



Google SketchUp

Google SketchUp is a 3D Modelling program which specialises in making computer generated representations of real-world objects, especially architectural, mechanical and building components, such as windows, doors, furniture and vehicles.

Using SketchUp

Most of the tools needed in order to build 3D Models in SketchUp are provided in the toolbar at the top of the screen. Additional tools can be accessed by opening the View menu, then the Toolbars drop-down, and selecting the Large Tool Set.

The Tool Set

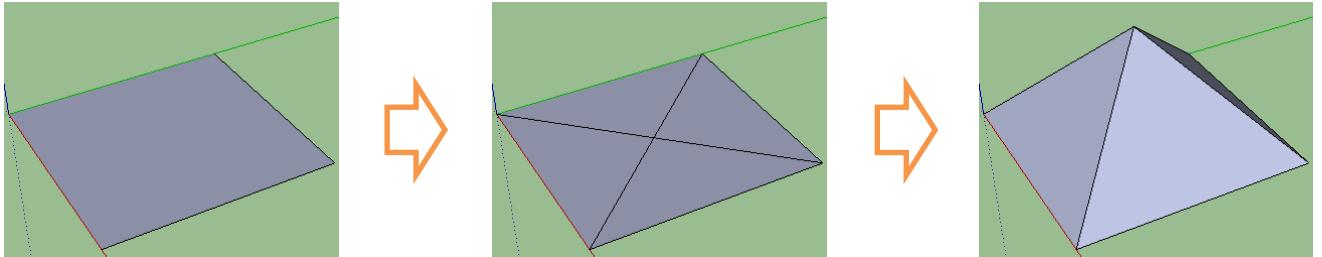
The Tool Set is split into sections based on functionality:



1. The first section contains tools for drawing lines, rectangles, circles and arcs.
2. The second section contains tools for grouping components, deleting components, drawing measurements and painting surfaces.
3. The third section contains the tools for modifying the components that have been drawn, allowing lines and surfaces to be pushed, pulled, moved, rotated, and offset.
4. The fourth section contains camera controls, allowing you to orbit components, pan around them, and zoom.
5. The other sections include tools to preview the object in Google Earth (used for creating buildings), and download objects from Google's 3D model warehouse.
6. An overview of the entire toolset is provided as an appendix in this SketchUp section

Building 3D Models in SketchUp

A 3D Model is formed of a mesh, containing vertices, edges and faces.



Simple pyramid made by drawing a rectangle, crossing it with two lines, then moving the point where the lines upwards.

To use any of the tools that place or modify components:

- Click once to activate the tool
- Move the mouse to increase or decrease its effect
- Click once again to apply the

If we want to give specific dimensions to the tool we are using we simply type them in and press “Enter” instead of moving the mouse after the first click. The dimensions will appear in the bottom right of the screen and we can use any real-world measurements, such as:

1. Millimetres, centimetres, meters (e.g. 1mm, 1cm, 1m)
2. Inches and feet (e.g.. 1”, 1’)


If the tool needs two dimensions, such as the length and width of a rectangle, we separate the dimensions with a comma (,).

Inference Points

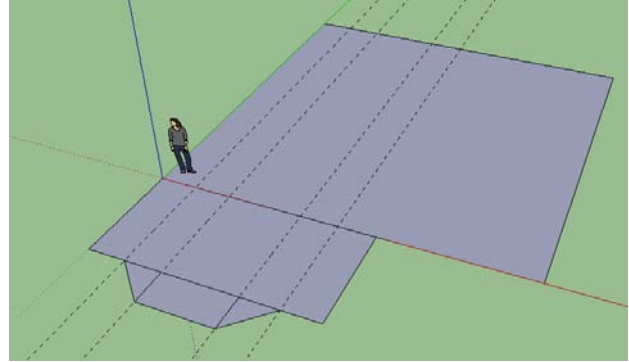
SketchUp uses Inference Points to allow us quickly draw and design accurate models. Whenever we hover the mouse over a component of our model for a few seconds (such as a line, or its midpoint or corner), the component will be marked as an Inference Point, and the mouse will automatically snap to it. If the mouse is moved away from the Inference Point, a line will be drawn from the mouse to the Point whenever the two are parallel.


