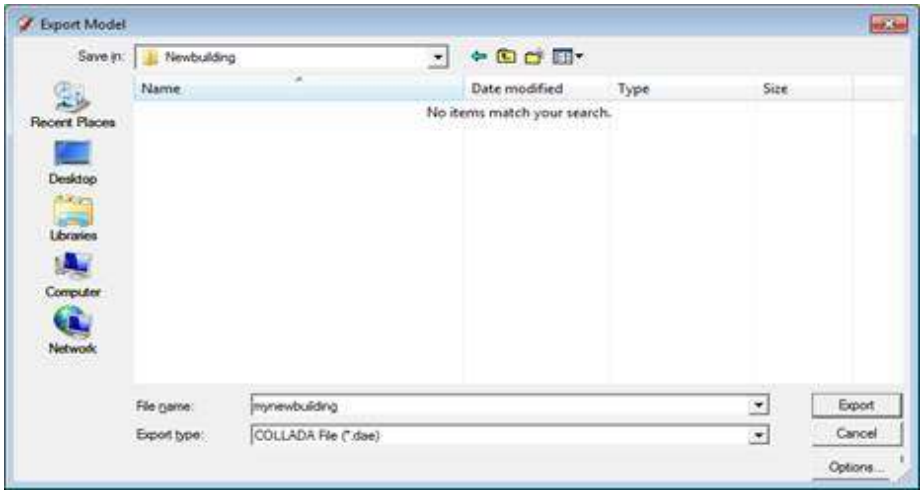
This building is distinct enough to model in detail, and a city of one million people might have 20 – 30 such buildings to create.



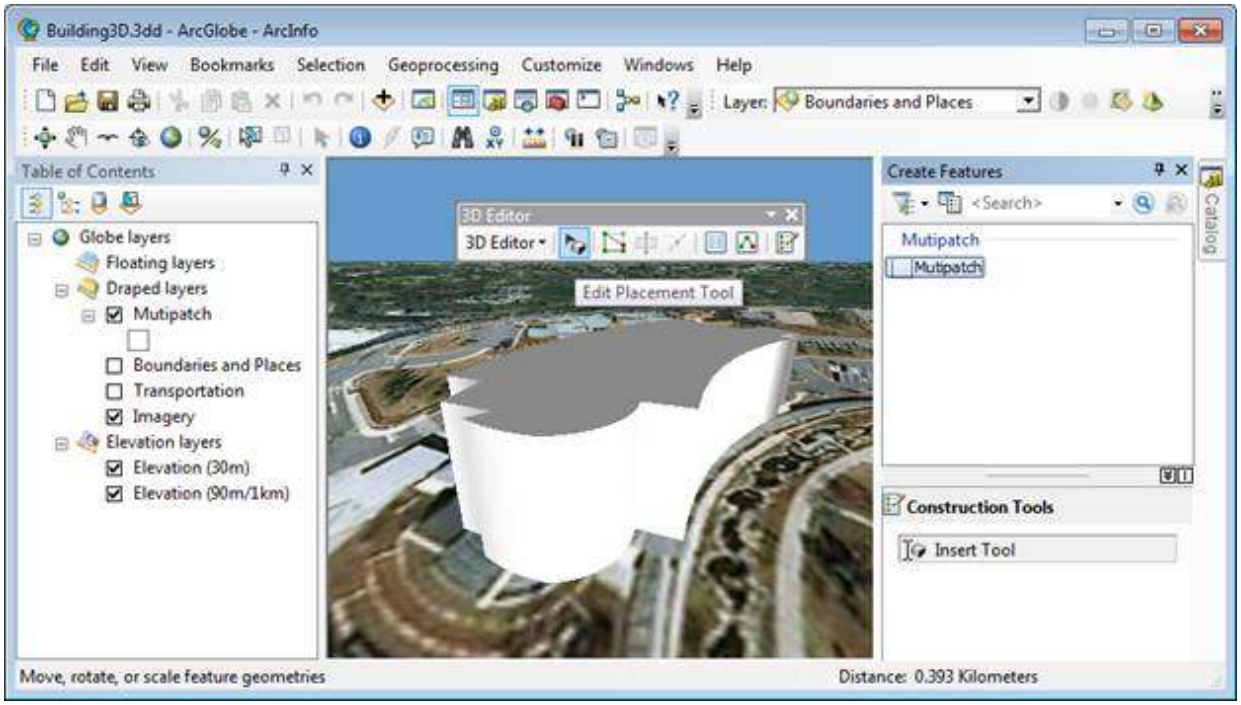


E – Replace the ArcGIS multipatch's geometry with the new Sketchup model's geometry.

