

INTRODUCTION TO SKETCHUP FOR THE BUILT ENVIRONMENT



THE PLAZA

Target Drawing

Figure 1 shows the Target Drawing, The Plaza.



Figure 1. Completed Model

Sketch Drawing

- Open the Sketch Drawing 'Base Plan' as shown in Figure 2 with **FILE/Open**.



Figure 2. Sketch Base Plan 2D drawing

- Using **VIEW/Toolbars** load the Views toolbar and click on 'Top' to obtain a plan view of the sketch.
- Dock the View toolbar in the margin.
- Create a layer called 'Trace' with **WINDOW/Layers** as shown in Figure 3.
- Make the Trace layer the current layer by clicking on the radio button as shown in Figure 3.
- From the bottom left hand corner draw a rectangle to the top right hand corner as shown in Figure 4.

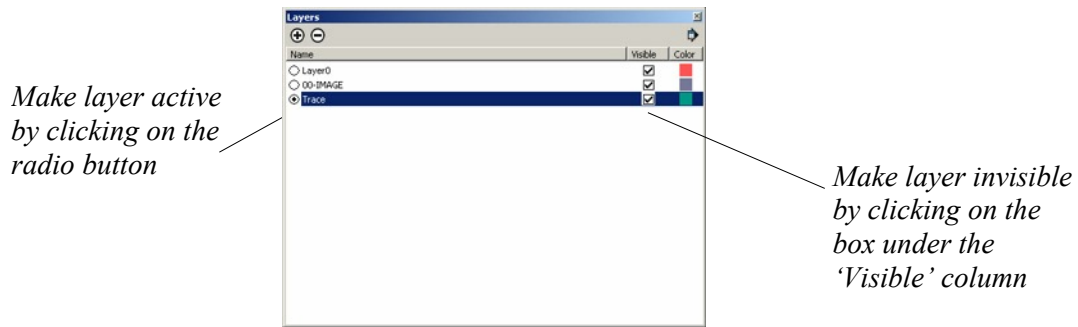


Figure 3. Layers dialog box with Trace layer as the active layer



Figure 4. Rectangle in process of being drawn

- We need to colour the rectangle but will not be able to select the rectangle face when the base plan image is still displayed on screen. To prevent the base plan from appearing on screen use **WINDOW/Layers** and deselect the '00-Image' layer by clicking on the tick so that the tick disappears. The base plan image will now be invisible.
- Using the pointer tool, select the face of the rectangle so that it is highlighted with the usual dotted selection.
- Activate the Paint Bucket tool with **TOOLS/Paint Bucket** and the Materials dialog box will appear as shown in Figure 5.

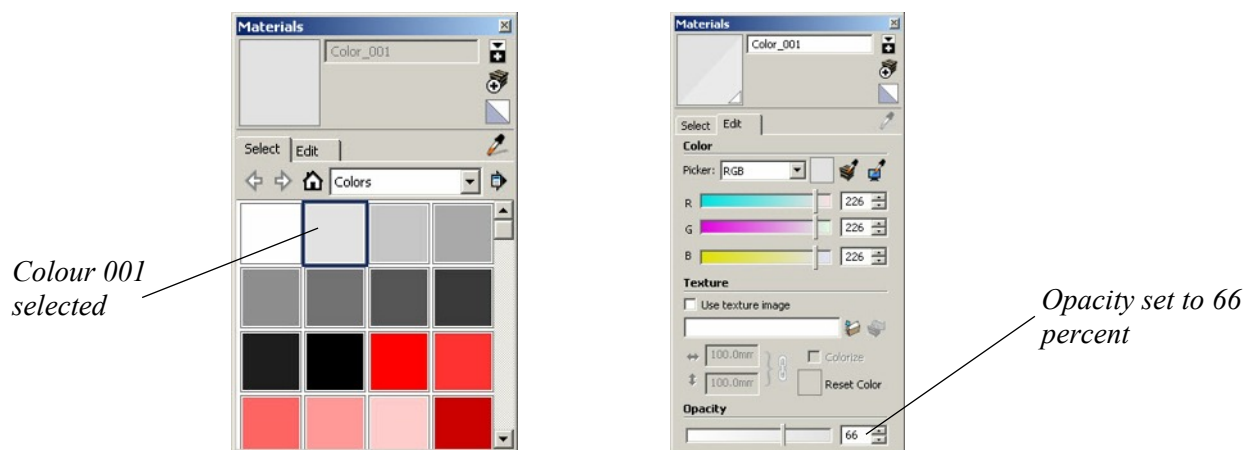


Figure 5. Materials dialog box showing colour 001 selected and the Edit tab with Opacity set to 66 percent

- Select colour '001' as shown in Figure 5 and use the Paint Bucket to colour the selected face of the rectangle.
- Click on the Edit tab in the Materials dialogue box as shown in Figure 5 and change the Opacity of colour 001 to approximately 66 percent.
- Using **Window/Layers** click on the 00-Image layer and place a tick in the Visible box to display the base sketch once again as shown in Figure 6.



Figure 6 showing the rectangle colour set to 66 percent opacity and the base plan layer visible underneath

We now need to trace the outline of the buildings, the plaza details and the outline of the kerb. Where possible use the Rectangle command and avoid overlapping rectangles.

- Firstly Create a layer called 'Buildings' with **WINDOW/Layers** as you did on pages 2&3 when you created the 'Trace' layer..
- Make the Buildings layer the current layer by clicking on the radio button as shown in Figure 3.
- Use **VIEW/Toolbars** and click on Layers to display the Layers toolbar. Dock the toolbar in the margin.
- Remember that we made the layer 'Buildings' the active layer and your Layers toolbar should look like that shown in Figure 7.



Figure 7. Layers toolbar showing the Buildings layer as the active layer

- Using the **Rectangle** command trace the outline of the buildings first as shown in Figure 8.

Tracing the details

- Make the Trace layer the current layer by clicking on the radio button as shown in Figure 3.
- Trace the red tree boundary with the **Rectangle** and **Line** commands and the outline of the kerb with the **Line** and **Arc** commands.

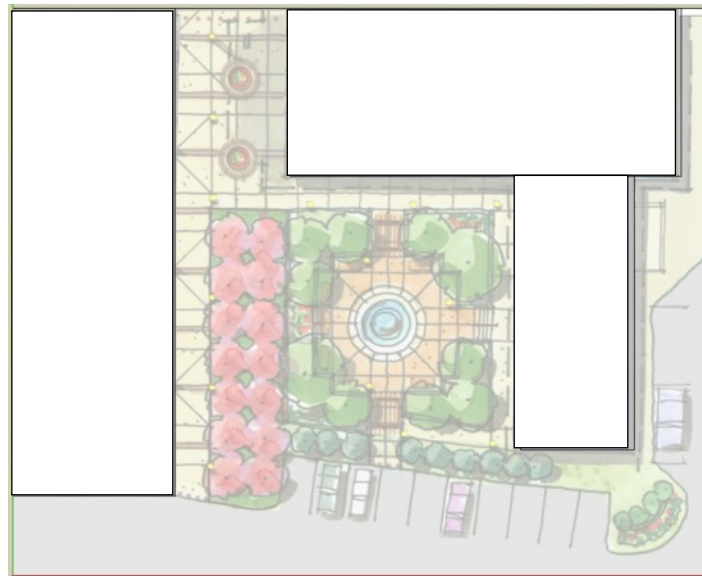


Figure 8. The buildings trace shown here accentuated for clarity

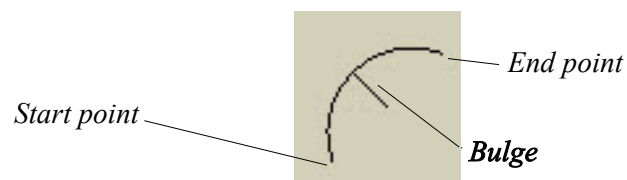


Figure 9. The Arc command

- The **Arc** command requires a start point, an end point and a 'bulge' distance as shown in Figure 9.
- To draw the central plaza area with the pond use the **Rectangle** tool to draw a square as shown in Figure 10. Draw a diagonal line across two of the corners.

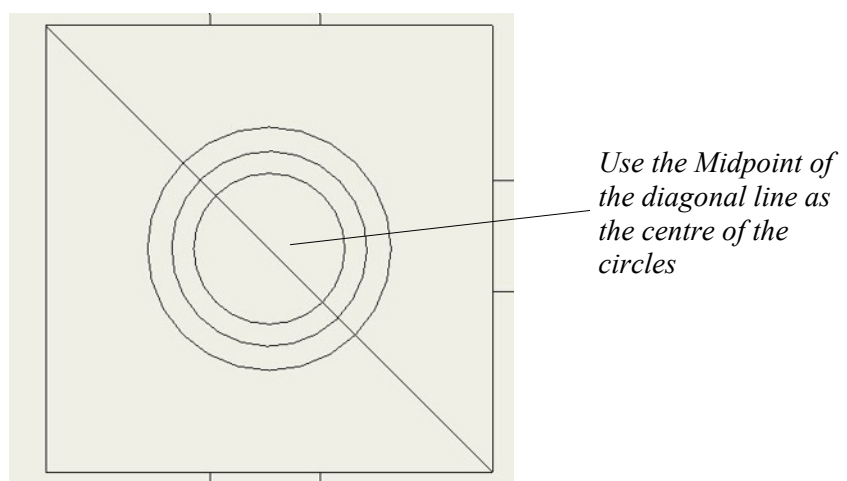


Figure 10. The central plaza with the three concentric circles

- Use the **Circle** tool to drag 3 concentric circles using the Midpoint of the diagonal line as the centre of the circles as shown in Figure 10.

- At a corner of the rectangle draw a square as shown in Figure 11.
- Using the **Move** command select the square but press the CTRL key on the keyboard at the same time. You will see a 'plus' sign appear next to the Move symbol as you are moving your mouse. Holding the CTRL key down turns this command into '**Copy**' as we want to copy the square to the remaining three corners of the large rectangle as shown in Figure 11.

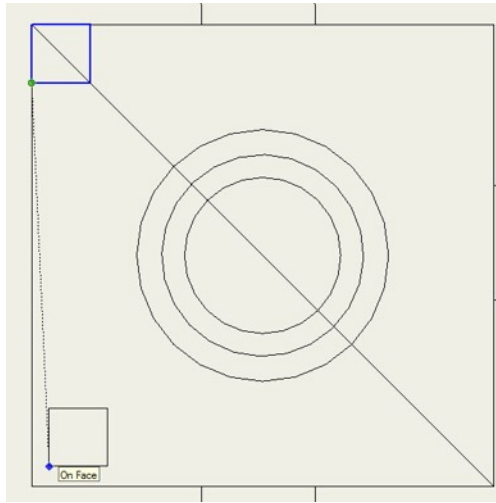


Figure 11. Copying the corner square to the other three corners of the large square

Erase the diagonal line and the corners of the large square as shown in Figure 12.

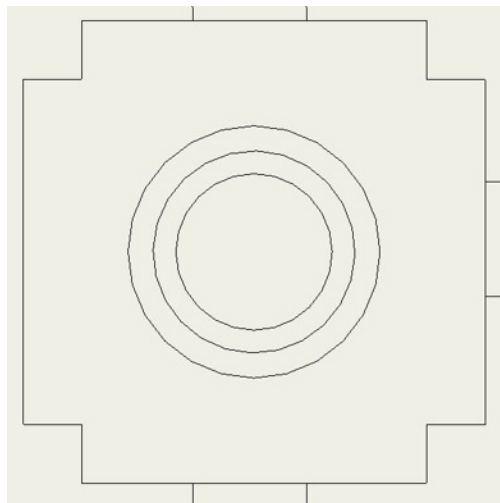


Figure 12. Diagonal line and corners erased

- Use **Line** to draw an outline of the green tree area joining the lines to the right hand corners of the red tree area.

Drawing the Steps

- Using **VIEW/Toolbars** click on **Measurements** and the Measurements toolbar will appear at the bottom of your screen.
- Select the Endpoint of the line as shown in Figure 13 and draw a line on the green axis. Move the pointer away from your selected point and type in 450. This figure will appear in the Measurement window as a length of 450mm.

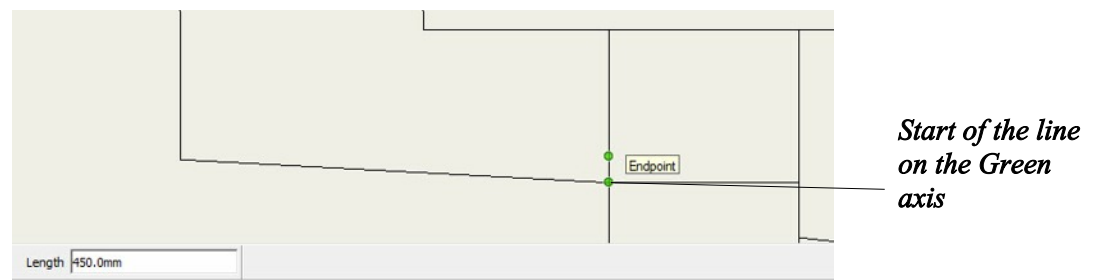


Figure 13. Drawing the 1st step

- From the Endpoint of the line draw a line on the red axis to meet the parallel line as shown in Figure 14. Complete a total of 4 steps.

TIP Sketchup will 'remember' the last measurement you entered. All you need to do is select the endpoint of the previous line and move your mouse in the green axis. When '450' appears next to your pointer, click there and continue across on the red axis to draw the step as shown in Figure 14.

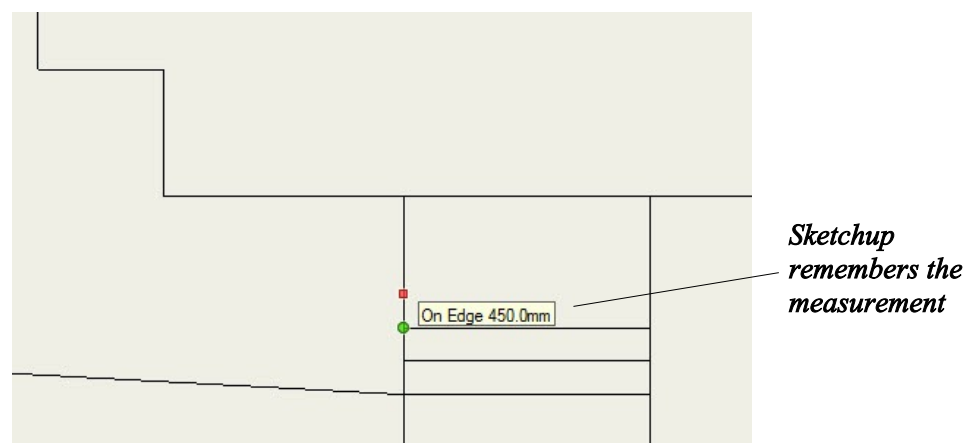


Figure 14. Sketchup remembers the last measurement entered

- Complete both sets of steps as shown in Figure 15.

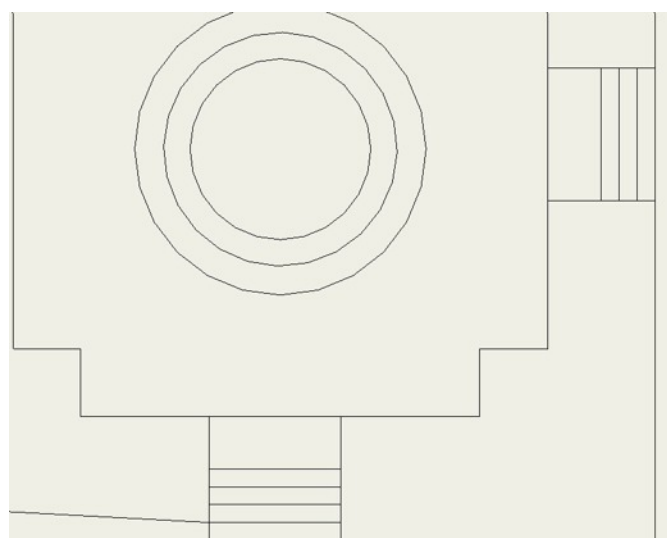


Figure 15. Completed steps

Creating the Kerb detail

- Highlight the face as shown in Figure 16 and **Offset** it inwards by 100mm. Click anywhere on the face and drag your mouse pointer inwards and type 100. This will create an inner boundary as shown in Figure 16.
- Repeat for the next adjacent face until the kerb edge is created as highlighted in Figure 16.
- Delete the unwanted edges formed by the **Offset** command as shown in Figure 16.
- Draw in connecting lines to complete the kerb as shown in Figure 16.

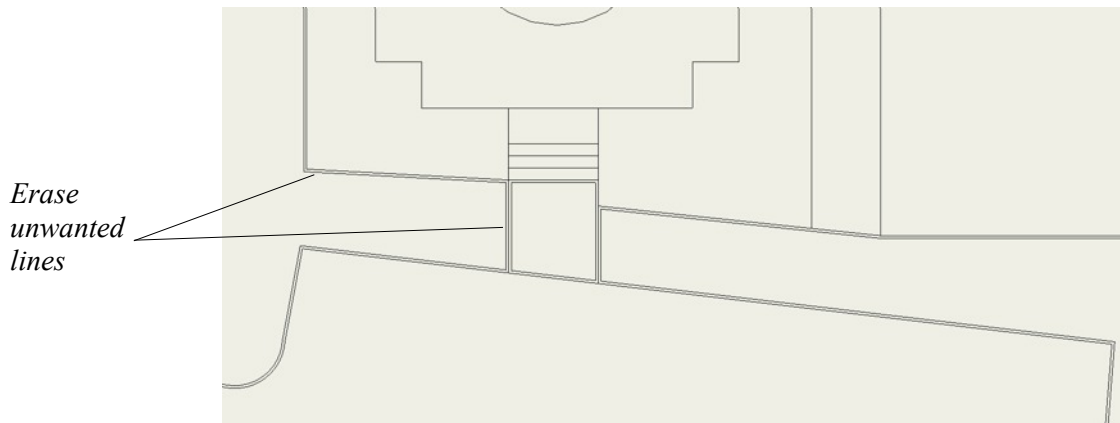


Figure 16. Drawing the Kerb using the Offset command

Adding Detail to the Plaza

Offset the plaza wall detail inwards by 400mm as shown in Figure 17. NOTE: Your plaza shape will differ from the shape shown here.