Modelling in SketchUp: Building a simple house

We will now use the practical example of designing a house to look at how each of SketchUp's tools works.


1. Starting with an empty scene in SketchUp, we will select the Rectangle Tool () and start drawing the floor of the house.

2. Click on the centre point of the scene (where the 3 axes meet), move the mouse slightly and type "10m,10m", then press Enter to create a square that is 10 metres long.




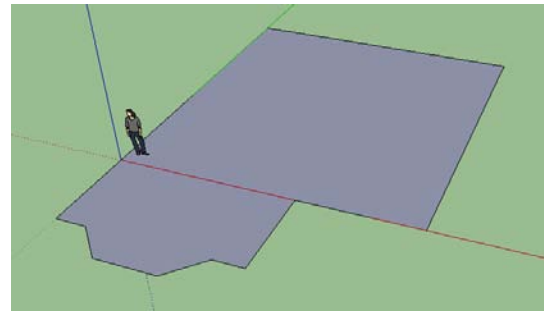
3. Click on one of the square's corners and make rectangle that is 6m x 3m.
4. Now we will switch to the Tape Measure Tool () to mark out the shape of the bay window.


5. With the Tape Measure selected, click on one of the shorter sides of the second rectangle we drew and move the mouse inwards. Type "1m" and press Enter to draw a measuring line (dashed line) 1 metre from the side of the rectangle. Draw another measuring line 2 metres from the side of the rectangle, and then do the same on the other side.

6. Using the inner measuring lines as Inference Points (the mouse will automatically snap to them) draw a rectangle 2 metres long and 1 metre wide. Now switch to the Line Tool () and draw a line from the corner of the new rectangle to the outer measuring line to finish the shape of the window.

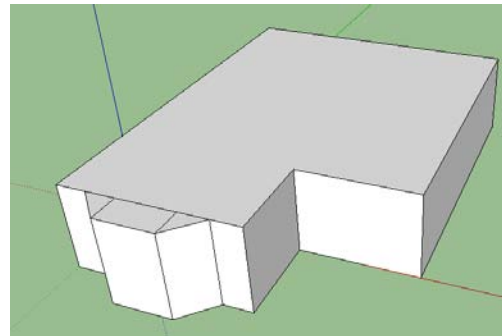
7. Delete the measuring lines by going to the Edit menu and selecting "Delete Guides".

8. We will perform one final step before making the 2D plan of the house 3D: healing. Healing is the process of removing any unneeded lines that run across the surface of an object using the Eraser tool ().



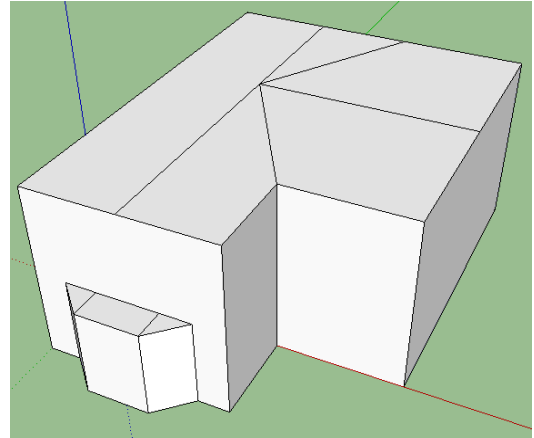
9. Now we will use the Push/Pull Tool () to give the house height. Select the Push/Pull Tool and click on the surface of the floor plan. Start sliding the surface upwards, then type "3m" and press enter to make the walls of the house 3 metres tall.