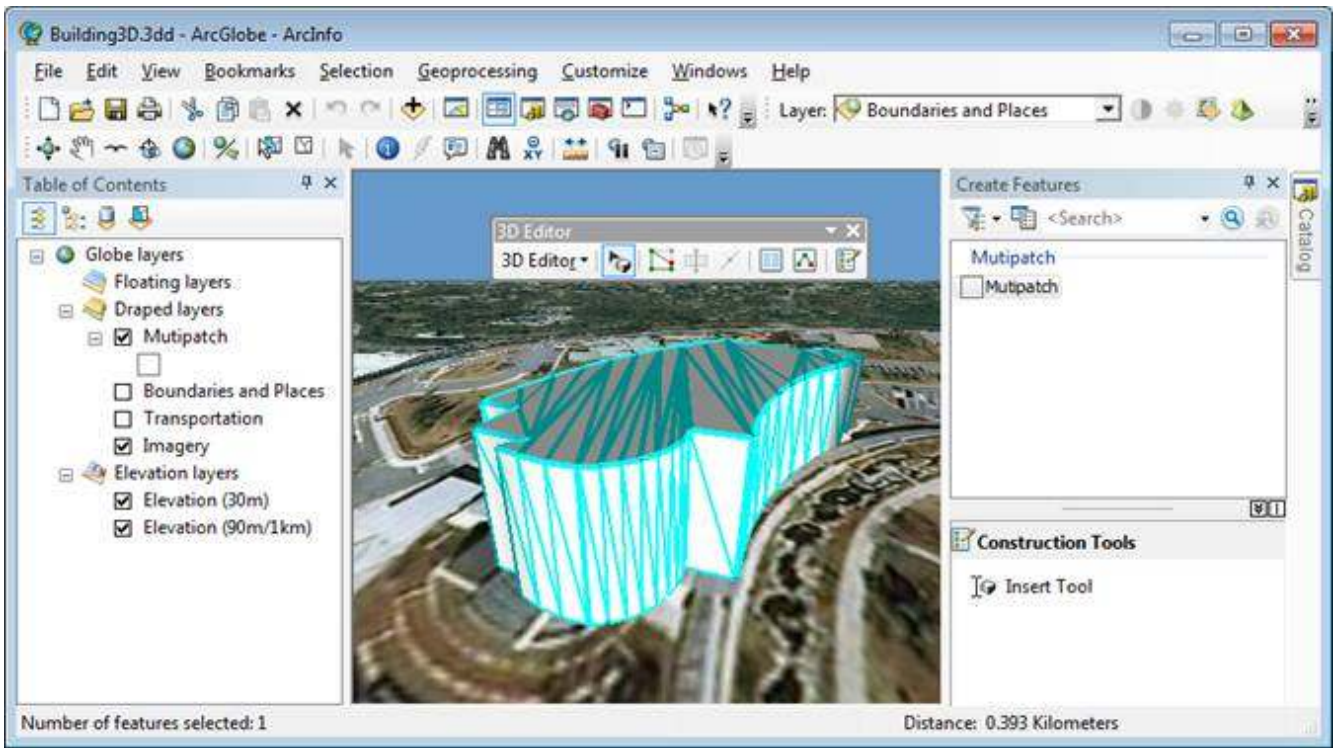
In Sketchup export the model as a new Collada file. Use export 3D model to .dae collada format.