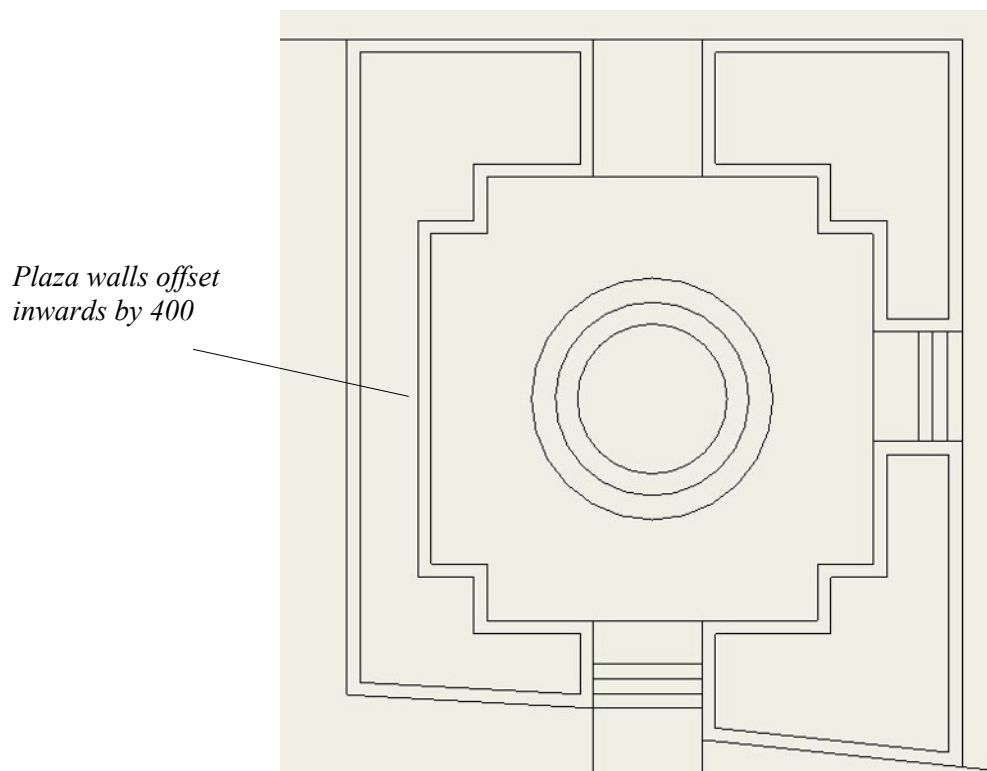
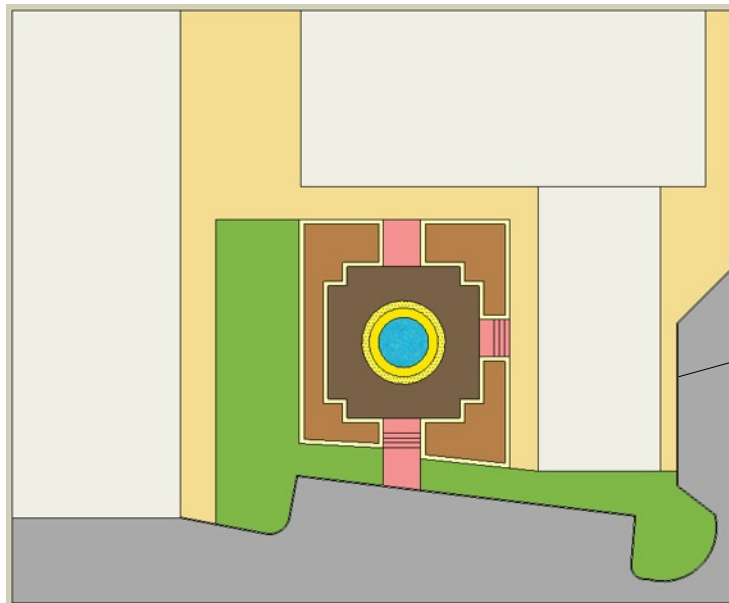


Figure 17. Offsetting the Plaza walls

Adding Colour to the Plaza detail

- At this point we can start adding colour to the detail in the Plaza central area. Use the **Paint Bucket** to add colours of your choice as shown in Figure 18. Note that the buildings have not been coloured.



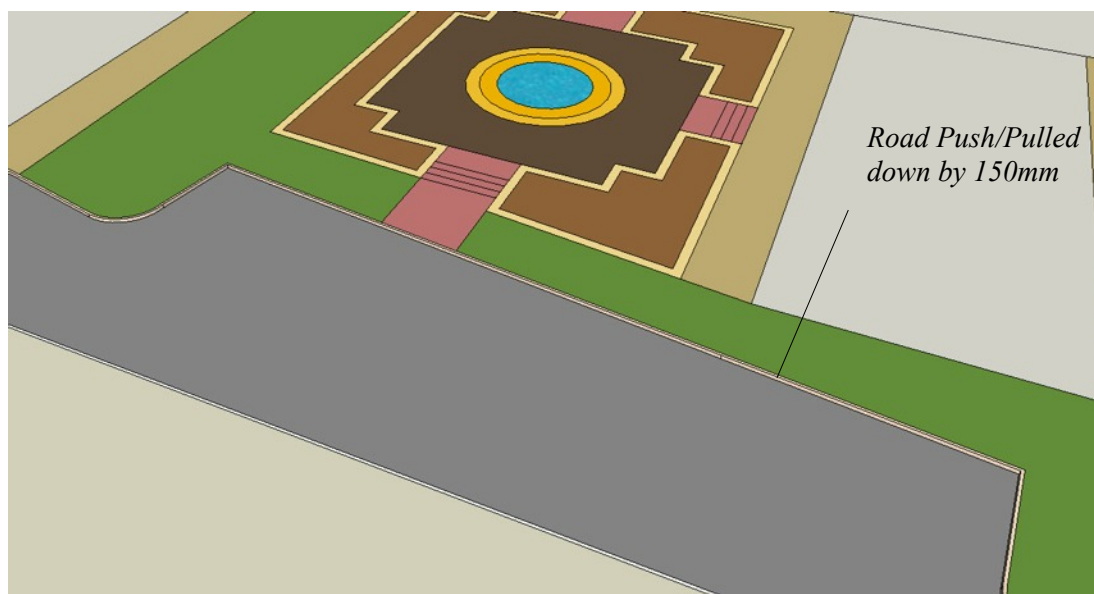
Ensure that the kerb is also given a light colour

Figure 18. Completed 2D plan with colour added

Adding Volume to the drawing

- Using **WINDOW/Layers** make the sketch '00-Image' invisible.
- Using the **Orbit** tool tilt the drawing as shown in Figure 19.
- Select the road area and with the **Push/Pull** tool Pull the selected area downwards by 150 mm as shown in Figure 19.

Ensure that the vertical edge of the kerb is coloured the same as the top as shown in Figure 19.



Road Push/Pulled down by 150mm

Figure 19. The drawing tilted with the Orbit tool and the road area pulled down with the Push/Pull tool

- Using the **Zoom** tool enlarge the central plaza area as shown in Figure 20.
- Using the **Push/Pull** tool, raise the boundary wall to 600mm as shown in Figure 20.

TIP When the second wall is being raised to 600mm move your pointer over the previous wall and the second wall will be raised to the same height as shown in Figure 20.

Wall height raised to 600mm

Hover the pointer over the first wall to raise the second wall to the same height

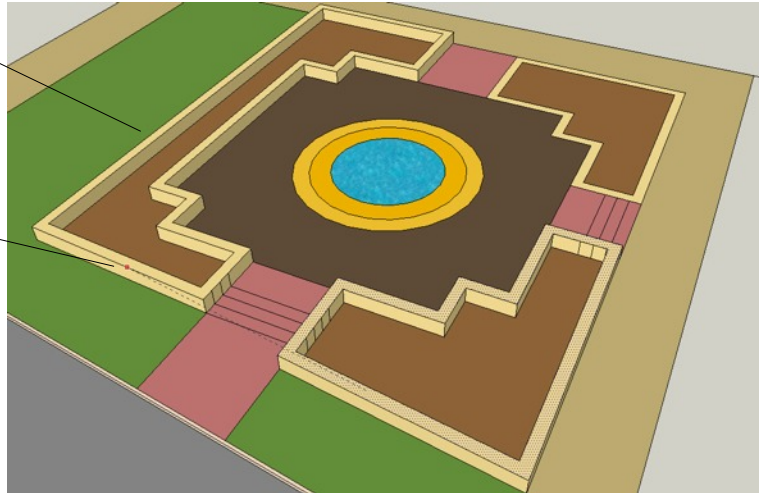


Figure 20. Using the Push/Pull tool to raise the height of the walls

- Complete the third wall using the same method.
- Use **Push/Pull** to raise the areas contained within the walls by 500mm as shown in Figure 21.
- Use **Push/Pull** to raise the pond, the concentric circles and the areas adjacent to the circles again by 500mm as shown in Figure 21.

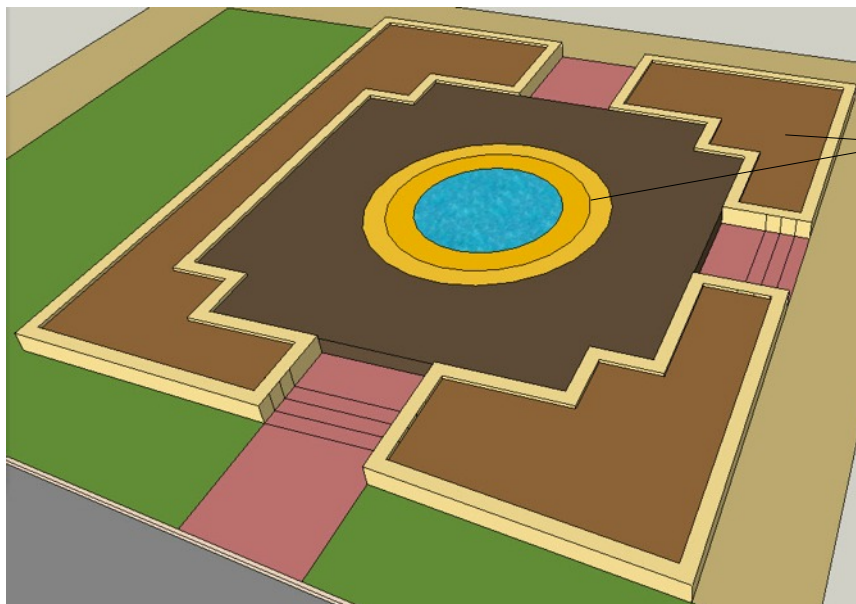


Figure 21. Central and planted areas raised with the Push/Pull tool

Adding the Steps and Ramp

- Use **Zoom** to enlarge the to the area shown in Figure 22.
- From the corner draw a line in the Blue axis upwards by 125mm as shown in Figure 22.
- Draw a line from the end of the previous line in the Green axis to meet the vertical line as shown in Figure 22.

- Continue by drawing another line in the Blue axis by 125mm and, once again, in the Green axis to meet the vertical line.
- Continue until the outline of 4 risers are formed and then draw a line in the Green axis to meet the raised central area as shown in Figure 22.
- Erase the vertical lines below the horizontal lines.

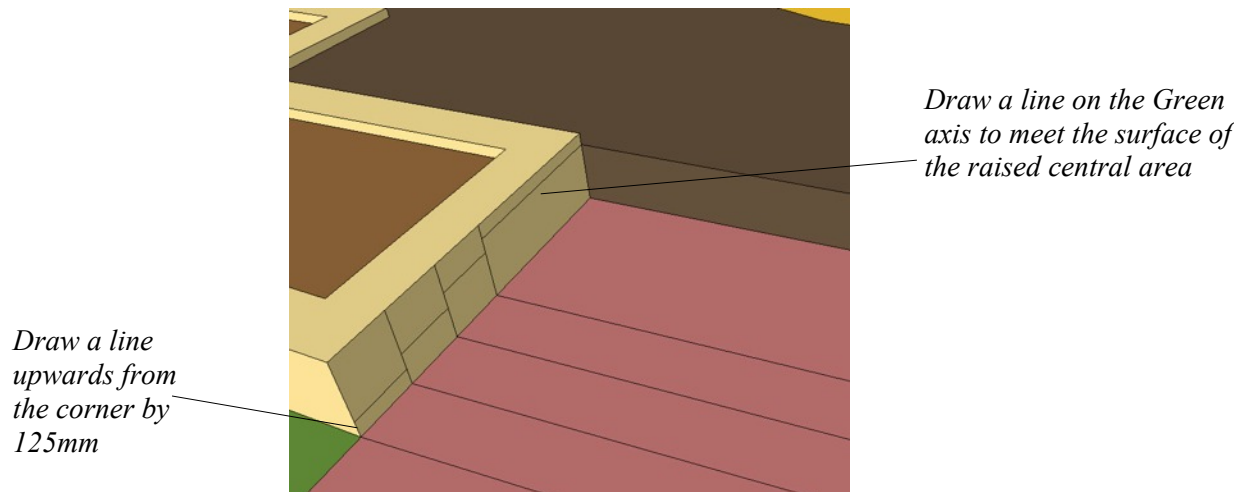


Figure 22. The outline of the steps

- Use the **Orbit** tool to slightly alter the viewing angle so that both walls are visible as shown in Figure 23.
- Using the **Push/Pull** tool to highlight the step area and Pull across to meet the other wall as shown in Figure 23.
- Complete the second set of steps using the same method.

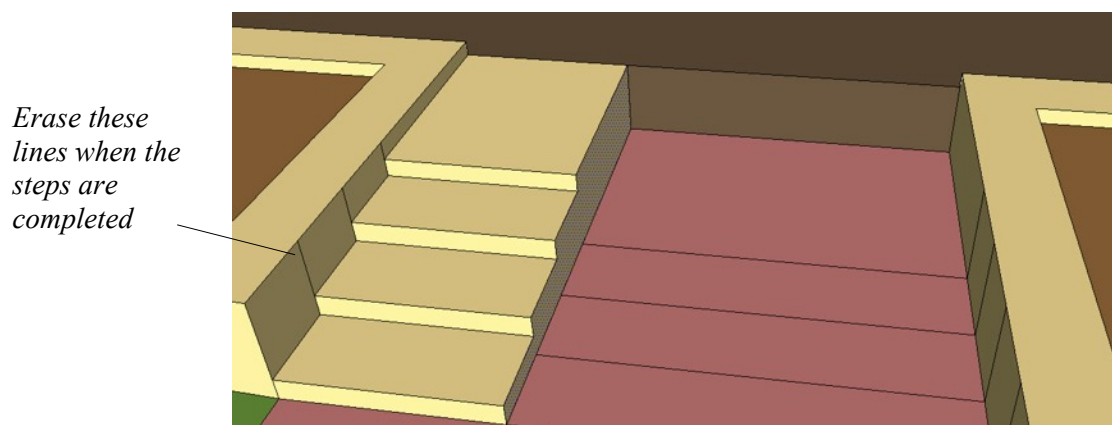
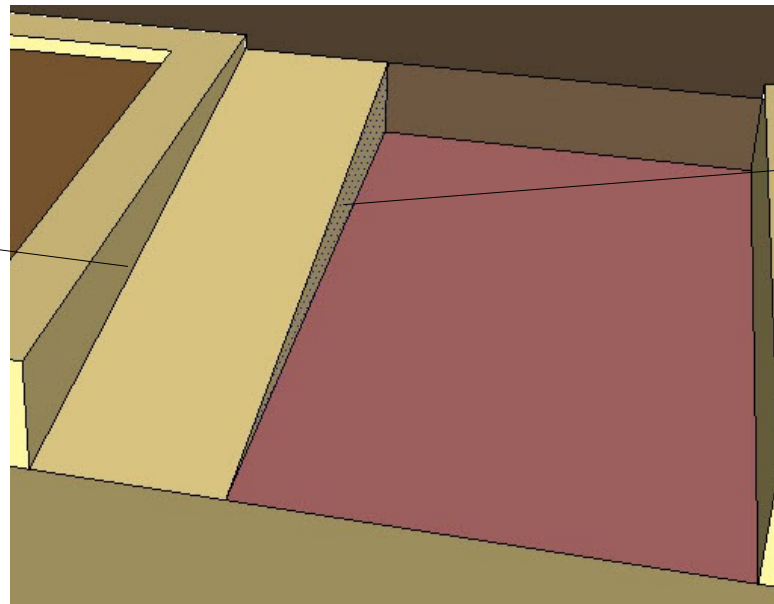


Figure 23. The steps being Push/Pulled across

- Use the **Orbit** tool to rotate the model to the view as shown in Figure 24.
- Draw a line from the bottom corner to meet the edge of the central raised area as shown in Figure 24.
- Use **Push/Pull** to create the ramp.

Diagonal line from bottom corner to edge of raised central area at edge of wall



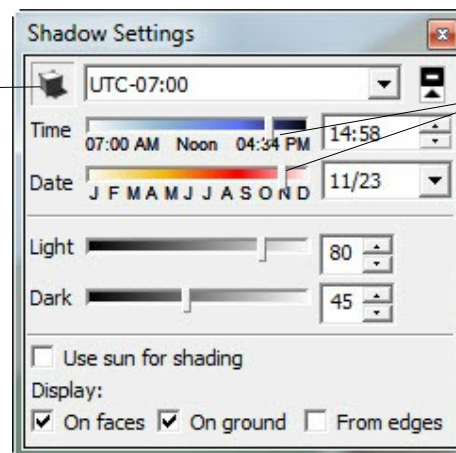
Push/Pull the area below the diagonal line to form the ramp

Figure 24. The ramp being created

Activating Shadows

- Now that some volume has been added, Shadows can be turned on to give the model more 'depth'.
- Use **WINDOW/Shadows** and the Shadow Settings dialog box appears. Click on the icon in the top left corner and use the slider settings to set the time of day and time of year to your liking as shown in Figure 25.
- Ensure that ticks are placed in the boxes as shown in Figure 25.

Click here to turn shadows on.



Change Time and Date here

Figure 25. Shadow Settings dialog box

Adding Volume to the Buildings

- Make the Buildings layer the active layer.
- Starting with Building No. 1 as shown in Figure 26, use the Push/Pull tool to give a height of 3500mm.
- Give building No. 2 a height of 4000mm
- Give building No. 3 a height of 6500mm

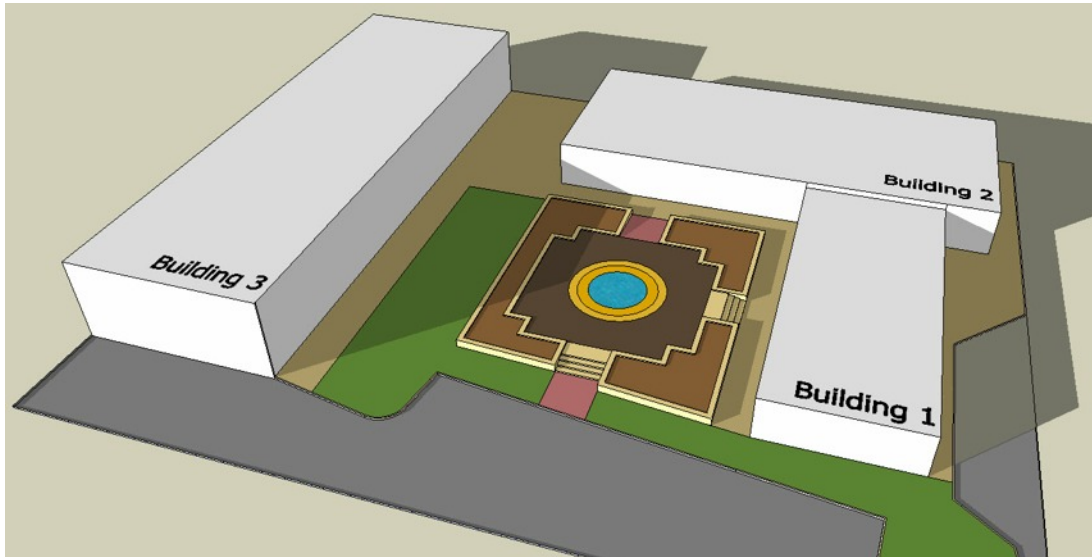


Figure 26. Buildings with added volume

- Use **WINDOW/Layers** to freeze all of the layers so that only the buildings layer is visible as shown in Figure 27.
- We need to make copies of the roofs on Building 1 and Building 2. This will allow us to create overhangs and parapets on both buildings.
- With the **Push/Pull** tool select the flat roof of Building 1 and, **pressing the CTRL key at the same time** copy the roof downwards by 600mm.
- Repeat the same process but this time by 300mm. You will see 2 lines around the perimeter of the building as shown in Figure 27.