10. We only want the bay window to be one storey tall, so draw a line across it to separate it from the surface of the house, and draw a line from each of its corners, as in the image on the right. We will use these later to give it a roof.




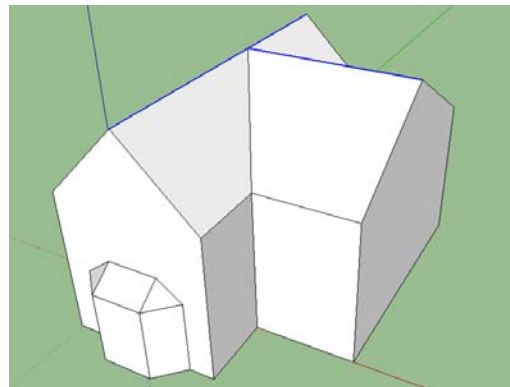
11. To add the second storey and the roof to the house, select the Push/Pull tool, click on the surface that makes up the main floor of the house, start sliding the mouse upwards, type "3m" and press Enter. Use the Eraser tool to "Heal" the lines that run from the top of the bay window to the roof.
12. We will use Inference Points and the Draw Tool to draw the lines of the roof. First, hover the mouse over the narrower front end of the "L" shaped roof surface until the mouse snaps to the midpoint.
13. Click on the midpoint to start drawing the line and slid the line towards the back of the house. Make sure the line has snapped to the Y axis (the line will be green) so that it is parallel to the other lines of the roof. When the mouse reaches the back of the house, click to finish the line. Perform the same process for the line in the middle of the wider section of the roof. This time, you will draw the line from the midpoint of the side of the house along the X axis (the line will be red). When it reaches the line you've just drawn, click again to place the line.



14. The last two lines that make up the roof are angled, the first running from the point where the lines we've just drawn meet to the front corner of the house. Once we've drawn this line, we will start drawing the second line by clicking on the centre point of the roof lines, hovering the mouse over the other end of the line we've just drawn, then slide the mouse towards the back of the house. A guide will appear showing that the endpoints of the two lines are in line, and we can click on the back of the roof to finish drawing this last roof line.



15. Now we will give the roof on the bay window and on the main house a slope. First, select the Move Tool () and click on the centre of the line where the top of the bay window meets the wall of the house. Slide the mouse upwards until the dotted guide line has turned blue and the words "On Blue Axis" have appeared beside the mouse. When this happens, type 0.75m and press enter.

16. To make the slope of the main roof, we need to select multiple lines. To do this, use the Select Tool (). Click on the first line, then hold "shift" and click on the other lines to select multiple. The lines of the roof we need to select are the ones that run parallel to the edges of the roof (i.e. the first two roof lines that we drew).




17. With these lines selected, switch back to the Move Tool and perform the same process we used in step 15 to create the bay window roof: click, and then slide the mouse upwards so that the dotted guide line is blue. This time we'll make the roof steeper by typing "3m" and pressing Enter.
18. We can now add extra detail to the house, such as windows and doors, by drawing rectangles on the walls of the house, then using the Push/Pull tool to indent them. We can also add ground around the house by drawing a rectangle underneath it.
19. When we are happy with the design of the house, we can add some colour to it using the Paint Bucket Tool () tool. When we select this tool, a new window appears, with a list of different materials and textures we can use including wood, stone, carpet and metal. We simply select the texture we want to use and click on the surface we wish to apply it to.
20. Finally, we can use the Get Models Tool () to search Google's 3D Warehouse to download some extra objects, such as trees and cars, into our scene.



Finished house with windows, doors and textures. Models of trees, shrubs and a car downloaded from Google's 3D warehouse.

Texturing & Modelling in Context Using Google StreetView

As seen in the first period, the materials tool () is a quick and easy way to apply textures to your models in SketchUp. All the textures we have used until now are part of the SketchUp library of textures. In this period we are going to take a look at applying our own new textures to surfaces in our models. We will also take a look at using Google's StreetView to build accurate models in SketchUp and to extract textures from existing buildings that we can apply to our models.