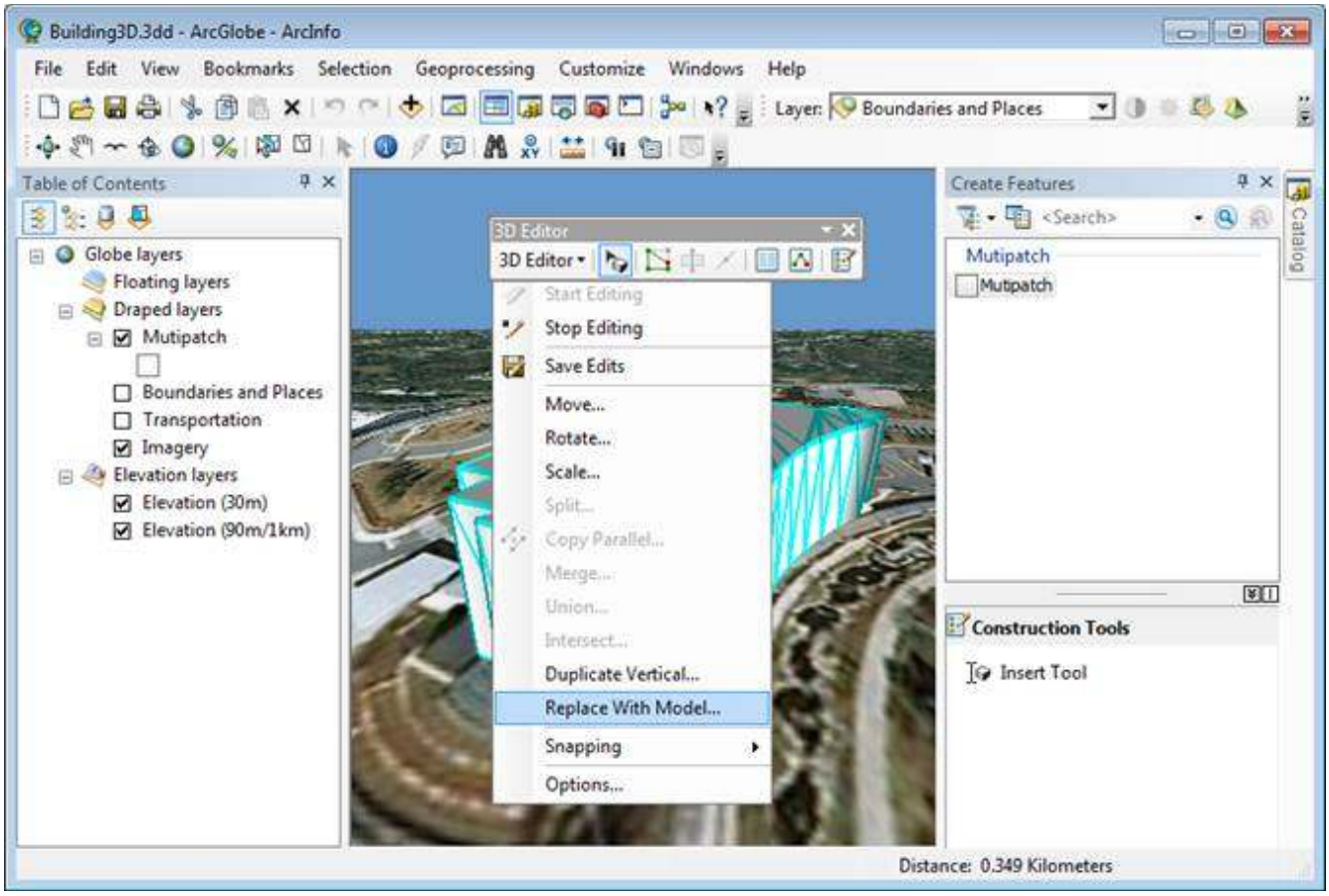
Start editing in ArcGlobe and choose the Multipatch featureclass we created earlier as the featureclass to edit. Click on the Edit placement tool on the editor toolbar.