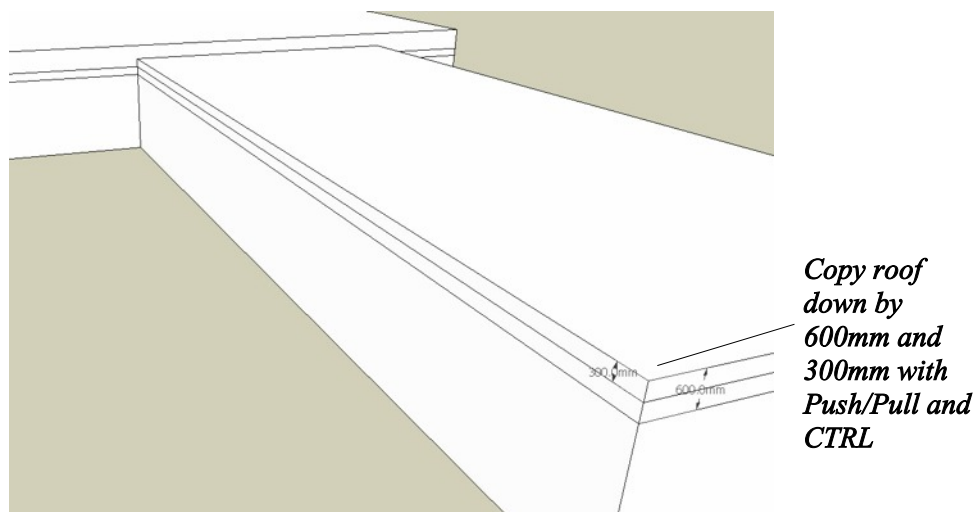


Figure 27. Buildings 1 & 2 with roof copied downwards with Push/Pull

- Copy the roof of Building 2 downwards with **Push/Pull** and **CTRL** and select the 300mm and 600mm points as shown in Figure 28.

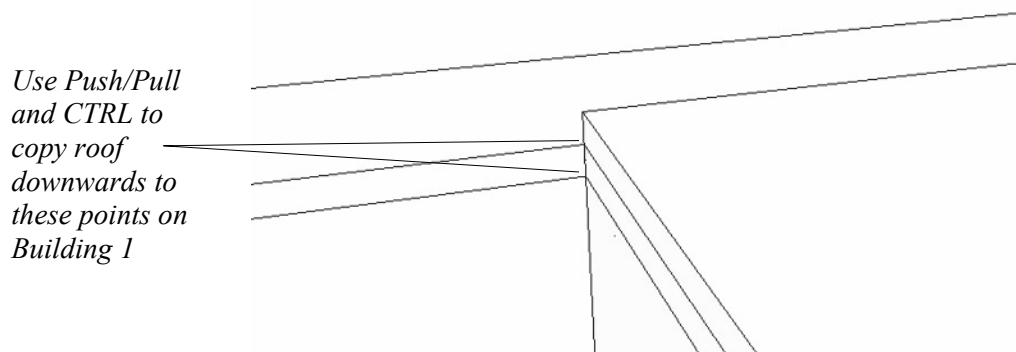


Figure 28. Roof of Building 2 copied downwards to copies on Building 1

- Buildings 1 & 2 front and side walls now need to be Push/Pulled inwards by 1500mm to form the overhang as shown in Figure 29.
- Using **Push/Pull** move the walls inwards by 1500mm.

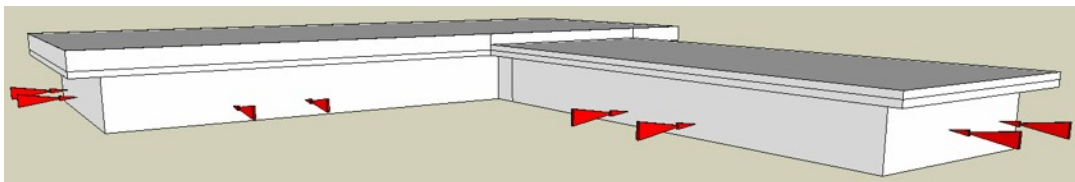


Figure 29. Walls moved inwards by 1500mm

- Select the faces between the 300mm and 600mm lines and **Push/Pull** outwards by 1000 mm as shown in Figure 30.

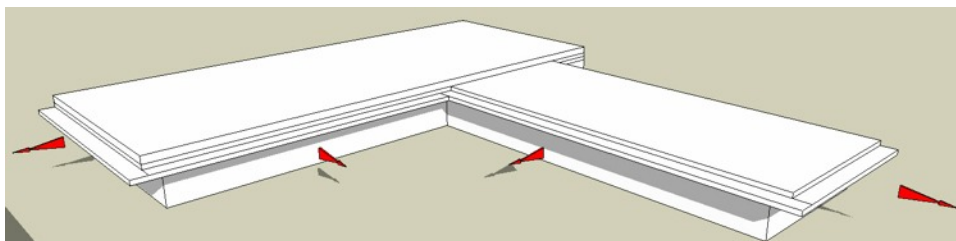


Figure 30. Parapet created by moving Faces outward by 1000mm

- Create the parapet on the roofs of Buildings 1 and 2 by using Offset to select the roof faces and copying inwards by 300mm as shown in Figure 31.
- Use **Push/Pull** to move the faces of both roofs downwards by 200mm to form a feature parapet as shown in Figure 31.
- Erase the extraneous lines created during the previous sequences as shown in Figure 31.

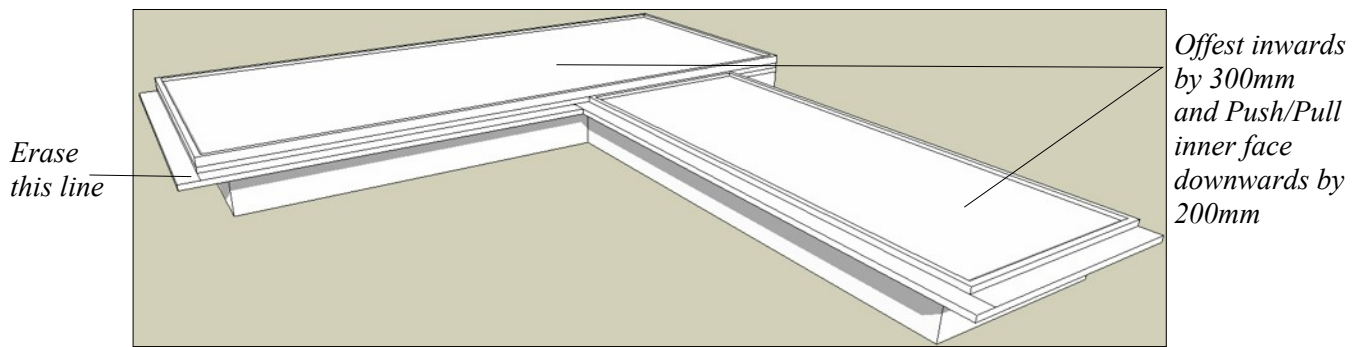


Figure 31. Roof parapet feature formed with the Offset and Push/Pull commands

Creating the Pillar Component

- Pillars now need to be added to the faces of Buildings 1 and 2 to form 'breaks' between the store units and to provide guidance for placing the window components later.
- **Zoom** and **Orbit** into the corner of Building 1 and check the height of the wall from ground level to the underside of the parapet as shown in Figure 32. It should be 2900mm.

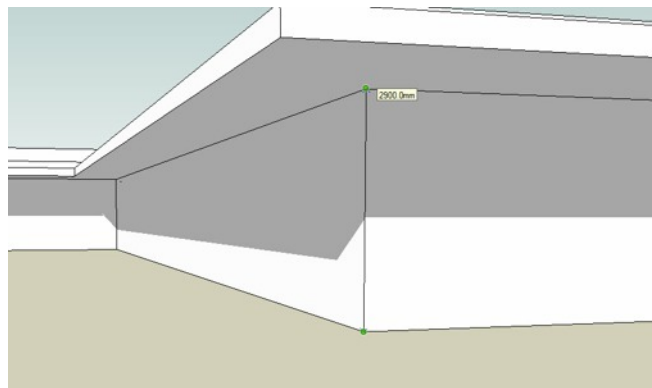


Figure 32. Checking the building height from ground to underside of the parapet

- In an open area close to the building corner, draw a Rectangle 250x450 and **Push/Pull** the face upwards by the height of the building corner, 2900mm as shown in Figure 33.

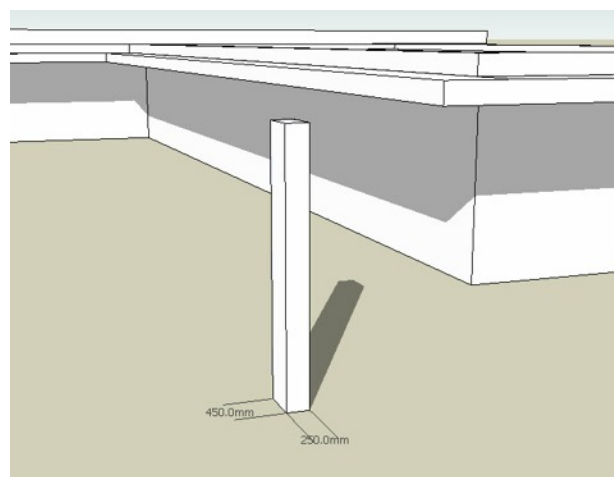


Figure 33. Pillar creation

- Select the pillar and use **EDIT/Make Component** to create the pillar component.
- The **Create Component** dialogue box will appear as shown in Figure 34.

- Overtyping 'Component #1' with 'Pillar1'. Under **Alignment** ensure that '**None**' is selected in the '**Glue to**' window.
- Click on '**Create**'.

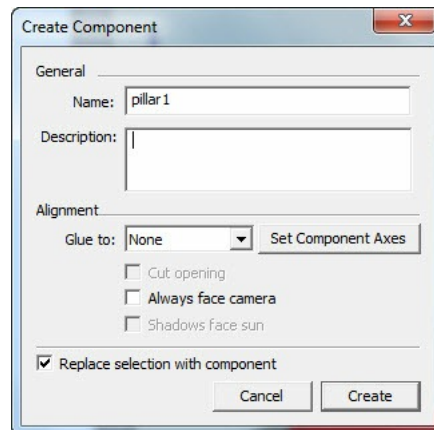


Figure 34. Create Component dialogue box.

- Use **WINDOW/Components** and the Components dialogue box will appear as shown in Figure 35.
- Click on the small house icon to show what components are currently in the model. Locate 'pillar 1' and insert the pillar into the model close to the corner of the building as shown in Figure 36.

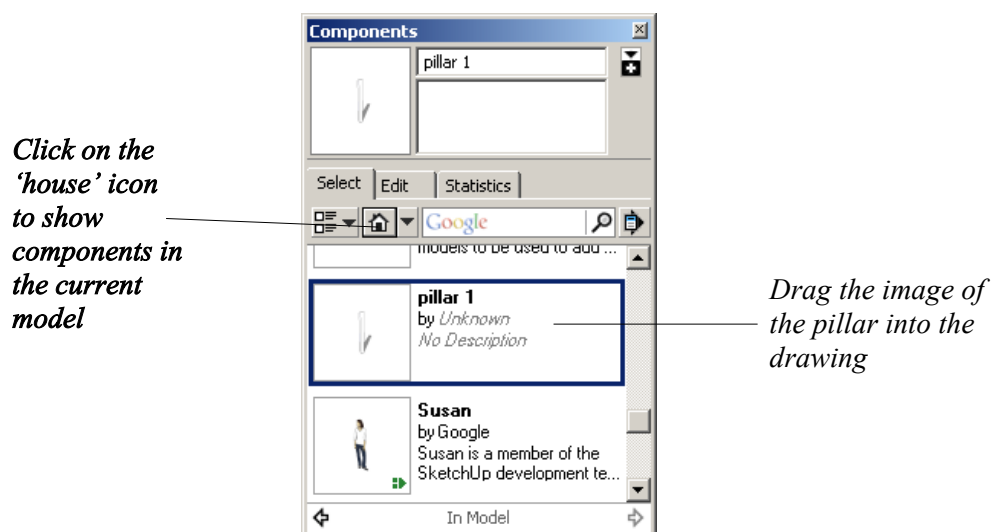


Figure 35. The Components dialogue box.

- Use **MOVE** to move the pillar into its position at the corner of the building. Ensure that the rear corner of the pillar is chosen as the endpoint as shown in Figure 36.
- We now need to copy the pillar along the face of Building 1 and create 4 pillars in between the first and last pillar. This is known as an Internal Array.

Creating an Internal Array

- Use **MOVE** and **CTRL** to create a copy of the pillar, and move the copied pillar along the face of the building. **Ensure that the rear corner of the pillar is selected as the endpoint**, and that you move the copy along the Green axis.

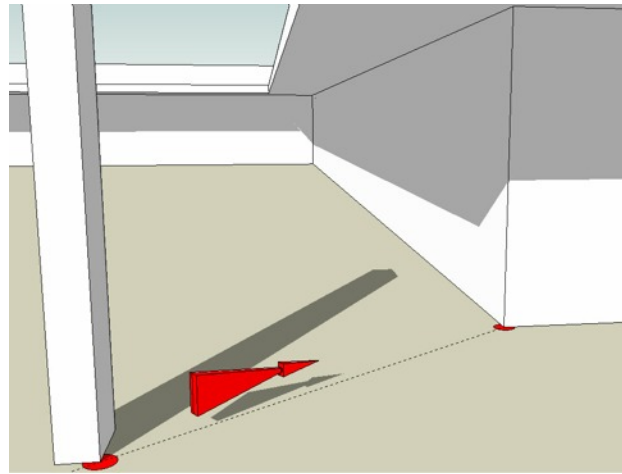


Figure 36. Moving the pillar into position

- Enter 25000 in the Measurement window to place the pillar 25m from the origin. Immediately after placing a copy of the pillar enter 5/ in the same box which will have now changed to 'Length' as shown in Figure 37.
- Repeat the operation for placing the pillar along the face of Building 2.

When the pillar component is placed in the model, it will need to be rotated so that the longest edge (450mm) is parallel with the face of the building.

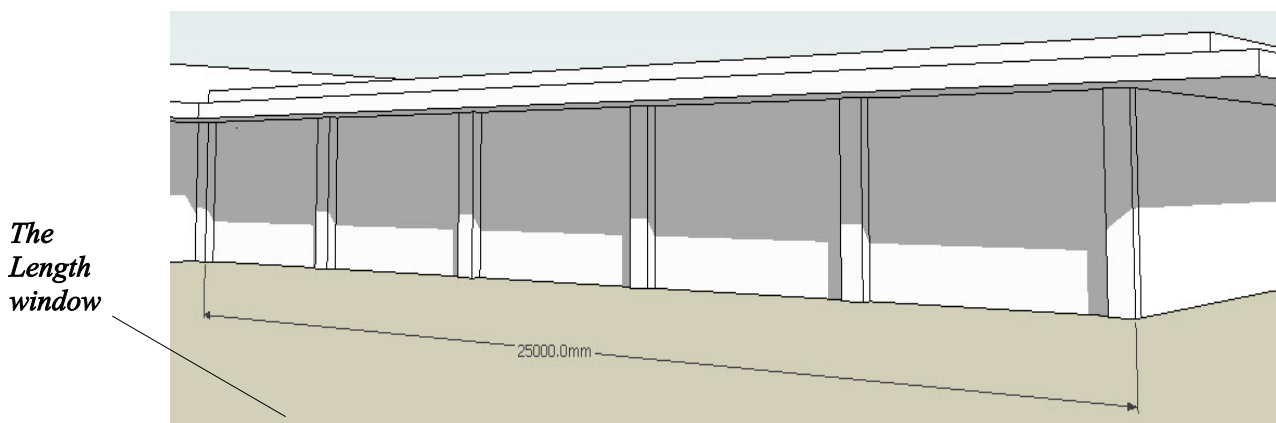


Figure 37. The pillar copied across the face of Building 1 by an Internal Array

- Use **WINDOW/Components** to select 'pillar1' and place it near the left corner of Building 2 as shown in Figure 38.
- Using **ROTATE** place the protractor on the corner of the pillar as shown in Figure 38. Ensure that the protractor is blue in colour i.e. the pillar is being rotated about the blue axis as shown in Figure 38.
- Move the cursor away from the protractor and, ensuring that the cursor is on the Red axis, click the mouse to select the start point of the rotation as shown in Figure 38.
- Move the cursor in the direction of the green axis (the pillar will rotate) until 90 degrees can be seen in the Angle window as shown in Figure 39. The angle can also be typed into this box to ensure accuracy.

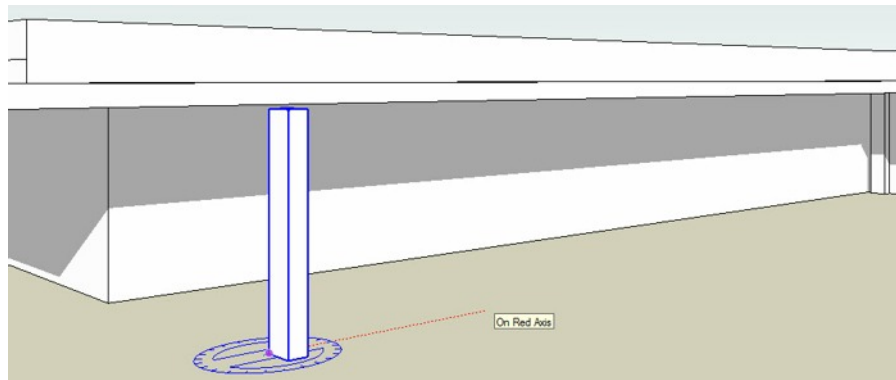


Figure 38. Selecting the zero angle on the Red axis.

- Use **Move** to place the pillar at the corner of the building ensuring that the rear left hand corner of the pillar is placed on the corner of the building as shown in Figure 40.