Importing Images as Textures

You can use almost any photograph as a photo texture in SketchUp. If possible, the best approach is to take your own pictures. Great 3D models are derived from great photos. In taking photographs for 3D modelling it is important to keep the following factors in mind:

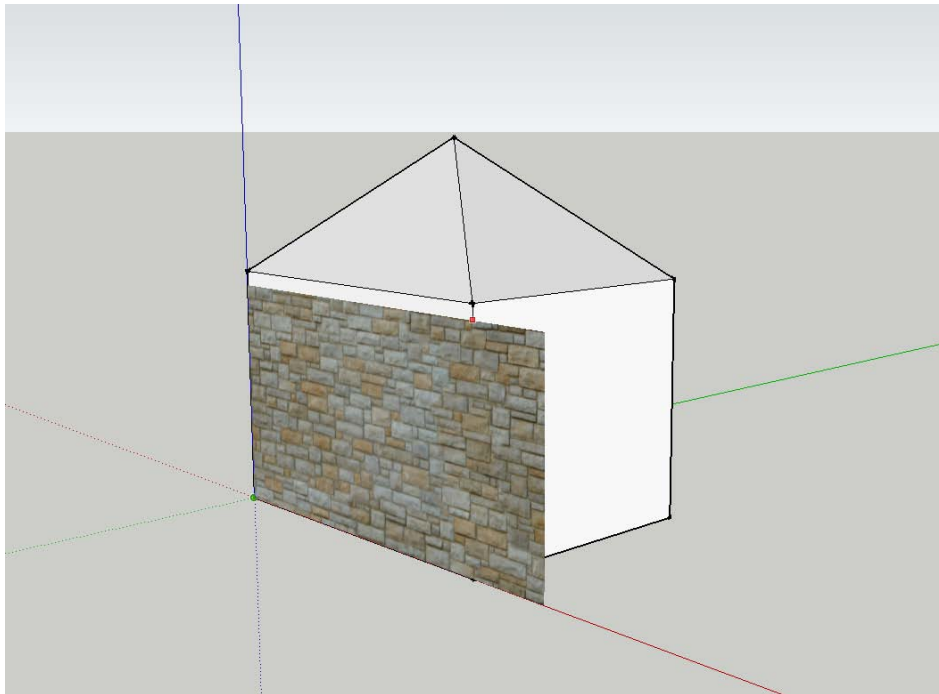
- Take images as "straight-on" as possible
- Be sure to take corner shots
- Avoid obstacles like cars, trees and other people as much as possible
- Take context shots - far away views overall views to accompany the straight-on shots.
- Ensure that all faces of the building have been photographed from multiple angles

For this the purpose of learning these tools today, if you do not have access to photos taken earlier in the week, Google Images is a good place to find texture images. Once you have acquired a texture image, we are going to look at applying this texture to both a flat a curved surface in SketchUp.

Applying a new texture to a flat surface

Follow these steps to apply photographs to flat faces in your model as photo textures:

1. Use the Orbit tool to orient your model so that you can see the face you want to photo-texture.
2. Choose File > Import... from the menu. The Import dialog box opens
3. Choose All Supported Image Types from the Files of Type
4. Locate the image file you want to use as a photo-texture
5. Make sure the **Use As Texture** radio button is checked
6. Click Open. The Import dialog box will close and the image is "loaded" onto the tip of your cursor