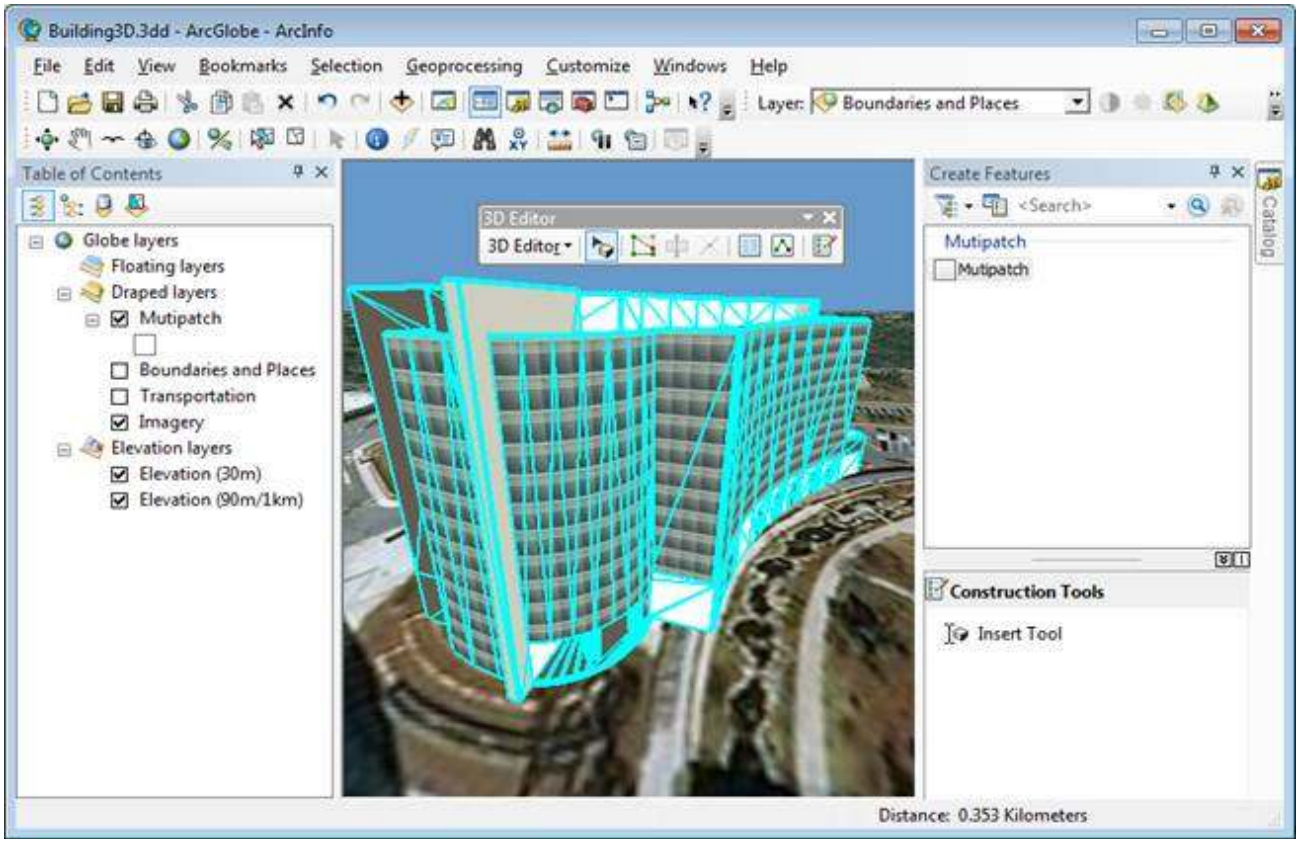
Select the model with the edit placement tool.



Choose replace model from the editing toolbar dropdown.



Choose the collada .dae model.