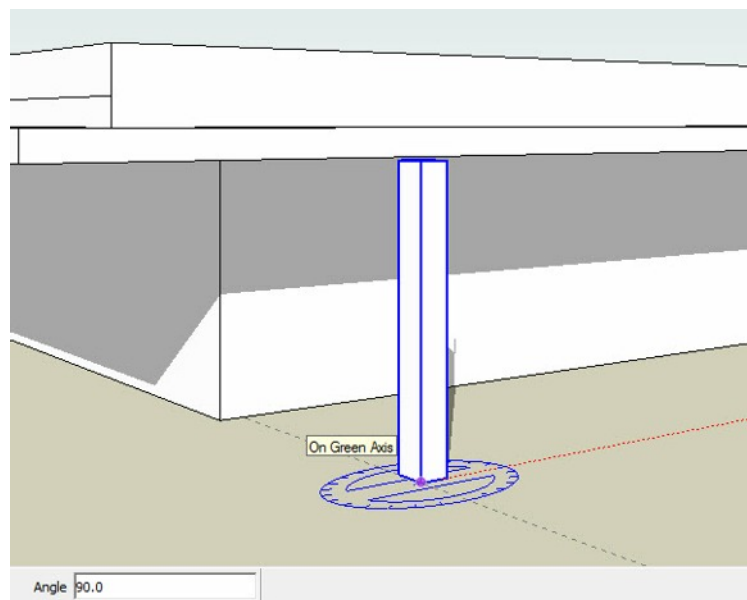


Figure 39. The pillar rotated through 90 degrees.

- Using **MOVE** and **CTRL**, copy the pillar 20000mm (20m) along the face of the building, the Red axis, ensuring that the rear corner of the pillar is selected as the endpoint. Enter **4/** in the Length window this time to copy a total of 4 copies of the pillar as shown in Figure 40.

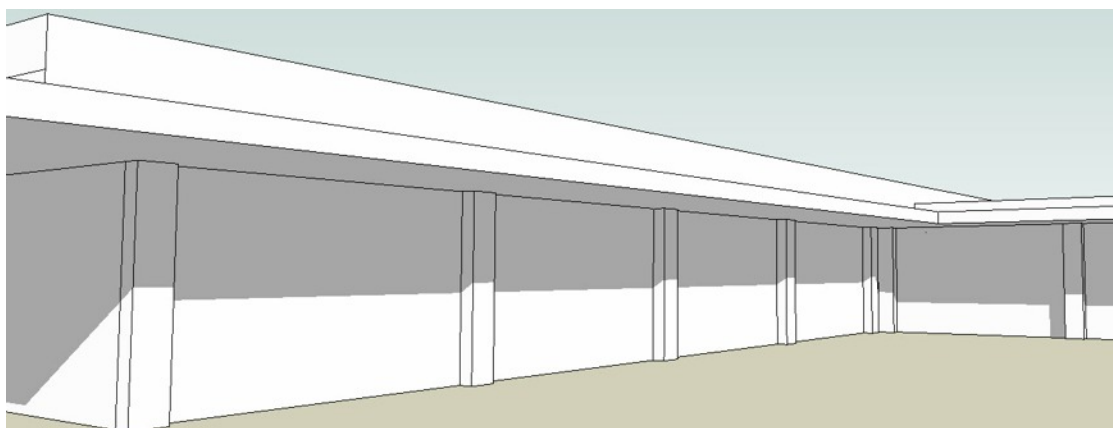


Figure 40. The pillar arrayed along the face of Building 2.

We now need to make changes to Building 3.

- **Zoom** to the corner of Building 3 as shown in Figure 41.

Use **Move** and **CTRL** to copy the roof downwards by 3000mm and 300mm in that order as shown in Figure 41.

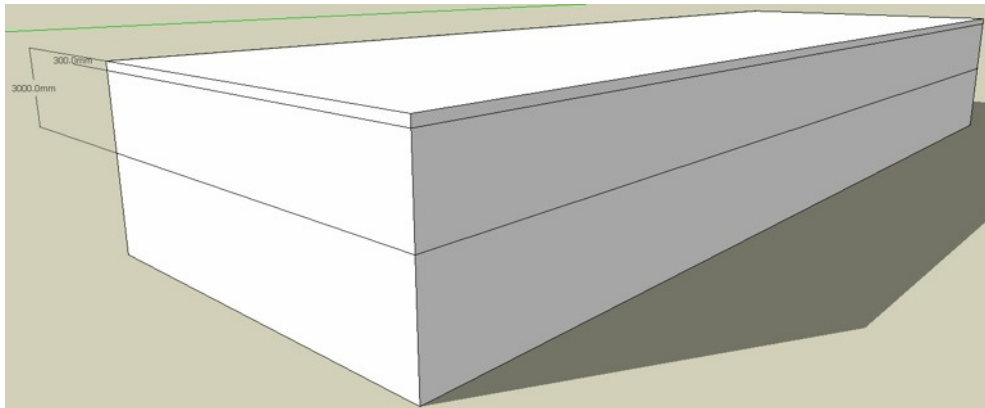


Figure 41. Copying the Roof

- Use **Push/Pull** to move the left hand walls and front upper wall inward by 300mm and the lower front wall inward by 1500 as shown in Figure 42.

TIP If you copy the roof down by 300mm and then try to copy the roof by 3000mm, Sketchup will try to stop you copying beyond 300mm, so copy the larger distance first.

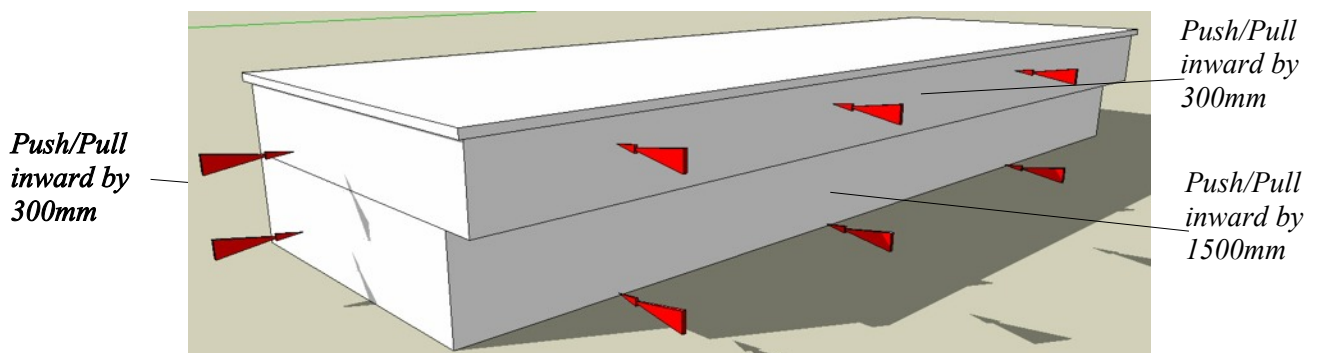


Figure 42. Side and front walls moved inward with Push/Pull

- Create a pitched roof with a height of 2500mm as shown in Figure 43.

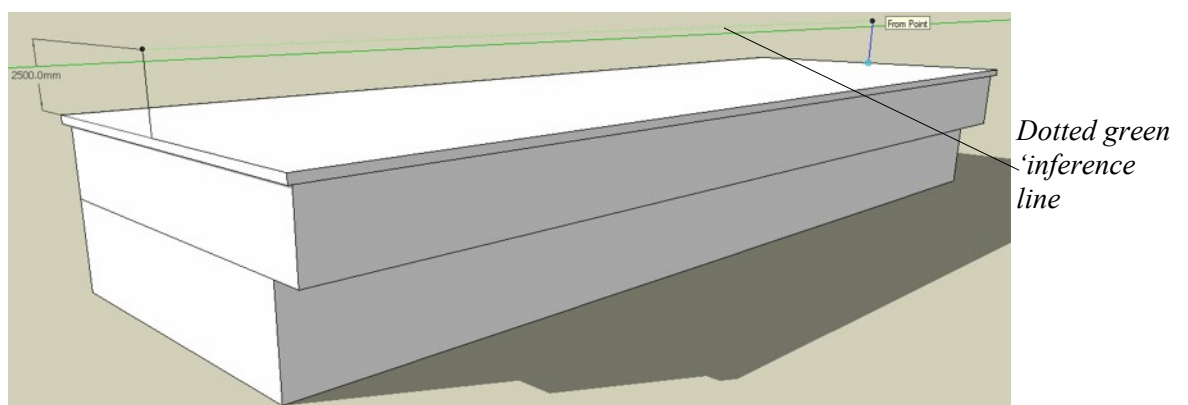


Figure 43. Drawing the roof ridge by 'inferencing'

TIP After you have drawn the first line at the Midpoint of the roof as shown in Figure 43, pick the Midpoint at the opposite end of the roof and then start drawing the line upwards on the blue axis. Move the pointer to the top of the first line whilst the line is being drawn and hover over the top Endpoint of the first line for 2 seconds. Move the pointer back to the second line and continue drawing it upwards. You will see a green dotted line joining with the top of the first line. Click this point as Sketchup is indicating that the second line is now at the same height as the first - 2500mm. This method is known as 'inferencing'.

- Complete the roof as shown in Figure 44.

Delete the extraneous lines at both ends of the roof as shown in Figure 44.

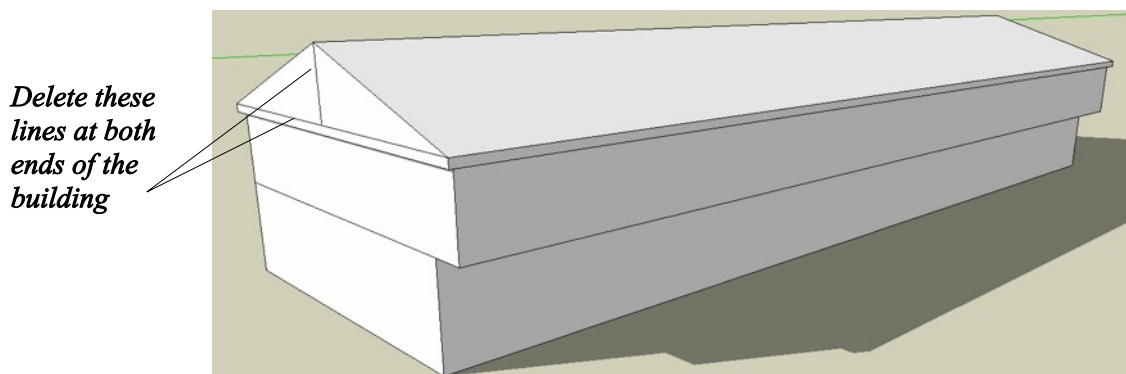


Figure 44. The Completed Roof

- Use **Push/Pull** to zoom to a position as shown in Figure 45 and draw a rectangle 450x250 on the underside of the overhang.
- Create a component of the rectangle with **EDIT/Make Component** and name it 'column2'.

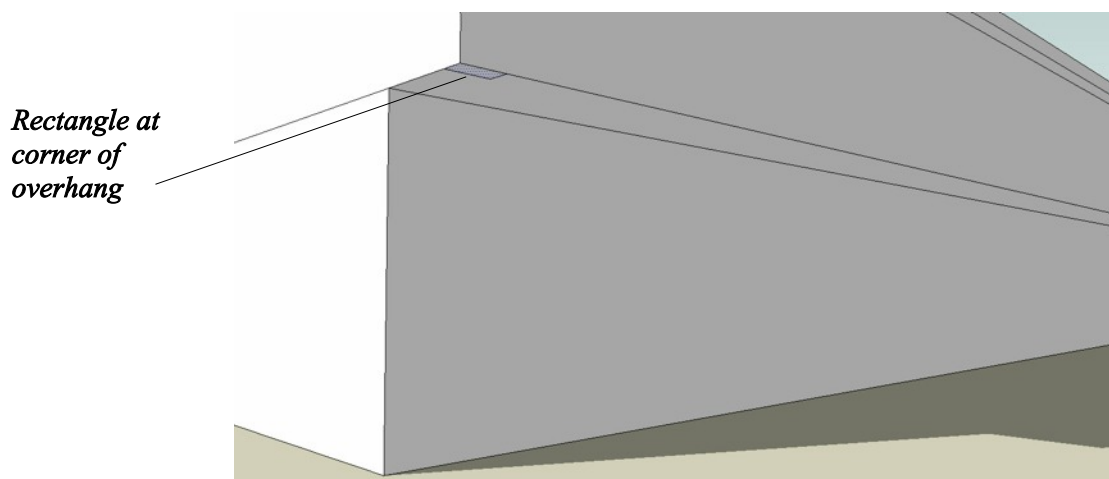


Figure 45. Rectangle at the corner of the overhang on Building 3

- **Double click** on the new component and use **Push/Pull** to pull the rectangle downwards to ground level as shown in Figure 46.

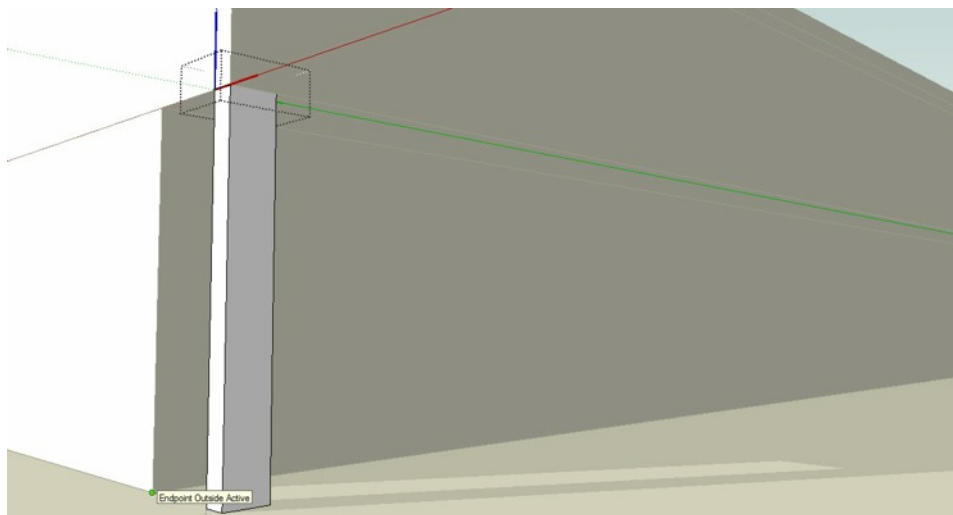


Figure 46. The Column pulled downwards to the same level as the building by inferencing

TIP You must double click a component as this enters the component 'edit' mode to allow Push/Pull, in this instance, to be used.

TIP As you are pulling the rectangle downwards move the pointer to the corner of the building. A green circle will appear, indicating that the column base is at the same level as the building corner as shown in Figure 46. This is also known as 'inferencing'.

- Select the component 'column2' and use **Move** and **CTRL** to copy the column to the other end of the overhang. Ensure that the top right hand edge of the column is selected as the base point so that it is copied to its correct position as shown in Figure 47.
- Immediately after the copy is made enter '**9**' in the Measurements window and the column will be arrayed between the first and last column as shown in Figure 47.

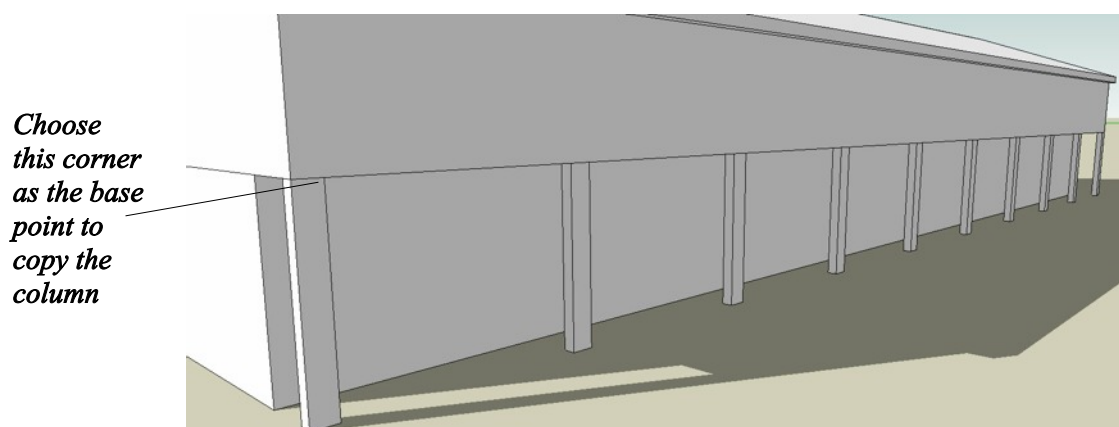


Figure 47. The copied column arrayed along the length of Building 3

Creating Window Components

We can now add windows to the three buildings in the model. We will create a simple rectangle component and add variations to that component to create different windows.

- Use **Orbit** and **Pan** to view Building 1 as shown in Figure 48. You may find it useful to use the **Position Camera** and **Look Around** commands also.
- Use **Rectangle** to draw a rectangle 3500mm long and 2500mm high in the position as shown in Figure 48. It does not matter where on the face the rectangle is placed at this stage.
- Select the four edges of the rectangle and right-click.

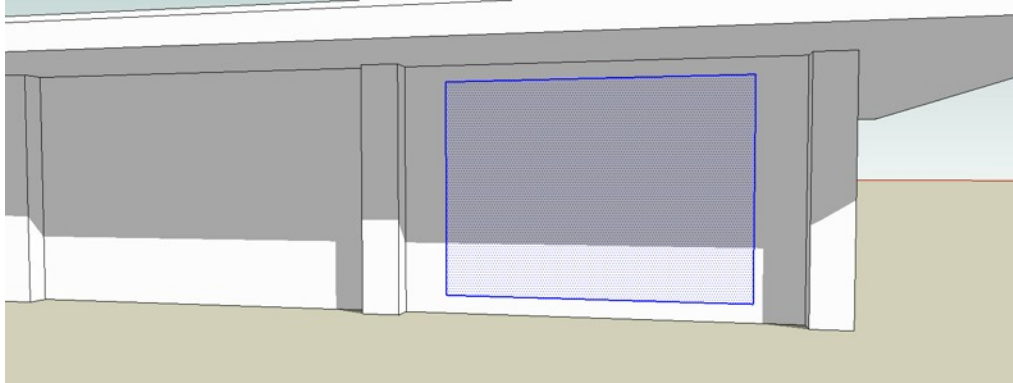


Figure 48. Rectangle drawn on the building face and selected

- Select **Make Component** and name the component **Window1** as shown in Figure 49. Ensure that Glue to **Any** is selected and the **Cut Opening** box is ticked.

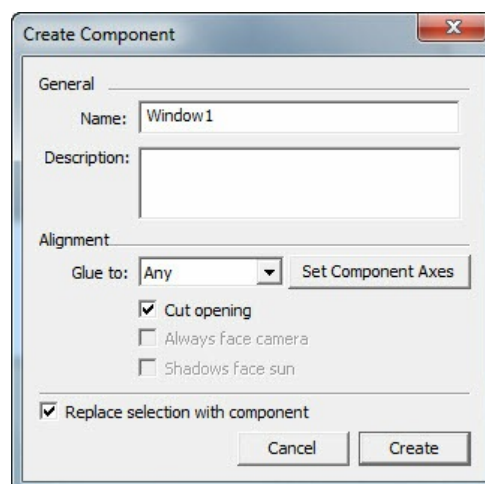


Figure 49. Create Component dialogue box

- Draw a line along any of the edges of the window to heal the face as the opening will have been cut.