Position Image Texture on Selected Face

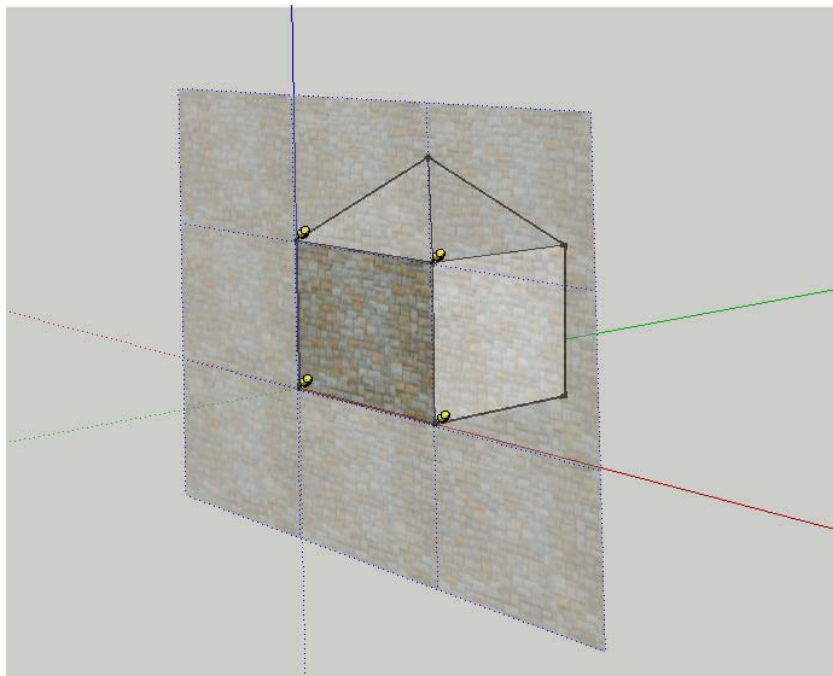
7. Click once on the lower-left corner of the face you want to photo-texture
8. Click once on the upper-right corner of the same face
9. Your photo texture is now applied

Now that your texture is applied you may need to adjust its appearance if it does not look correct on your model. If your texture needs to be adjusted the following will instruct you how to do so.

Stretching a photo texture to make it look right:

In most cases, you need to position (stretch) your new photo texture so it fits the face to which it's been applied. You use SketchUp's relatively hidden Position Texture feature to do this. Follow these steps to stretch a photo texture after it has been applied to a face:

1. Choose Tools > Select to activate the Select tool.
2. Right-click on the face with the photo texture you want to correct and choose Texture > Position from the menu.
3. Right-click on the face again and choose (uncheck) Fixed Pins to switch to Free Pin Mode. You should see four yellow push-pins – one on each corner of your photograph.
4. Click once on the lower-right pin to "pick it up"
5. Click and drag the pin to the desired position. Release the mouse key to "put down" the pin at the point on the photo that you'd like stretch to the lower-right corner of the face.



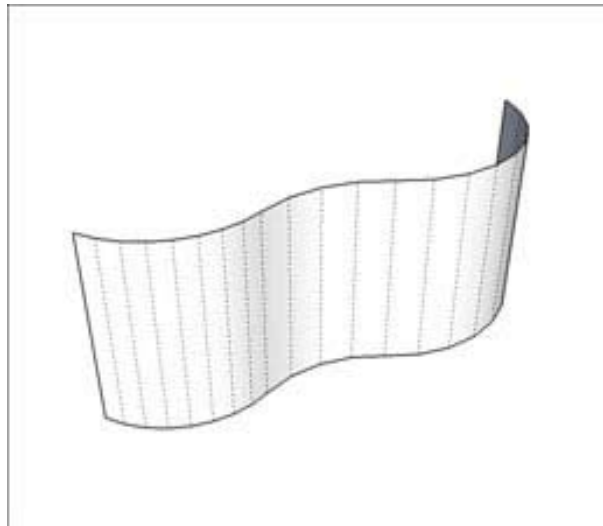
Click and drag the pins to the desired location - clicking and dragging the texture itself will reposition the texture on the face

6. Repeat steps 4 and 5 for each of the other three yellow pins. Use them to define the corners of the photo texture you'd like to see stretched to the corners of the face.
7. Click down on a pin and drag it to its corresponding corner. The photo should distort as you move the pin.
8. Repeat step 7 for each of the other three pins.
9. Right-click on the face and choose "Done" from the menu when you are happy with your repositioned texture.