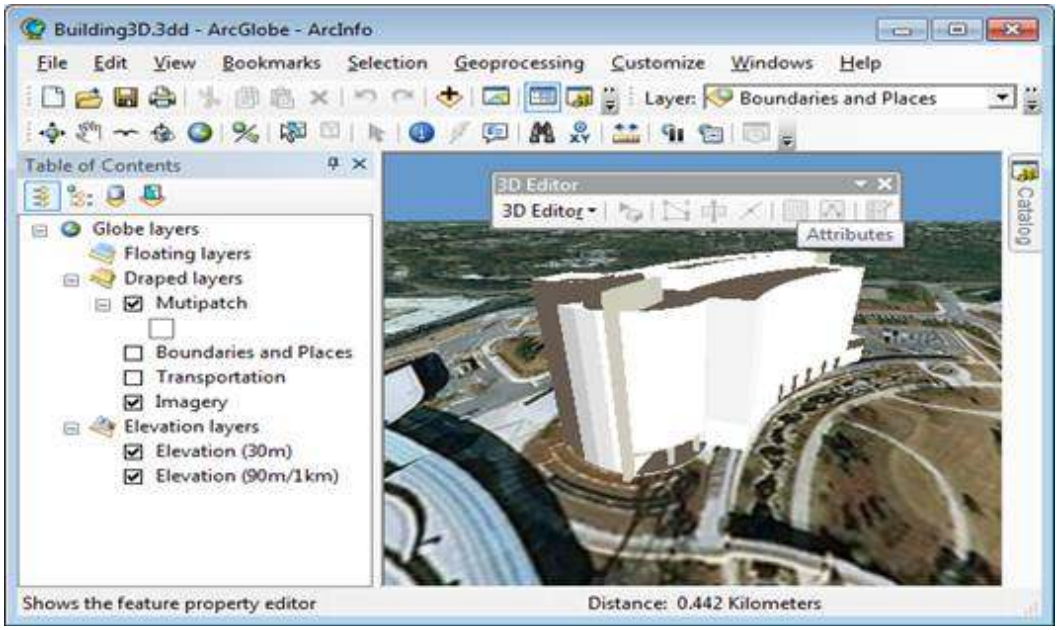


The centroid of the imported model is used to position the new (imported / updated) feature geometry, so if

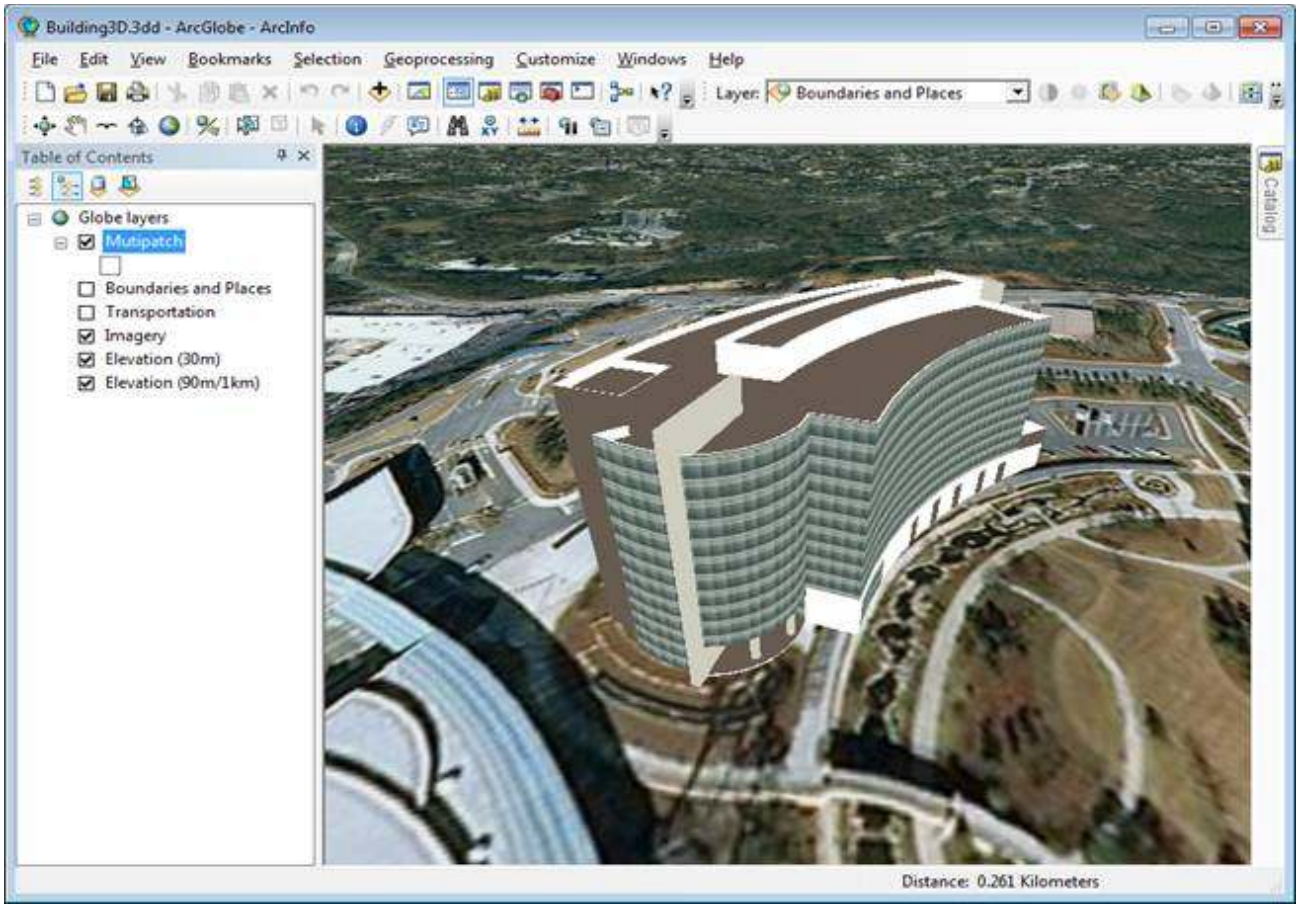
the user changes the overall footprint of the model in SketchUp (eg: they add a new wing, or a garage) then they will see the model “jump” or “move” when the import the new model. Users will then need to interactively move the feature to its correct position.