- Create the window subdivisions with the dimensions shown in Figure 50.

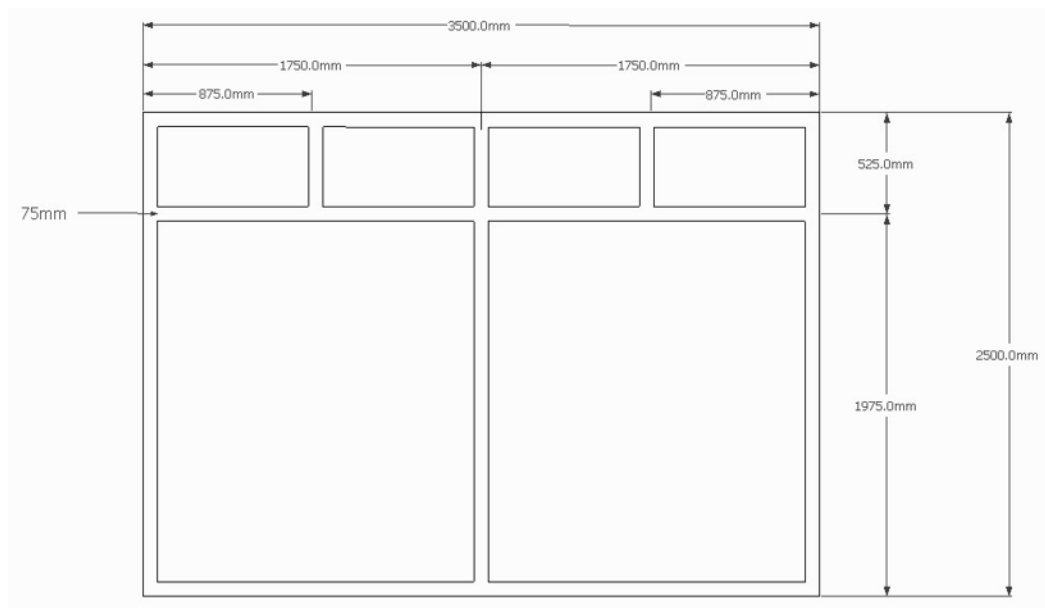


Figure 50. Window1 dimensions

- The partially completed window frame is shown in Figure 51.



Figure 51. The partially completed window frame.

We will use **Scale** to stretch the window frame in two directions - horizontally, then vertically to fit exactly into the window bay between the pillars and then the roof overhang and the ground. We will then use **Push/Pull** to give the window frame depth and lastly we will add colour to the frame and to the face of the window glass.

- **Double click** the window frame to enter the Component Edit mode and **double click again** on the frame. Building 1 will 'grey out'.
- Use **Scale** and click on the left midpoint of the frame at the green square. The square will turn red as shown in Figure 52.
- Drag the red square until it locks onto the rear line of the left hand pillar as shown in Figure 53.

- Repeat this operation on the right hand square and the window will have stretched between the pillars as shown in Figure 52.

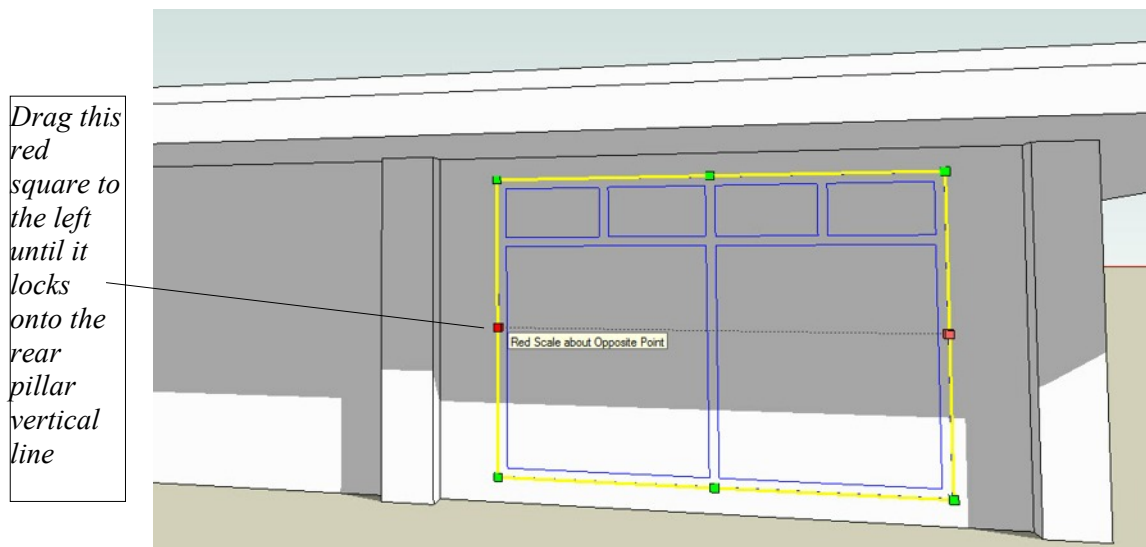


Figure 52. Scaling the window frame between the pillars

- Repeat again on the two central squares, but this time in the vertical direction to lock onto the horizontal overhang line and the ground line as shown in Figure 53.

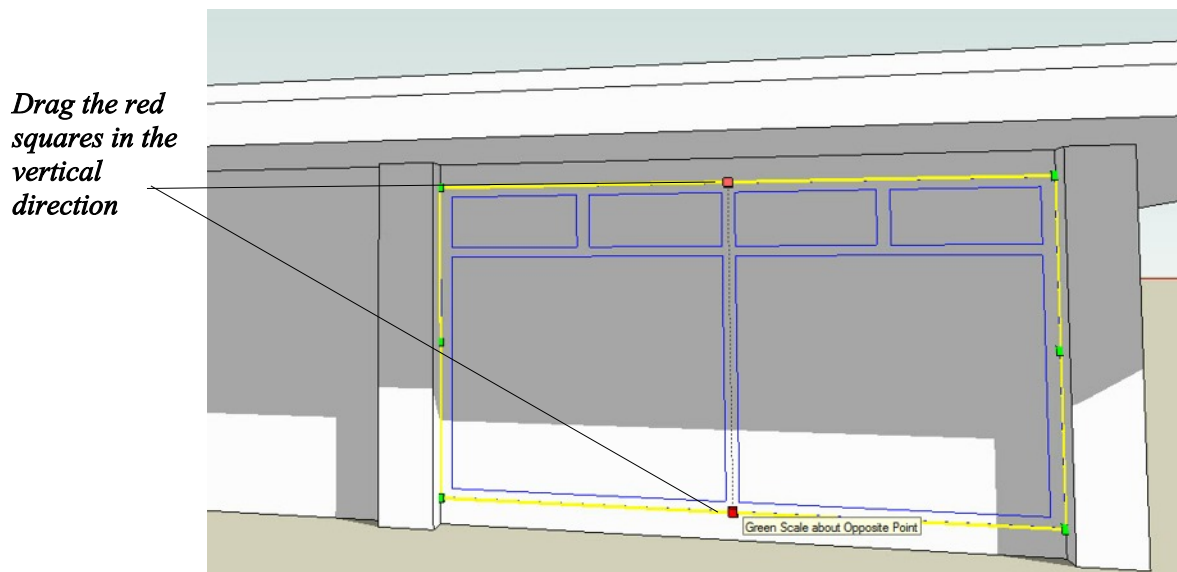


Figure 53. Scaling in the vertical direction

- Use the **Paint Bucket** to colour the window glass and window frame.
- Select the **Paint Bucket** and the **Materials** dialogue box will appear as shown in Figure 54.

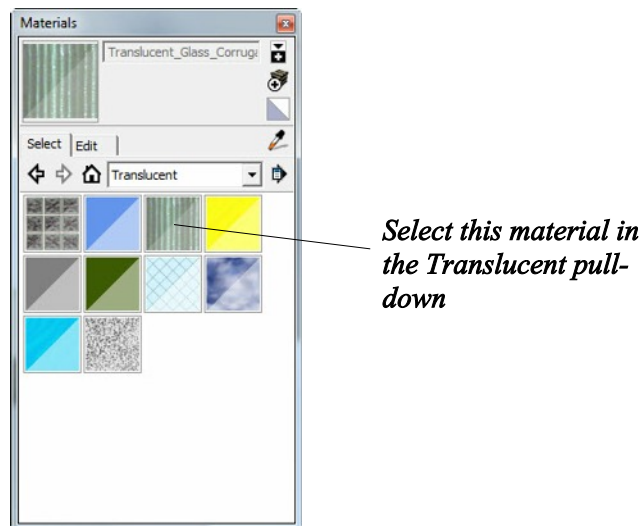


Figure 54. The material selected for the face of the window glass areas

In the pull-down select the '**Translucent Glass Corrugated**' material.

- Move the pointer over the windows in turn and click to 'paint' each face with this material as shown in Figure 55.



Figure 55. Window1 with materials

Repeat the operation for the window frames selecting the **Colors** pull-down and select colour 'H13' as shown on the frames in Figure 55.

We can now copy and array Window1 along the face of Building 1 in between the pillars.

- Select **Move** with **CTRL** to copy the window. and pick the lower left corner of the window as shown in Figure 56.
- Copy the window to the last pillar on Building 1 ensuring that the rear of the pillar is selected as shown in Figure 56.
- Immediately after copying enter '**4/**' in the Measurements dialogue box and the window will be internally arrayed along the face of Building 1, between the pillars as shown in Figure 56.



Figure 56. The completed window internally arrayed along Building 1.

- Repeat the operation on Building 2 by inserting the window at the left hand bay, scaling it between the pillars and internally arraying with 3 window copies as shown in Figure 57.



Figure 57. Building 2 windows inserted and copied

We shall now alter the window in the middle bay of Building 1 to include sliding doors.

- Select the **window1** component in the middle bay.
- Right click the mouse and select **Make Unique**.
- As shown in Figure 58 bisect the window horizontally and vertically with identical mullions and transoms.
- Push/Pull the mullions and transoms to a 75 mm thickness inwards to match the rest of the window frame.

Use the **Paint Bucket** to paint the new frames the same colour as the other windows. It is easy to forget what colour has been used so use the 'eyedropper' tool as shown in Figure 59 to take a sample of the

colour on an existing frame. Follow this with the **Paint Bucket** tool and it will be painted in the same colour.

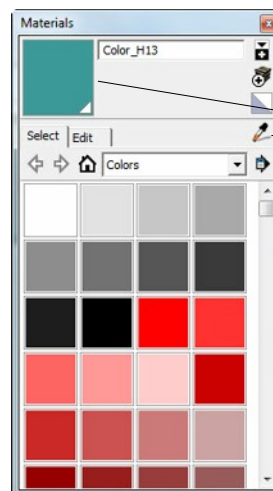
- Repeat the operation to insert a door in one of the window frames in Building 2.

TIP Why do you need to make the altered component unique? Because any changes to a component will be duplicated in all instances of that component in the model if it is not used. In this case every window would be altered to include doors.



Figure 58. The middle bay of Building 1 altered to include doors

We are now ready to insert the windows in the ground floor of Building 3. We will insert 12 windows along the facade of Building 3 and then add a door as we did in Buildings 1 and 2. The difference this time is that we will change the glass colour. In order to do this the Window1 component must be made 'unique' as changing any feature of a previously used component will change all of the Window1 components in the drawing. Before that we need to measure the length of the building.



Use the eyedropper tool to sample an existing colour and it will appear in the swatch window

Figure 59. Using the eyedropper tool to sample the window frame colour

- Using the **Tape Measure** tool measure the length of the building and divide that number by 12. Divide the answer by 2 to obtain the distance that the first window will be placed from the corner of the building as shown in Figure 60.
- Use the **Tape Measure** tool again and place two vertical guide lines the required distance from the corner of both ends of the building as shown in Figure 60.
- Using **WINDOW/Components** insert the Window1 component at the junction of the guide and the bottom of the building as shown in Figure 60.
- Whilst the component is still selected, right click and select **Explode**. Left click on the component and it will revert to its original individual objects.

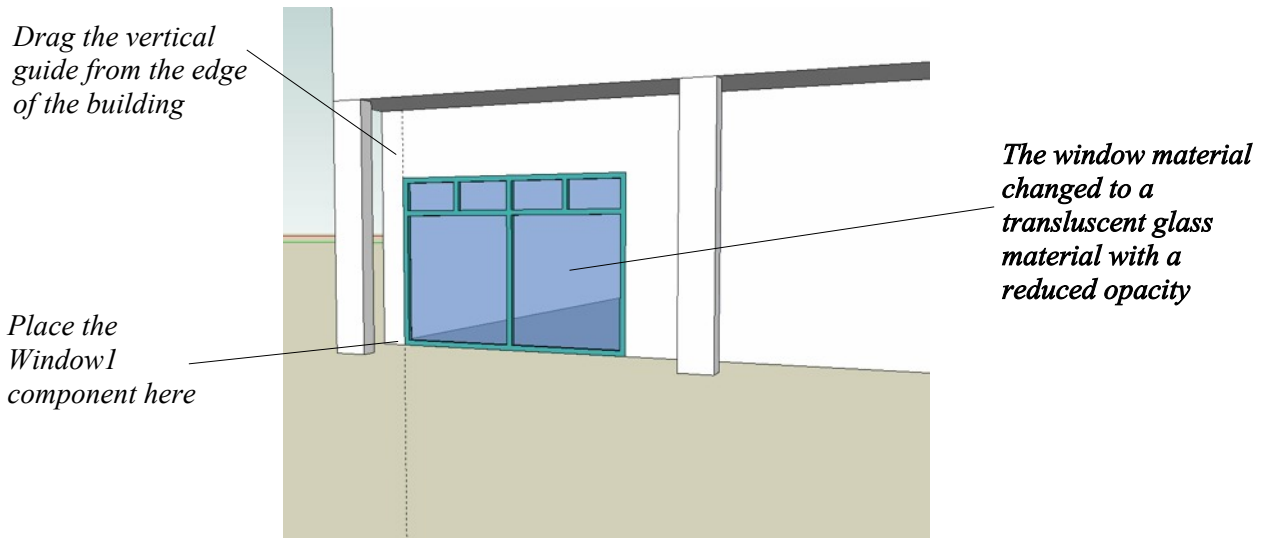


Figure 60. Window1 component placed at the junction of the guide and base of the building

- Select the windows and use the **Paint Bucket** to change the window material to a Translucent Glass colour. Click on the **Edit** tab and edit this colour and change the opacity to a suitable number so that the glass is translucent.
- Select all of the objects which comprise the updated window and right click on the mouse and select **Make Component** to rename the window component as Window6. Ensure that **Glue to Any, Cut Opening and Replace Selection with Component** are selected.
- With the Window6 component selected use **Move** with **CTRL** to copy the window to the other end of the building. Ensure that the bottom right corner of the window is the base point and copy the window to the intersection of the previously created guide line.
- Immediately after copying enter **12/** in the **Measurement** box and an internal array will be created as shown in Figure 61.
- Erase the two vertical guides.
- In the window of the middle bay of the ground floor, add a door as shown in Figure 61, using the same method as in Buildings 1&2. Ensure to right click the mouse and **Make Unique**, otherwise every instance of **Window6** will have a door.



Figure 61. Ground floor window6 component copied and arrayed

We are now ready to add the first floor balcony and window and doors.

- Using the **Tape Measure** tool create two horizontal guides, 300mm from the soffit and 200mm from the top of the columns as shown in Figure 62.
- Using the **Tape Measure** tool create two vertical guides lining them up with the edges of the columns as shown in Figure 62.
- At the intersections of the horizontal and vertical guides use the **Rectangle** tool to create a rectangular face as shown in Figure 62.

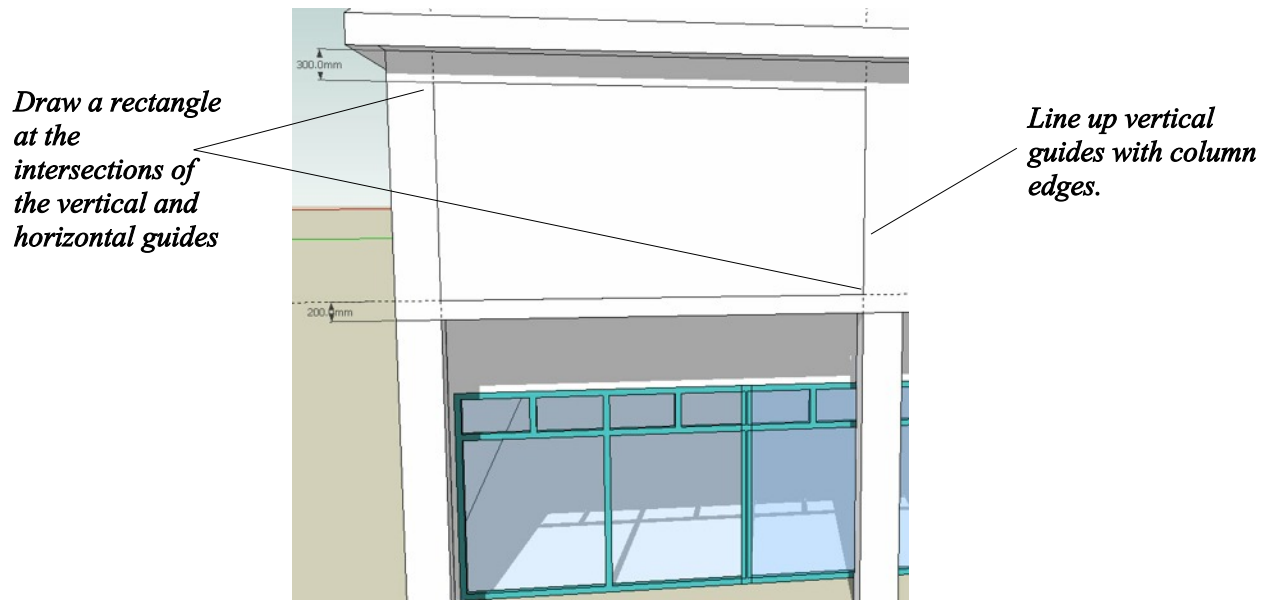


Figure 62. Guides and rectangle used to form balcony opening

- Using the **Push/Pull** tool select the face created by the rectangle and push it into the building by 2000mm as shown in Figure 63.

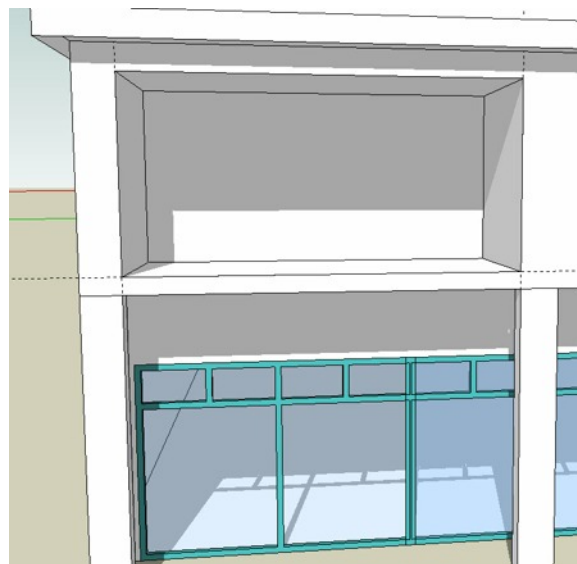


Figure 63. Balcony recess formed with the Push/Pull tool

- On the rear face of the balcony recess create a window and doors as shown in Figure 64 using your own dimensions.
- Use **Push/Pull** to add a 75mm depth of frame.