You can now import your own textures and reposition them to look aesthetically correct on flat surfaces. Of course, all surfaces are not flat lets now take a look at applying your own texture to a curved surfaces.

Applying a new texture to a curved surface:

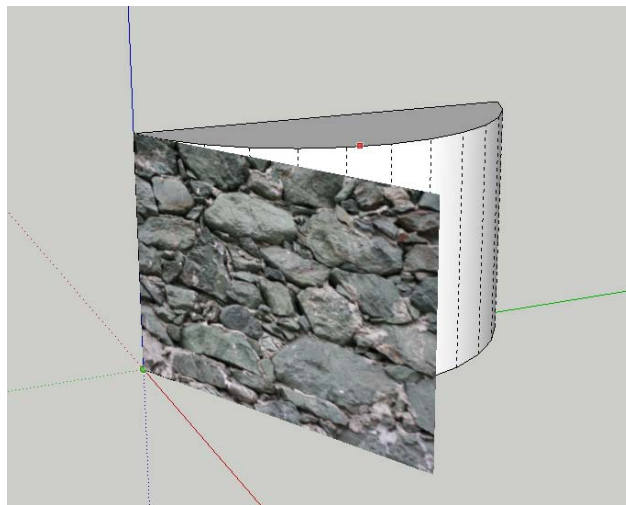
As with all 3D modelling software, all faces are built up with *polygons* which are flat shapes consisting of straight lines that are joined to form a closed plane. In theory these modelling packages don't actually make curves but instead aligns many polygons to give the illusion of a curved surface as seen in the figure below. This architecture means we must texture these surfaces in a slightly different way when we wish to import our own images as textures to be mapped to a curved face.



Hidden geometry of a curved surface in SketchUp consisting on many polygons

This example will show how to map a new image as a texture to a curved surface:

1. Choose View, Hidden Geometry to turn on Hidden Geometry so you can see the individual faces in your model
2. “Load” your cursor with an imported image using the same steps as with the flat surface
3. Paint the leftmost sub-face entirely with the image as shown below



Place the texture image on the left most face of the curved surface

4. Hover your loaded cursor over the lower-left corner of the sub-face farthest to the left
5. When the image is oriented in the right direction, click once
6. Click again on the upper-right corner of the same sub-face
7. Use the Paint Bucket tool with the Alt key held down to sample the texture image you just placed
8. With the Paint Bucket tool, click once on the face immediately to the right of the face you painted in Step 3
9. Keep painting sub-faces until you're done

Note: We had “Hidden Geometry” turned on to deconstruct the face to explain how the curves are built up. By turning off hidden geometry, this will treat the curve as one face and this will allow you to paint the face as one after sampling the texture.

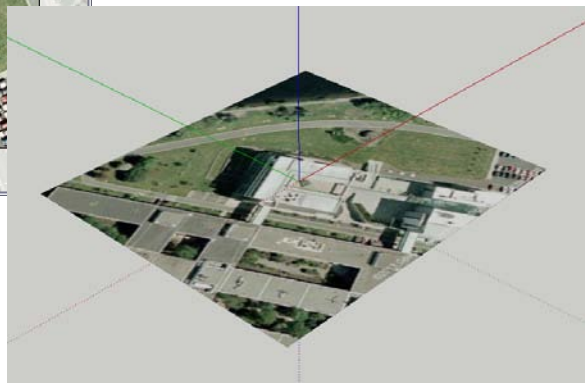
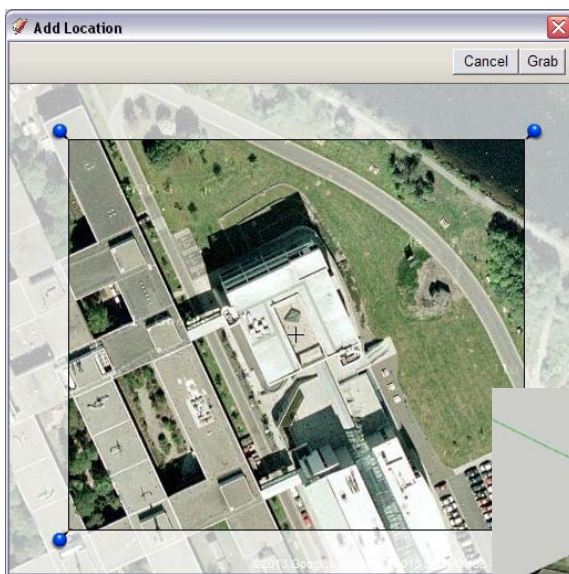
Modelling & Texturing Using Google StreetView