The “Replace model” action is also undoable within the edit session, so users can always undo the import (or not save their edits).

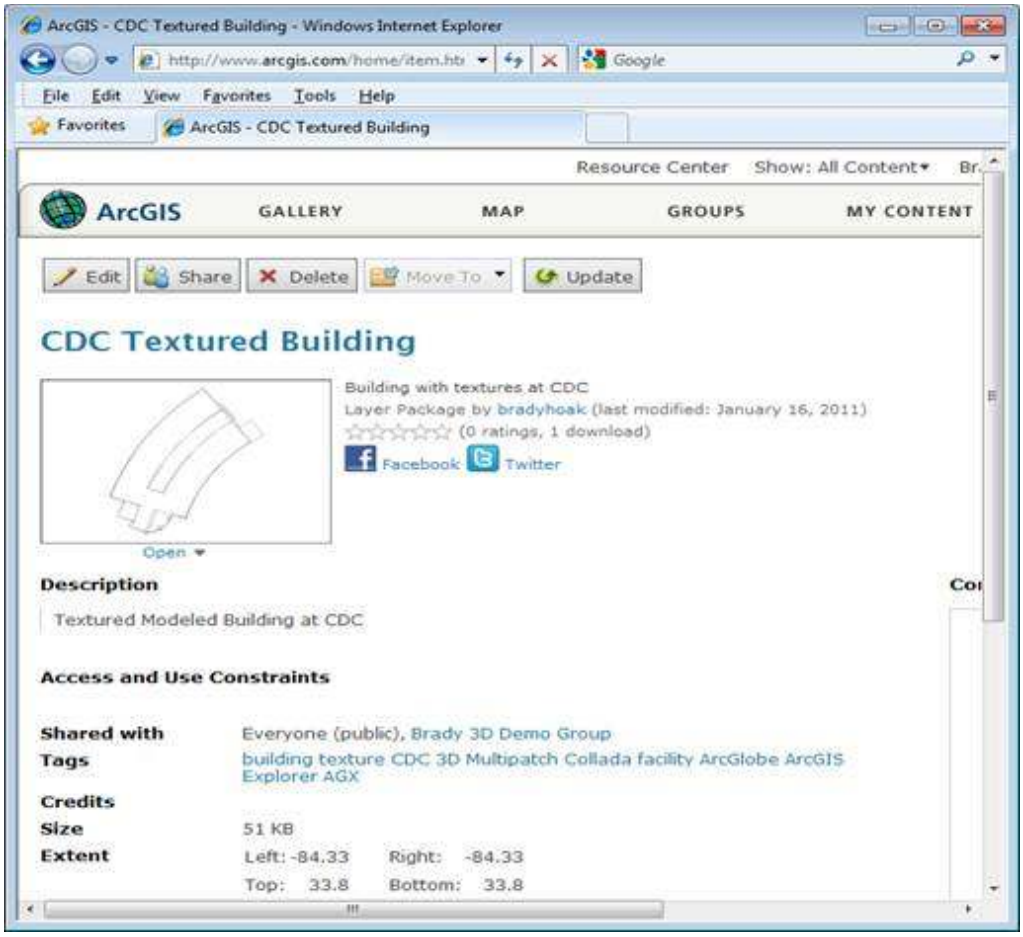
Stop editing, and save edits. You might notice the textures disappear.