- On each of the window faces add a suitable material to create the impression of a semi-opaque glass as shown in Figure 64.
- Add two circles of 25mm radius to form door handles as shown in Figure 64.

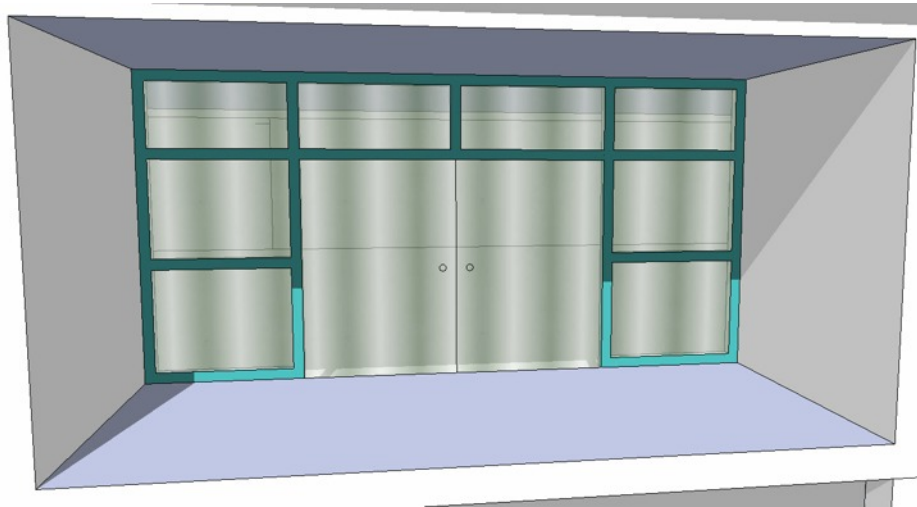


Figure 64. Windows and doors created in recess of balcony

- Select all parts of the newly created window and doors and use **EDIT/Make Component** to create a new component called **balcony window**.
- Create identical rectangles along the 1st floor face of Building 3 and recess each face by 2000mm as you did for the first rectangle.
- Insert the **balcony window** component at the rear of all of the recesses as shown in Figure 65.



Figure 65. 1st floor rectangles created and balcony window component added to each recess

We can now add a balustrade topped with a circular handrail to the front of the balconies.

- Zoom to the right hand side of the first balcony on the left side of Building 3.
- Using the **Tape Measure Tool** create two guides, the first 1000mm from the balcony floor and the second 50mm inwards from the edge of the balcony as shown in Figure 66.
- Draw a 25mm radius circle at the intersection of the guides as shown in Figure 66.
- From the centre of the circle draw a line on the green axis until it meets the face opposite, on the other side of the balcony.

- Draw a line downwards on the blue axis until it meets the face of the balcony floor. You could enter 1000mm in the Measurement box instead.
- Draw a line in the green axis along the floor of the balcony until it meets the face and directly below the circle.

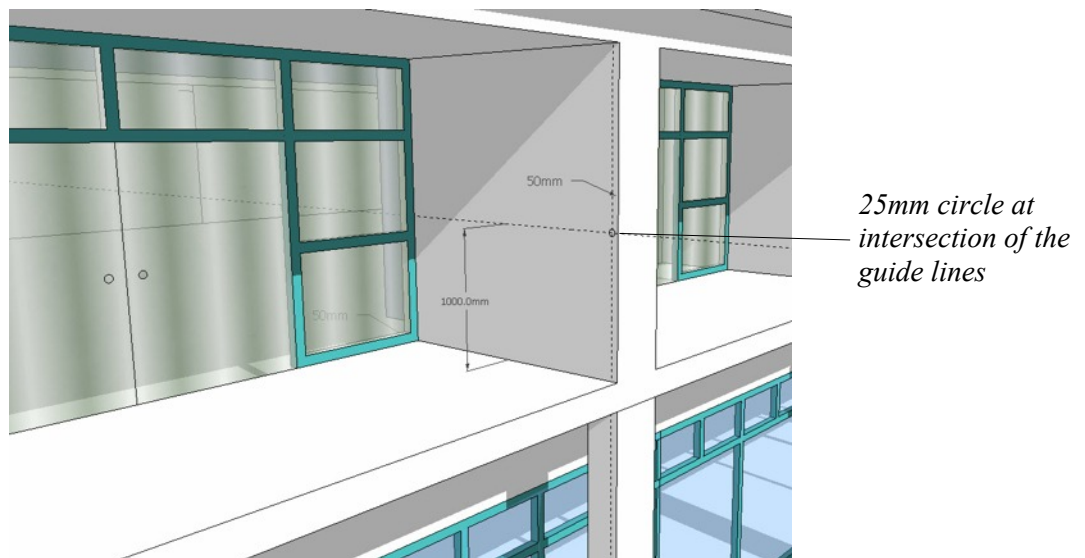


Figure 66. Construction of the balustrade

- Draw a line up to meet the centre of the circle and a face will be formed as shown in Figure 67.

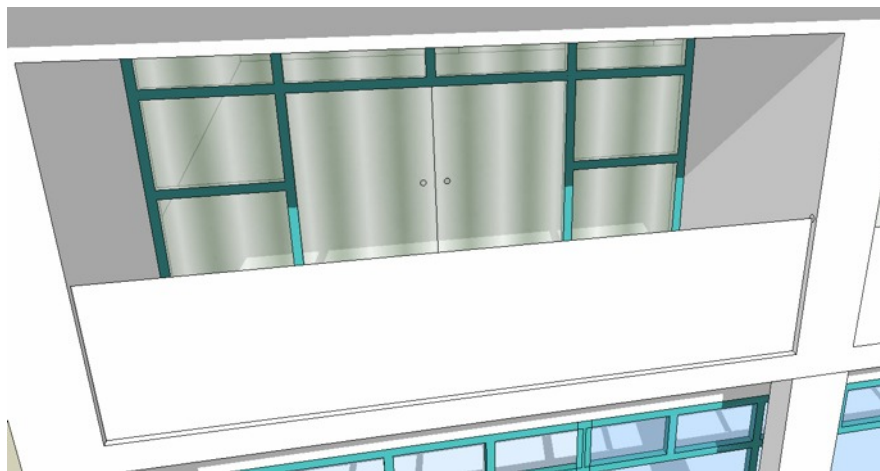


Figure 67. The balustrade face is formed from four lines

- Using the **Follow Me** tool select the circle face and select the top line of the balustrade. Move the mouse pointer towards the opposite wall until the extruded circle touches the face of the opposite wall as shown in Figure 68.
- Use the **Paint Bucket** tool to add materials to the handrail and face of the balustrade. I used **Water Pool (1)** and in the **Edit** tab I increased the spacing to create a glass effect on the face of the balustrade. To complete the handrail I used **Water Stream Shallow** and again increased the spacing to obtain a matt chrome reflective effect.
- Select all of the objects comprising the balustrade and use **EDIT/Make Component** to create a component called **balustrade**.

- Insert the **balustrade** component along the balconies ensuring that they are recessed 50mm in from the balcony edge as shown in Figure 69.

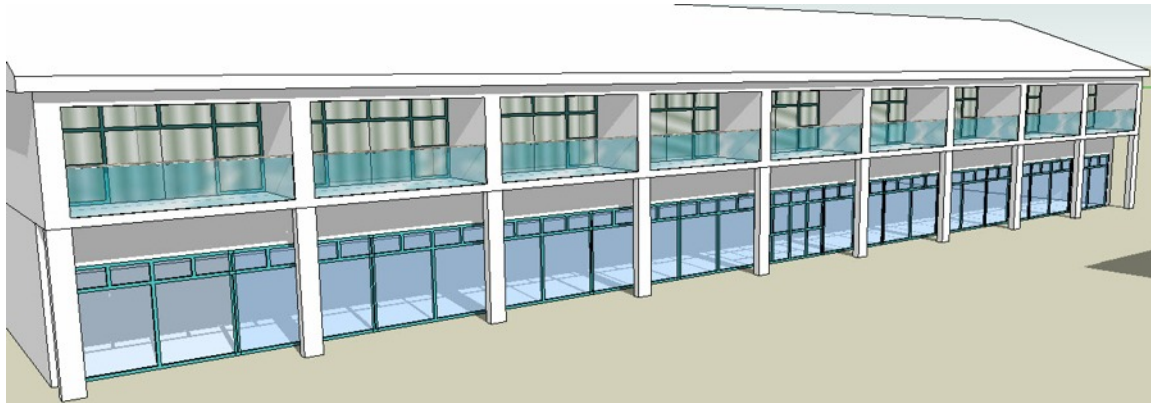


Figure 69. Completed balustrades in position

Creating Street Furniture

We will create 5 types of street furniture:- steps handrail, a planter bench, bollards, street light and a modern type bench seat.

The Steps Handrail

- Using **WINDOW/Layers** turn off as many layers as possible to. Create a layer called **Handrail** and make it the current layer.
- Draw 500mm lines from the middle of the top and middle of the bottom of the steps as shown in Figure 70, ensuring that both line are in the 'Green direction'.
- From the ends of both lines draw 1000mm lines upwards in the 'Blue direction' as shown in Figure 70.

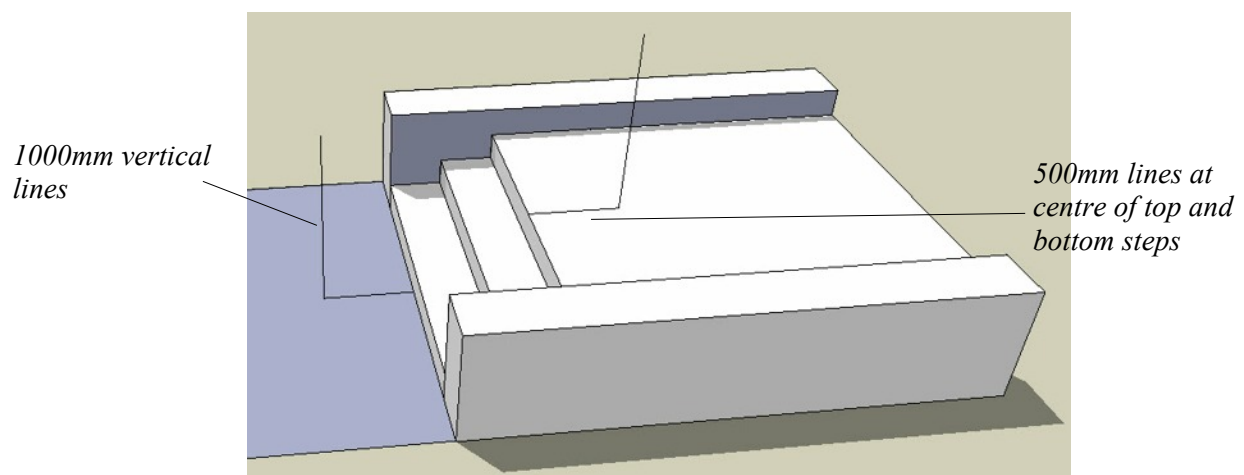


Figure 70. 500mm and 1000mm lines drawn in position

- At the top of each of the 1000mm lines draw 200mm and 300mm lines as shown in Figure 71 ensuring that they are drawn in the green direction.
- Delete the 500mm lines at the top and bottom of the steps.

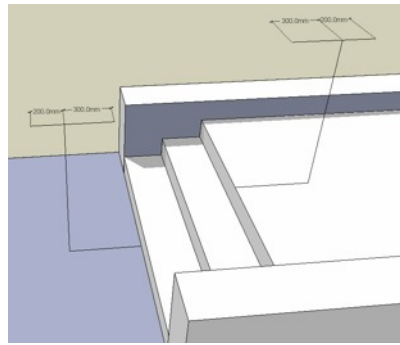


Figure 71. The horizontal 200mm and 300mm lines in position

- Join the ends of the horizontal lines with a line as shown in Figure 72.

*Draw this line to join
the two horizontal lines*

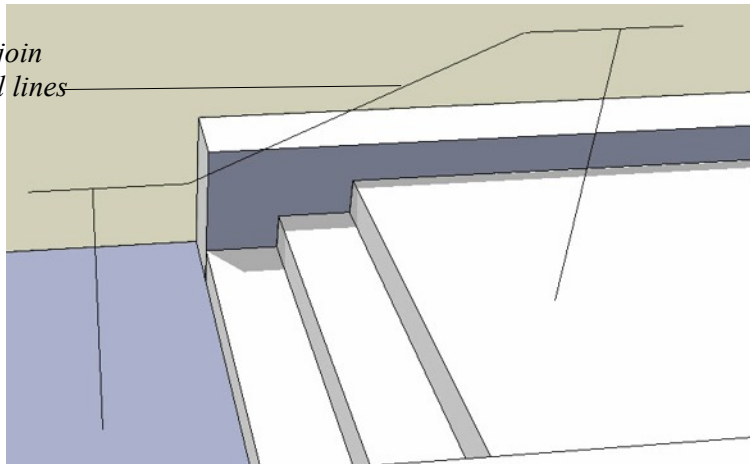


Figure 72. The outline of the completed handrail

- At the end of the rail at the bottom of the steps, draw a circle with 20mm radius as shown in Figure 73.

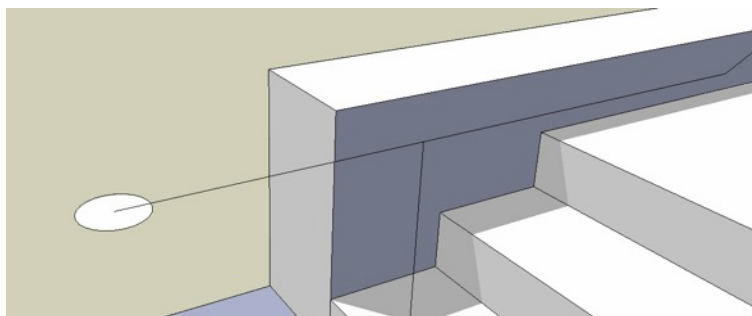


Figure 73. The 20mm radius circle at the end of the line

- Select the face of the circle as shown in Figure 74.
- Using the Rotate tool select the centre of the circle and hold down the mouse button. The Blue axis of rotation appears first.
- Still holding the mouse button down, move the cursor until the Red axis appears.
- Release the mouse button.

- Click once in the centre of the circle and click again on the perimeter of the red axis.
- Move the cursor so that it is at a point 90° from the perimeter point you just chose and click once. You will see the circle rotate through 90° as shown in Figure 74.

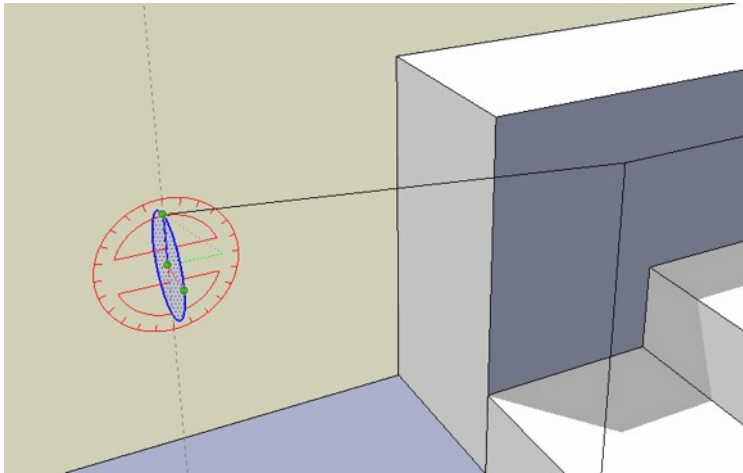


Figure 74. The rotated circle

TIP Rotating Objects. To successfully rotate an object takes a little practice to obtain the correct axis of rotation - blue, red, green or black (black is any angle you stop at). The trick to cycling through blue, red or green is to:-

Select the objects to rotate. Activate the **Rotate** tool and click once to establish the axis of rotation but **HOLD THE MOUSE BUTTON DOWN**. Still holding the mouse button down, move the cursor around until, in this case, the RED axis of rotation appears. Release the mouse button to set the axis of rotation. Click the point at which you want to activate the rotation. Rotate the red axis through 90 degrees.

- Because Sketchup employs 'sticky geometry' (i.e. If you move an object which is attached to another object it will drag that object with it), you will see that the horizontal line of the handrail has now moved to either the top or bottom of the circle depending on how you rotated it.
- Use the **Eraser** to delete this line as shown in Figure 75 and use **Draw/Line** to draw another line from the centre of the circle to the end of the vertical line.

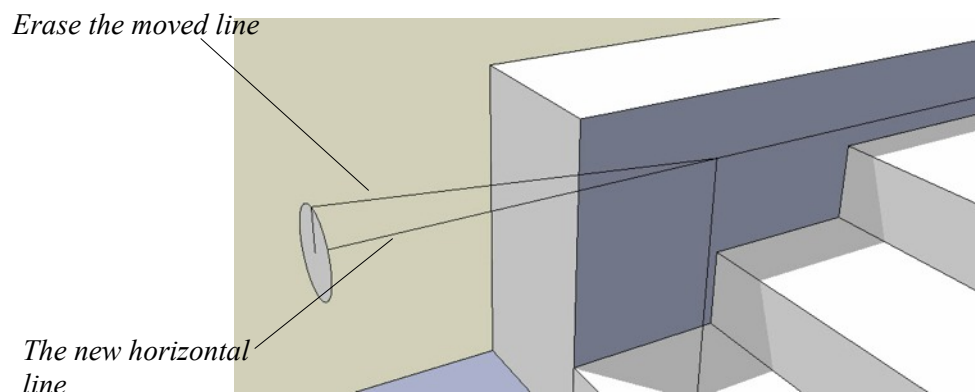


Figure 75. The line to be erased with the new line drawn in position

- We will now use the **Follow Me** tool to extrude the circle using the path of the handrail as the path of extrusion.
- Firstly ensure that you can see the whole of the handrail onscreen.
- Using the Follow Me tool select the face of the circle and then move the cursor along the line of the handrail which will turn red as shown in Figure 76.