SketchUp allows you to capture images from Street View to texture the buildings you are creating for Google Earth. This feature is useful when Street View images are available for the exterior walls of a building in Google Maps. The following outlines the process:

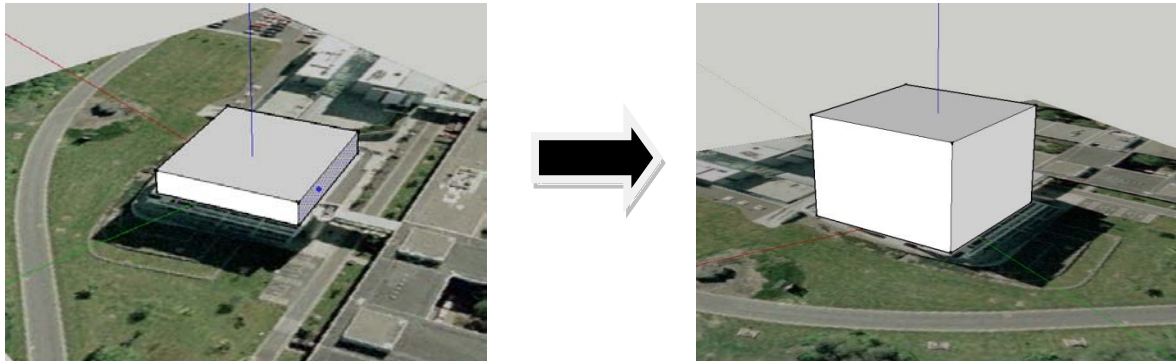
1. Click the "Add Location" button in the toolbar to locate the building you wish to model on Google Maps



2. Locate a building in Google Maps that you want to model. This building must have Street View images for one or more exterior wall



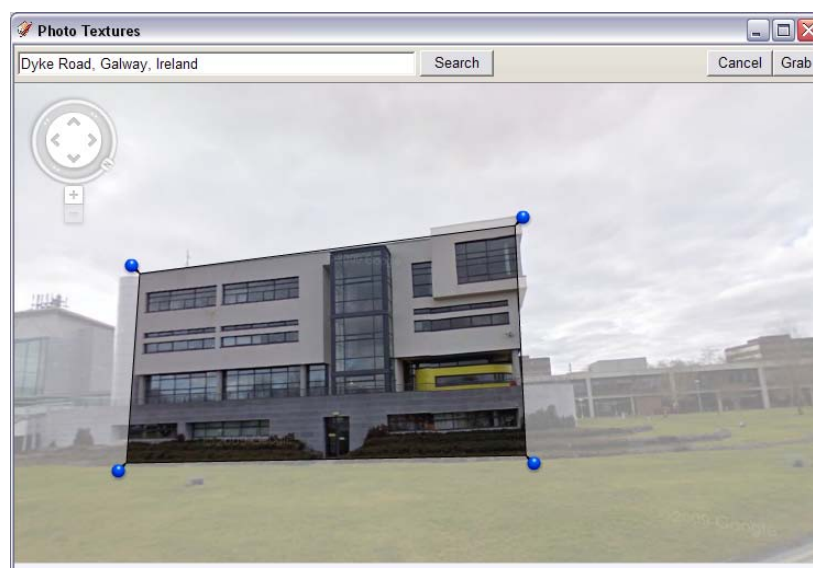
3. Model the building in using the bird's eye view of the building as a plan