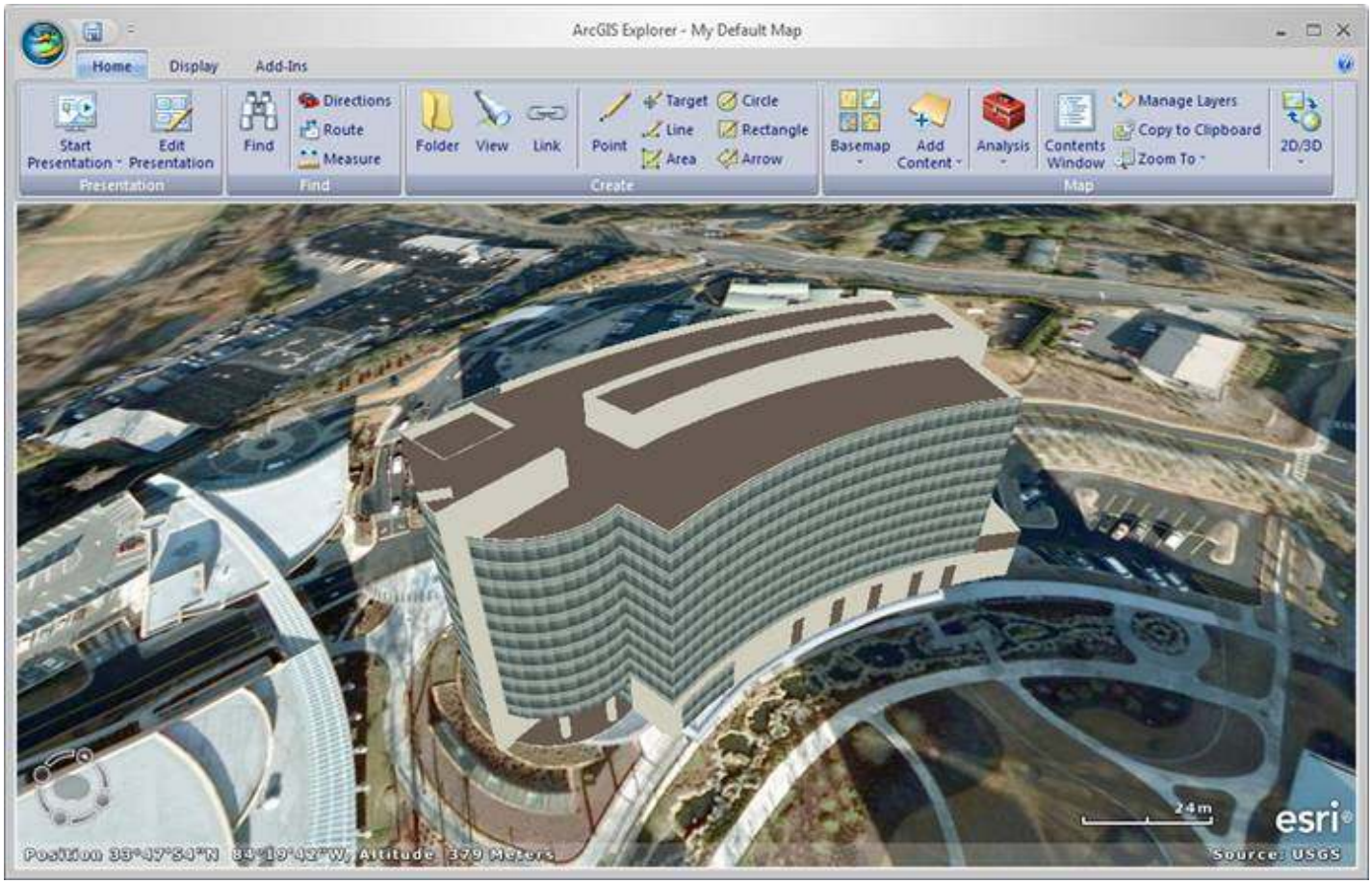
Refresh the layer (right click on layer) and you will see the textures. All done!



You could then share the model on ArcGIS.com as a layer package. This building is currently shared there. Right Click on the Layer in the Table of Contents to Share as a Layer Package on ArcGIS.com. Others can then find it on ArcGIS.com, download it, and use it in ArcGlobe or ArcGIS Explorer.



Here is the building layer package in another users ArcGIS Explorer client, after being discovered on ArcGIS.com, and downloaded directly into ArcGIS Explorer.



For more information on 3D and ArcGIS please visit the Esri Resource Center for more information at http://resources.arcgis.com and click on 3D GIS.