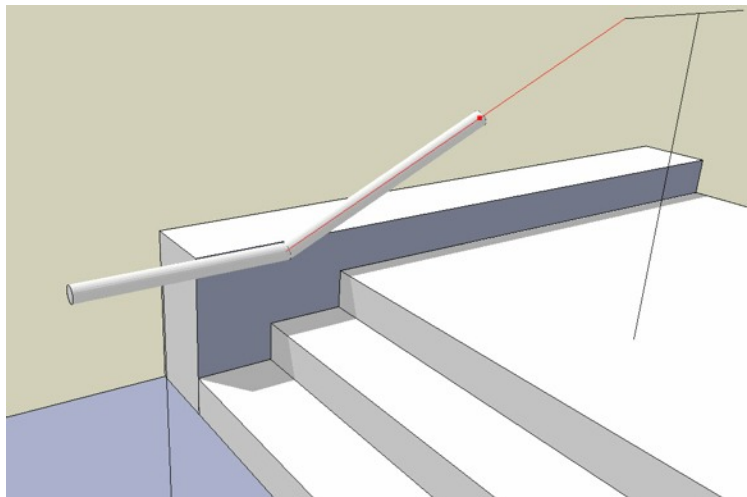


Figure 76. The Follow Me tool extruding the circle along the handrail.

- Use **DRAW/Circle** to draw a 20mm radius circle with centres at the base of the vertical handrail lines.
- Use **PUSH/Pull** and select the face of the circle to drag it up to the centre of the horizontal handrails.
- Figure 77 shows the completed handrail. Use the **Paint Bucket** to apply a metal aluminium material.

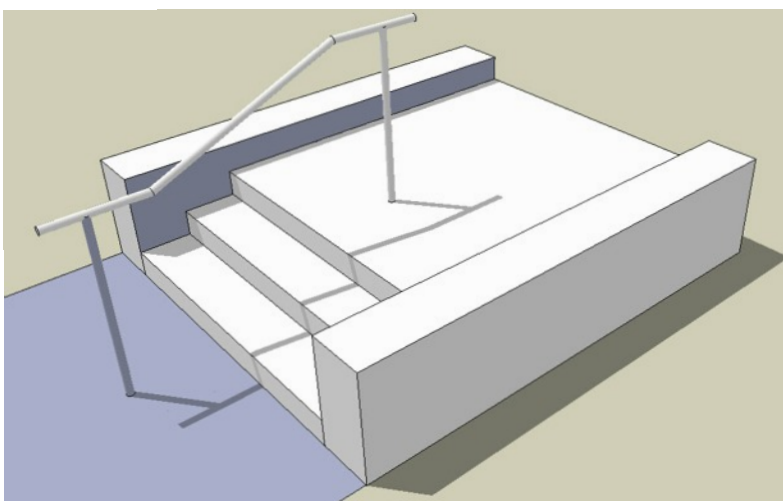


Figure 77. The completed handrail before material is applied using the Paint Bucket

Creating the Bollard

- We will now create the circular bollard by creating its profile and use the **Follow Me** tool to rotate the profile around its base to create the completed circular effect.

TIP Drawing profiles. To successfully draw a vertical profile it is advisable to draw a vertical face on which to draw the profile, delete the vertical face and then rotate the profile into its final shape with the Follow Me tool.

- Using **WINDOW/Layers** create a layer called '**Bollard**' and make it the current layer.
- In an open area of the drawing create a rectangle 500mmx500mm and use **Push/Pull** to pull the rectangle up by 600mm as shown in Figure 79.

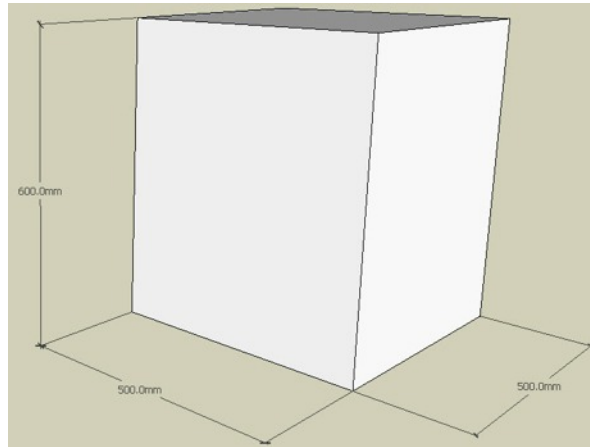


Figure 79. The rectangular box created with the required measurements

- At the left edge of the box create guides to the dimensions as shown in Figure 80.

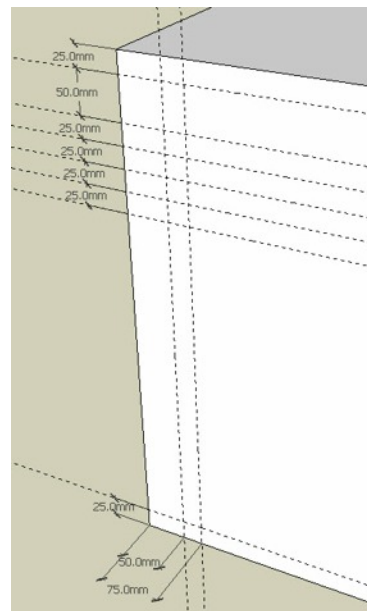


Figure 80. The left edge of the box with guides and distances shown

- Draw in the profile of the bollard as shown in Figure 81 (shown in red for clarity only).
- Use the **Arc** command for the dome.
- For the protrusions and indentations use the Arc command again to form half circles as shown in Figure 81.
- Ensure that the vertical line from the lowest indentation reaches the base level as shown in Figure 81.

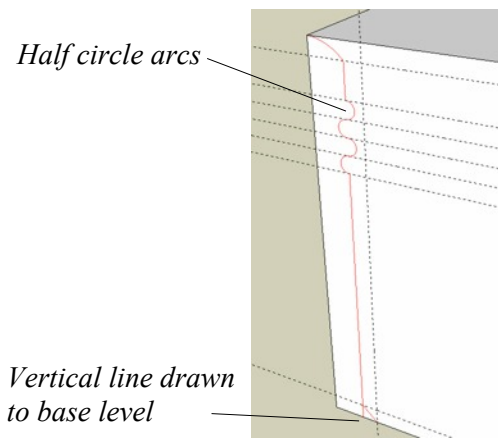


Figure 81. The profile of the bollard shown in red

- Use the **Eraser** to delete the box and guides, leaving the bollard profile.
- Draw a circle at the base of the bollard profile with a radius of 75mm as shown in Figure 82.

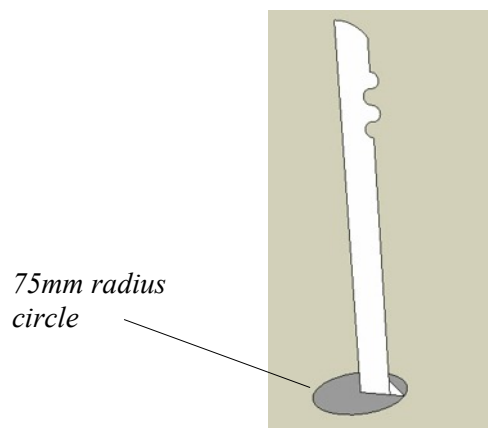


Figure 82. The guides and box deleted and the circle drawn at the base

- At the base use the **Follow Me** tool to rotate the triangular wedge shape around the circle as shown in Figure 83.

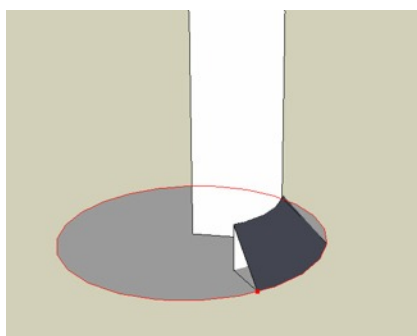


Figure 83. The triangular wedge being rotated with the Follow Me tool using the circle as the path

- Once completed use the **Push/Pull** tool to pull the central core up to the bottom of the lowest semi-circle as shown in Figure 84.

Draw a line from the centre to the end of the semi-circle

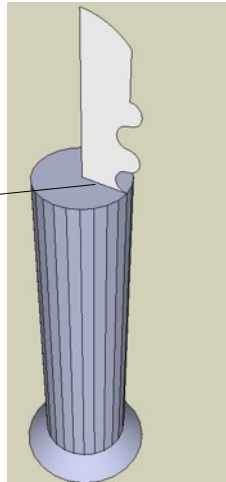
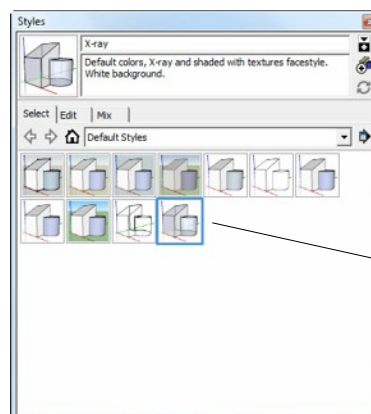


Figure 84. The central core pulled to the base of the lowest semi-circle.

TIP The Push/Pull tool. As in this case, when you are pulling a face to a level, you will see that Sketchup will only raise the face by 25mm because it has encountered a barrier. Simply raise to this level, click again on the face and continue to pull the face upward to its destination.

- Using **WINDOWS/Style/X-Ray**, change the drawing style to X-Ray as shown in Figure 85.



X-Ray style highlighted

Figure 85. The Styles dialogue box with X-Ray Style chosen

TIP Using the X-Ray Style. We are going to use the Follow Me tool again to rotate the upper face of the bollard. The problem here is that we are unable to see the whole of the perimeter of the circle, which is the path of rotation, as it is obliterated by the face of the bollard profile. Sketchup sometimes doesn't like this and produces weird results, so I use the **WINDOW/Styles/X-Ray** style to enable a view where all edges in the model can be seen.

- Use the Follow Me tool to highlight the upper bollard face and rotate around the path of the circle face taking care to follow each vertices of the circle as shown in Figure 86.

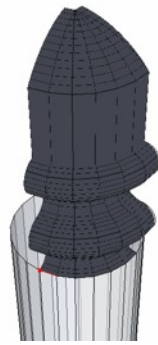


Figure 86. The upper bollard face being rotated around the perimeter of the circle

- When completed use **WINDOW/Style/Default Style** to return the model to its original solid style as shown in Figure 87.

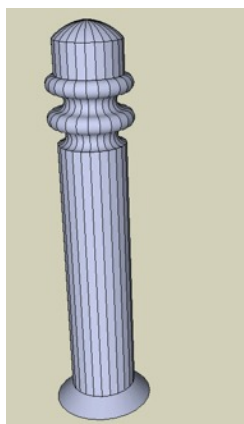


Figure 87. The completed bollard with original Default Style

- Use the **Paint Bucket** to apply material colours as shown in Figure 88.

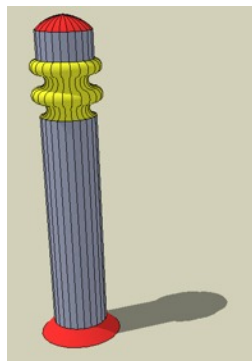


Figure 88. Material colours applied to the completed bollard with the Paint Bucket

- We will now create a Component out of the bollard so that we can insert it into the drawing repeatedly without having to redraw it or copy it each time.
- Select the bollard by putting a selection window around it.
- Select **EDIT/Make Component** and the Create Component dialogue box will appear as shown in Figure 89.
- Overtyping 'Bollard' in the Name line and clicking Create.

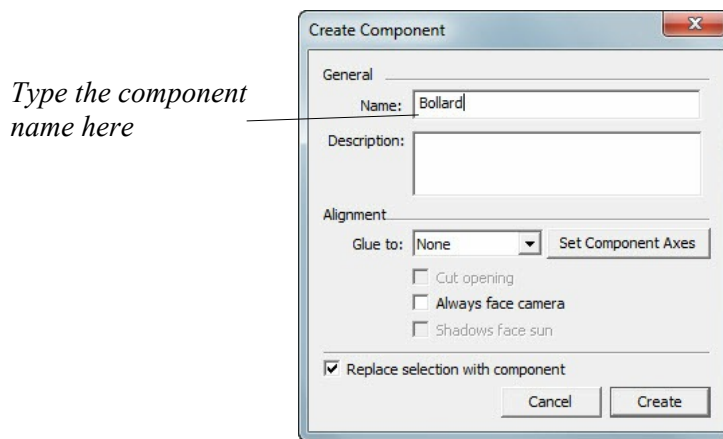


Figure 89. The Create Component dialog box

- Use **WINDOW/Components** and the Components dialogue box will appear as shown in Figure 90.
- Click on the small house icon to show what components are currently in the model. Locate 'Bollard' and insert bollards into the model by dragging the icon into the model.

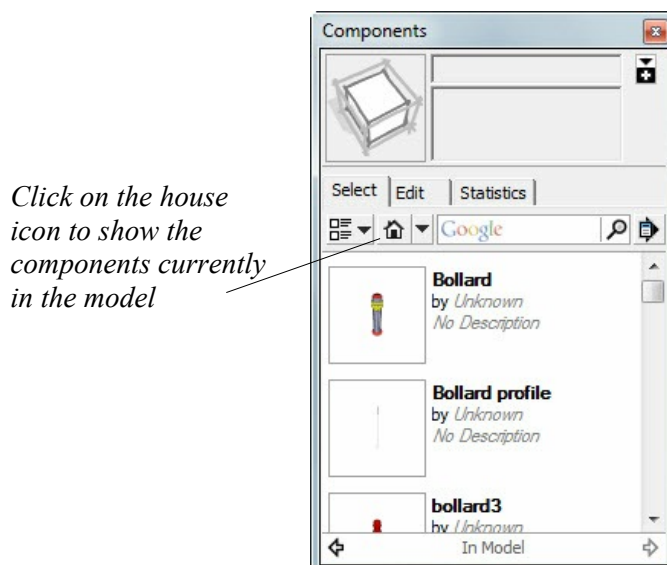


Figure 90. The Components dialogue box

Creating the Small Streetlight

- Using the same process as for creating the bollard, create the small streetlight with the same dimensions for the lower portion and using the dimensions shown in Figure 91 for the upper portion.
- When completed use the **Paint Bucket** to apply the material 'Translucent Glass Gold' to the light lens and a solid grey shade to the remainder of the column as shown in Figure 91.
- Create a Component of the light and call it 'Low Streetlight'.
- Create a layer called 'Streetlights', make it the current layer and insert the Low Streetlight component at strategic positions in the model.

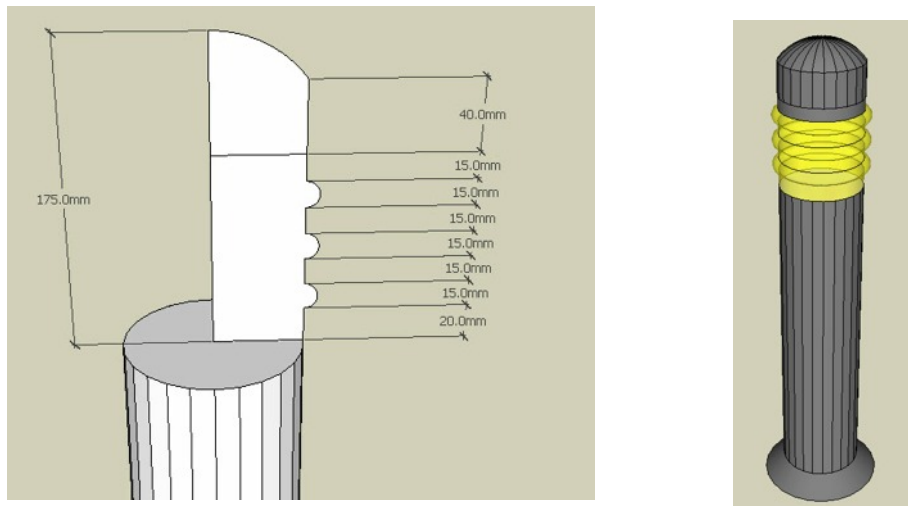


Figure 91. Dimensions for the upper portion of the low streetlight

Creating the Tall Streetlight

- Using the same process as for creating the bollard and the Low Streetlight, create the Tall Streetlight with the dimensions as shown in Figure 92.
- When completed use the **Paint Bucket** to apply the material 'Translucent Glass Gold' to the light lens and a solid colour of your choice to the remainder of the column as shown in Figure 92.
- Using **EDIT/Make Component** create a Component of the light and call it 'Tall Streetlight' and, ensuring the Streetlights layer is the active layer, insert it in strategic positions in the model.

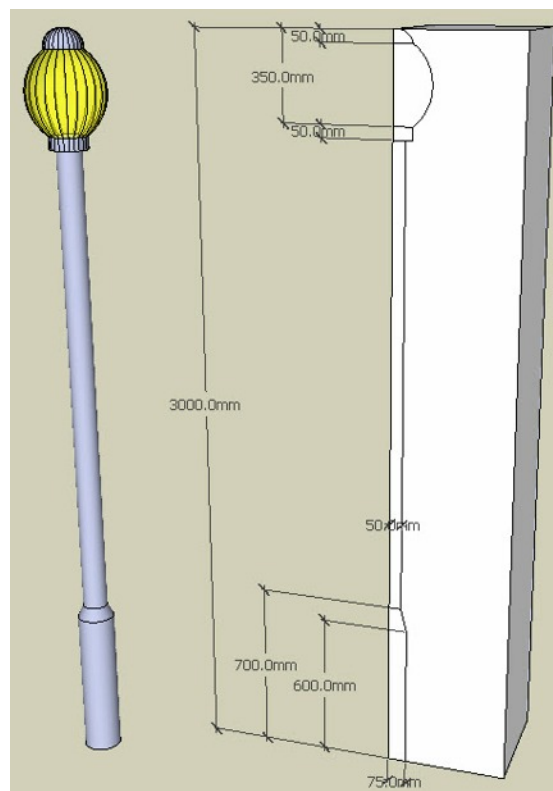


Figure 92. The Tall Streetlight dimensions and completed model

Creating the Large Planter with Seat

- We will now create a large circular planter with a seat around its perimeter and with a semi- mature tree on top, downloaded from the Google 3D Warehouse.
- This time we will not draw a cube with a vertical face so that the object is automatically aligned vertically. Instead we will draw it on the ground and then rotate the outline to a vertical position.
- Firstly, use **VIEW/Toolbars** and click on **Views** to load the Views toolbar as shown in Figure 93.
- Move and dock the Views toolbar somewhere in the margin.

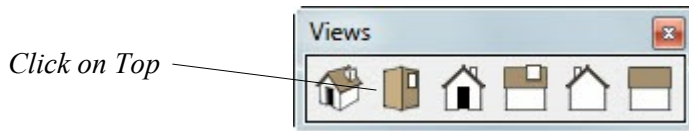


Figure 93. The Views Toolbar

- Click on the 'Top' view as shown in Figure 93 and your model will adopt a plan view.
- Create a layer called 'Large Planter' and make it the active layer.
- Using the dimensions as shown in Figure 94, draw the profile of the large planter.