4. To apply a texture to a face, you must first select the face you wish to texture and then click the "Add Photo Textures" button for the "Photo Textures" window to appear



5. Navigate so you are facing the image of the exterior wall that you have selected in SketchUp
6. Click the Select Region button. The image in the Street View window fades. A smaller area, the same shape as the wall chosen in SketchUp, appears. This shape represents the portion of the Street View image that you will use to photo texture your building
7. You must position the four pins around the portion of the Street View photo that you want to use to texture the wall or face selected in SketchUp



8. When you are happy with your selection click the "Grab" button to grab the selected portion of the Street View image and apply it as a texture to your building in SketchUp. The figure below shows your building in SketchUp with the Street View image as an applied texture

















9. Repeat these steps for each of your faces
10. Use the applied textures as a guide to extrude more detail in your model as you go
11. At any point, you can select any face to re-apply a texture from StreetView to build up your tweak your model



Proceed to add more detail to your models to resemble the building you wish to model

SketchUp

<p>Select Tool Shift = Toggle Ctrl = Add Shift+Ctrl = Subtract Right to Left = Crossing Selection Left to Right = Window Selection</p> 	<p>Move Tool Shift = Inference Lock Ctrl = Copy Alt = Auto-Fold VCB: Number = Distance</p> 
<p>Paint Bucket Tool Shift = Matching Ctrl = Connected Shift+Ctrl = Object Alt = Sample Paint</p> 	<p>Push/Pull Tool Double-Click = Repeat Ctrl = New Face VCB: Distance</p> 
<p>Eraser Tool Shift = Hide Ctrl = Soften/Smooth Shift+Ctrl = Unsoften/Unsmooth</p> 	<p>Rotate Tool Ctrl = Copy VCB: Number = Angle VCB: Rise:Run = Slope</p> 
<p>Rectangle Tool VCB: Length, Width</p> 	<p>Follow Me Tool Alt = Use Parameter of Surface as Path</p> 
<p>Line Tool Shift = Inference Lock VCB: Number = Length</p> 	<p>Scale Tool Shift = Toggle Uniform Ctrl = About Center VCB: Number = Scale Factor VCB: Number w/ units = Length</p> 
<p>Circle Tool VCB: Number+s = Segments VCB: Number+r = Radius</p> 	<p>Offset Tool VCB: Number = Length Double-Click: Repeat</p> 
<p>Arc Tool VCB: Number = Bulge VCB: Number+s = Segments VCB: Number+r = Radius</p> 	<p>Orbit Tool Shift = Pan Ctrl = Free</p> 
<p>Polygon Tool VCB: Number+s = Segments VCB: Number+r = Radius</p> 	<p>Pan Tool</p> 
<p>Freehand Tool Shift = Draw 3D Polyline</p> 	<p>Zoom Tool Shift = Change Field of View VCB: Number = View Angle VCB: Number in mm = Focal Length</p> 
<p>Tape Measure Tool Ctrl = Measure Only VCB: Number = Resize Model</p> 	<p>Zoom Window Tool</p> 
<p>Dimension Tool</p> 	<p>Zoom Extents Tool</p> 
<p>Text Tool</p> 	<p>Previous</p> 
<p>Protractor Tool Shift = Measure Only VCB: Number = Angle VCB: Rise:Run = Slope</p> 	<p>Walk Tool Shift = Move Vertically Ctrl = Run Alt = Walk Through Entities VCB: Number = Eye Height</p> 
<p>Section Tool</p> 	<p>Look Around Tool VCB: Number = Eye Height</p> 
<p>Axes Tool</p> 	<p>Position Camera Tool</p> 

Overview of Tools in SketchUp