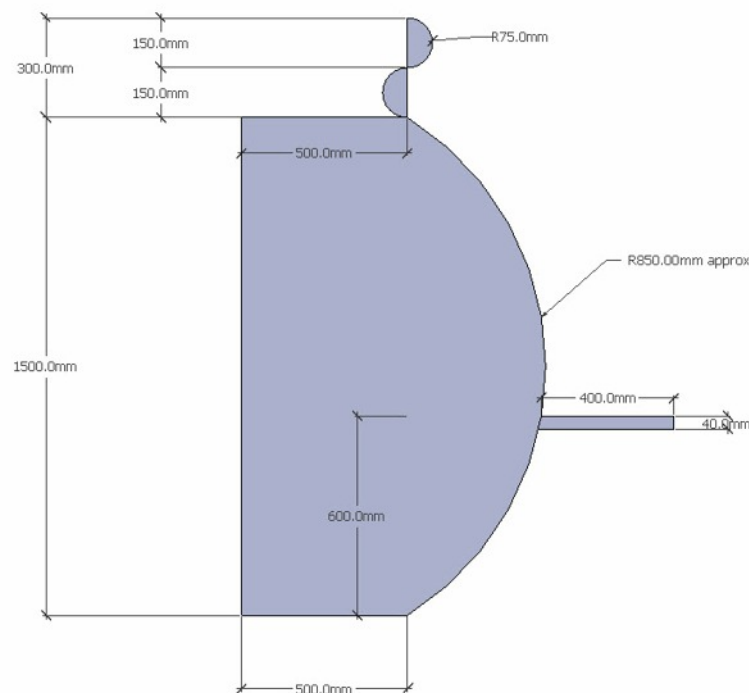


Figure 94. Large Planter dimensions

- Use the Orbit tool to obtain a view similar to Figure 95.
- Select the whole of the planter profile as shown in Figure 95.
- Using the Rotate tool select the end of the planter profile and hold down the mouse button.
- Still holding the mouse button down, move the cursor until the Red axis appears.
- Release the mouse button.

- Click once in the centre of the red axis and click again on the perimeter of the red axis where it coincides with the line of the planter as shown in Figure 95.

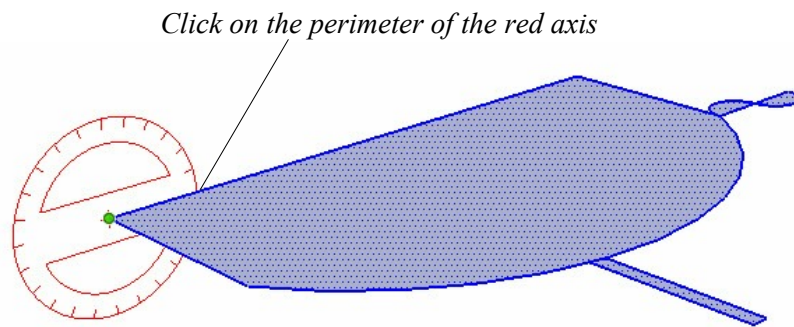


Figure 95. Rotating the Large Planter profile to the vertical axis

- Move the cursor so that it is at a point 90 degrees from the perimeter point you just chose and click once. You will see the planter profile rotate through 90° as you move the cursor as shown in Figure 96.

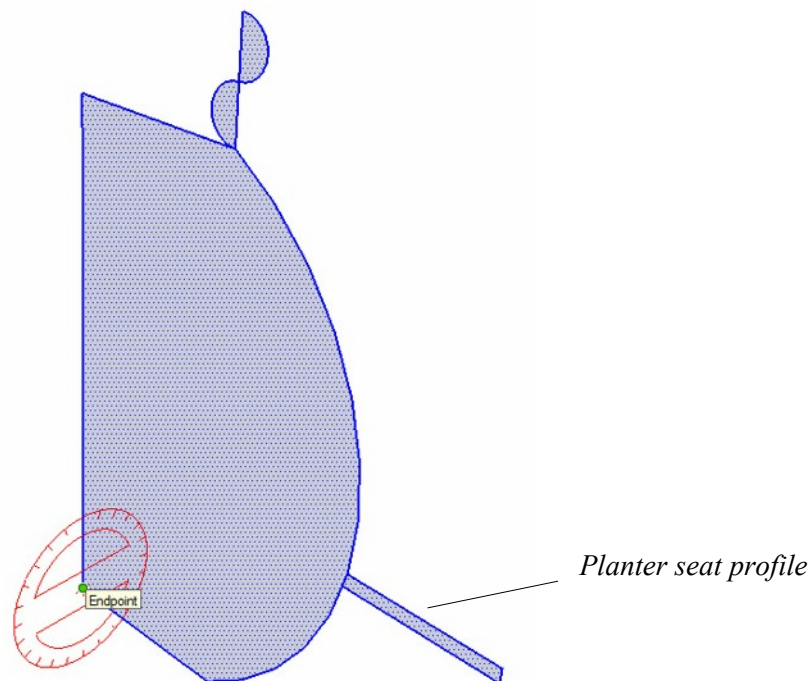


Figure 96. The Large Planter profile rotated through 90° up to the vertical axis

- Use **WINDOW/Styles** to activate the X-Ray drawing style.
- Draw 2 circles with their centres at the bottom and top of of the profile line with a radius of 500mm as shown in Figure 97.

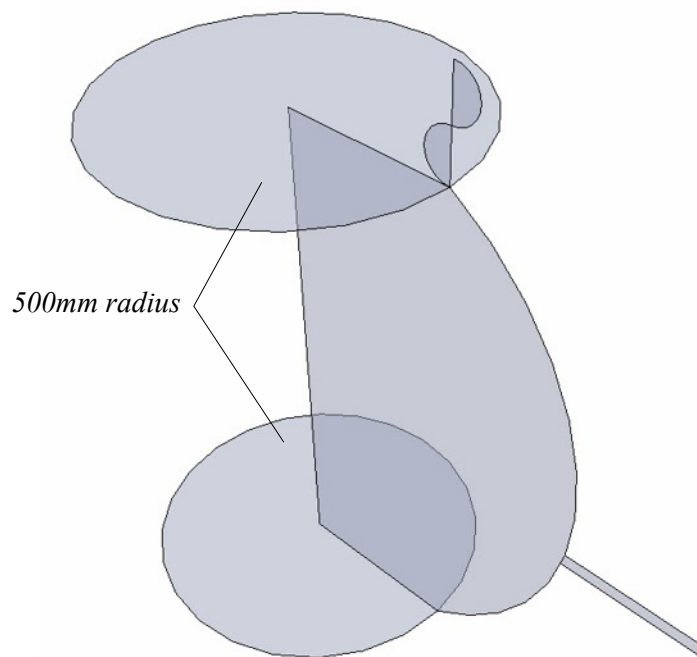


Figure 97. 500mm radius circles drawn at both ends of the vertical profile line

Use the Follow Me tool to rotate the Planter seat using the lower circle as the path to follow as shown in Figure 98.

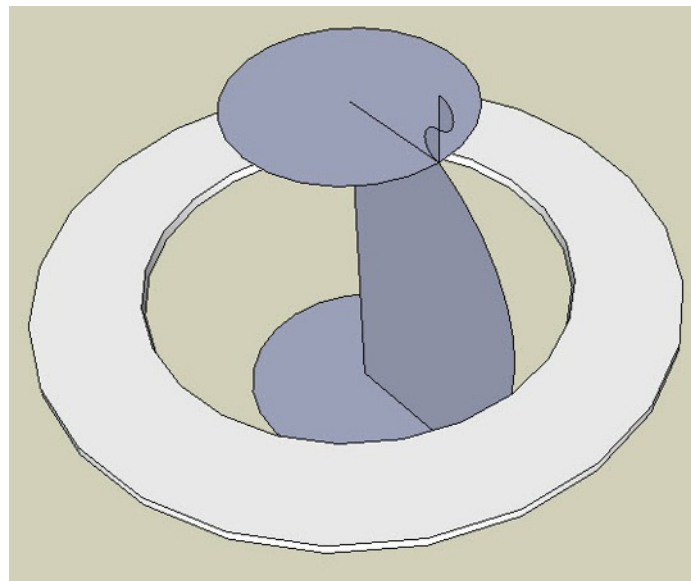


Figure 98. The rotated planter seat using the Follow Me tool, shown here in the Default Style for clarity

- Again, use the Follow Me tool to rotate the main body of the Planter using the lower circle again as shown in Figure 99.
- The top circle will disappear once the Follow Me has completed. Draw a line along one sector of the top edge of the planter and the circle face will be reinstated as shown in Figure 99.
- Still in the X-Ray drawing style, use Follow Me to rotate the top edges of the Planter as shown in Figure 100.

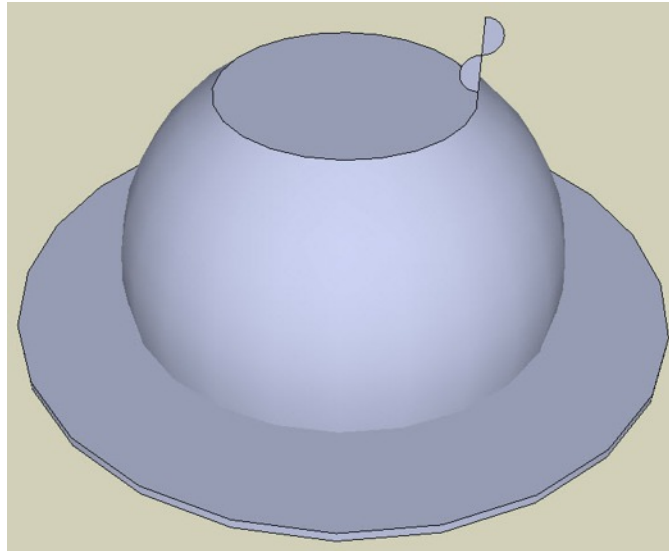


Figure 99. The main body of the Planter rotated with the Follow Me tool and the top circle reinstated

TIP Circles and Arcs. Circles and Arcs are formed with straight lines and the default number of lines is always 24 to form a circle. This is clearly visible with the rotated seat. To reinstate the circle face at the top of the planter simply draw a line along one of the sectors.

- Use the **Eraser** to delete the vertical lines so that the curves at the lip of the Planter are visible as shown in Figure 100.

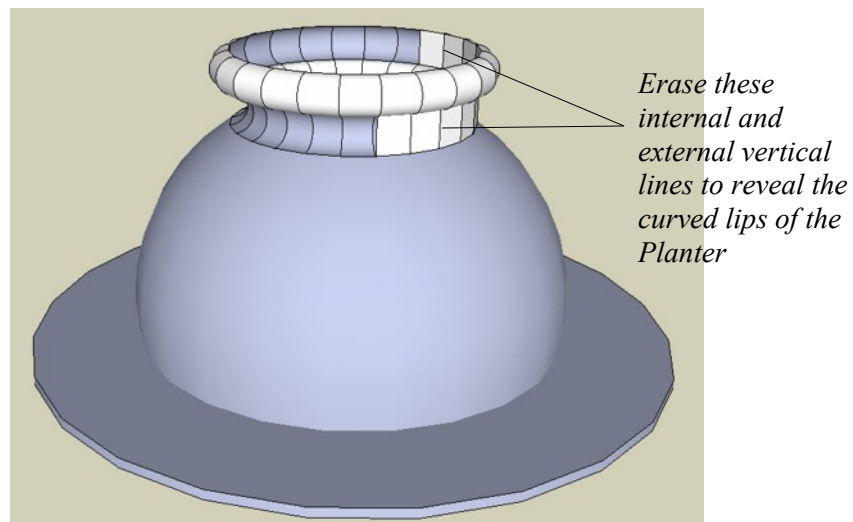


Figure 100. The completed top of the Planter with the vertical faces partially deleted

- Use the **Paint Bucket** to add Material colour to the faces as shown in Figure 101.

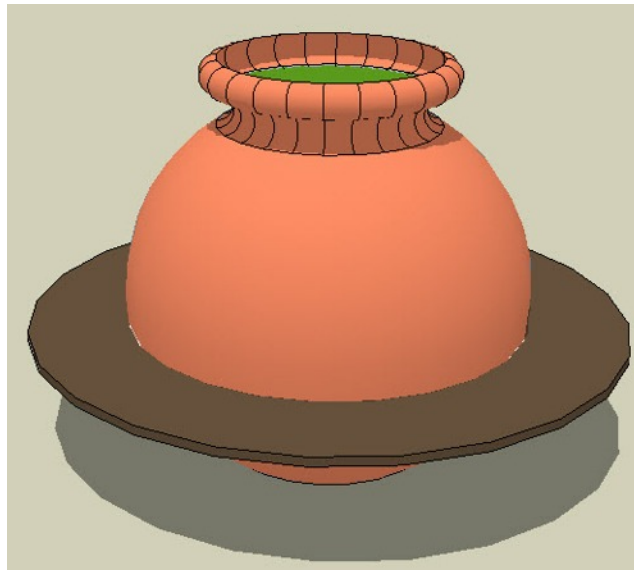


Figure 101. The Planter shown with material colour added and shown here with Shadows activated

- Using **FILE/3D Warehouse/Get Models** locate a suitable 3D tree as shown in Figure 102 and download into the model.
- Move the tree component using its base as the endpoint and place it in the centre of the large Planter as shown in Figure 102.
- Using **EDIT/Make Component** create a Component of the Planter and call it 'Large Planter'.



Figure 102. The completed Large Planter component

- Create a layer called 'Large Planter', make it the current layer and insert the Large Planter component at appropriate positions in the model.

Creating the Canopy

- We will now create an architectural style complex canopy to place in the Plaza.
- Using the **Rectangle** tool draw a rectangle with the dimensions as shown in Figure 103.
- Use the **Push/Pull** tool to pull the rectangle upwards by 6500mm as shown in Figure 103.

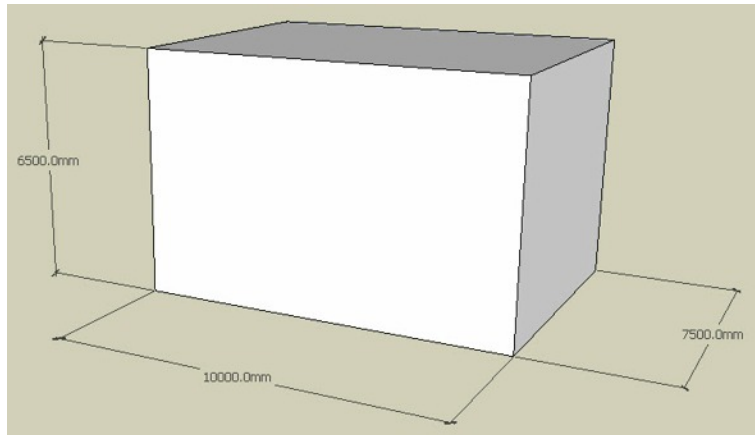


Figure 103. The completed rectangle Pulled to 6500mm with the Push/Pull tool

- Use WINDOW/Styles to activate the X-Ray style if necessary and draw 4 arcs as shown in Figure 104.

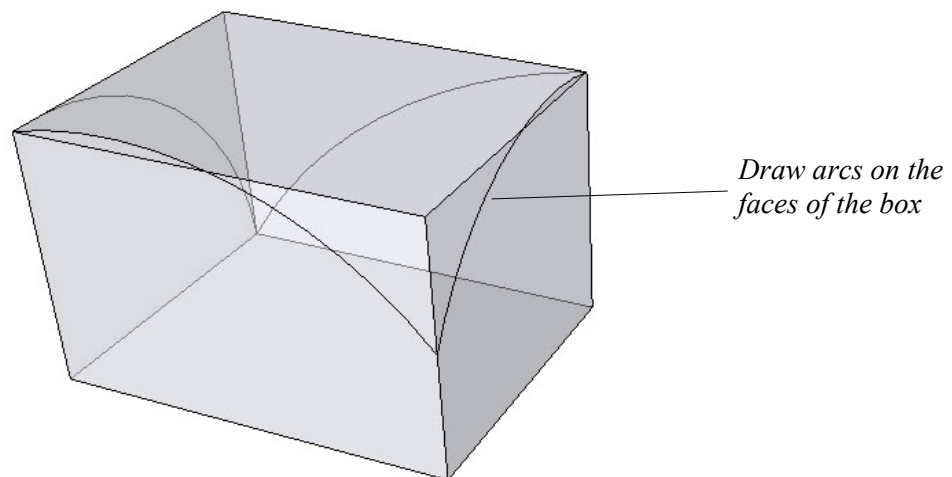


Figure 104. The 4 arcs drawn on the faces of the box

- On completion of the 4 arcs, erase the superfluous lines and faces as shown in Figure 105.

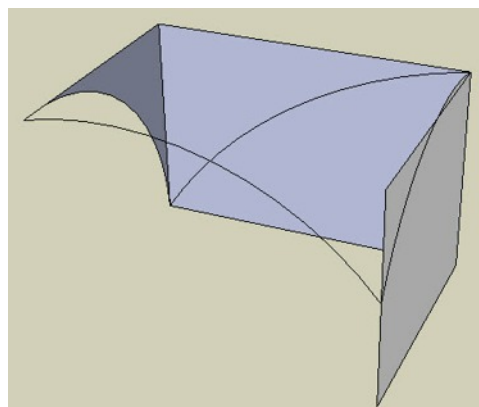


Figure 105. The lines and faces being erased

- Figure 106 shows the remaining arcs.

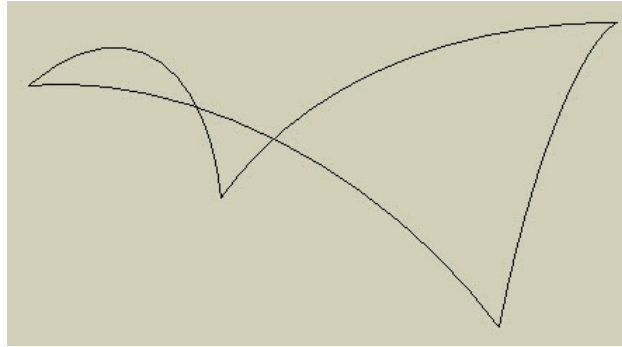


Figure 106. The 4 arcs after the lines and faces have been erased

- We will now add a face to the 4 joined arcs. Sketchup, normally, does not cope with this sort of action where the resultant face is not co-planar i.e. not on the same plane. However, this is overcome by using the Contour tool in the Sandbox.
- Using **VIEW/Toolbars** load the Sandbox toolbar as shown in Figure 107 and dock it in a convenient position.
- Select the 4 arcs with the Pointer tool and click on the **From Contours** option.

From Contours option



Figure 107. The Sandbox toolbar

- A single contoured face will be applied to the area surrounded by the 4 arcs as shown in Figure 108.

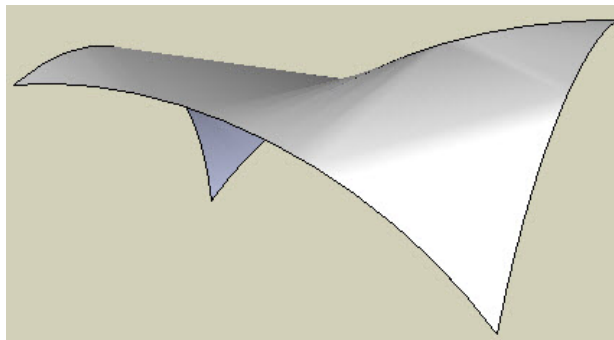


Figure 108. A contoured face is applied between the arcs

- Using the Paint Bucket apply a suitable colour to the canopy face as shown in Figure 109.
- Use the Line tool and draw lines from each of the 3 corners of the canopy to simulate 'wire stays' as shown in Figure 109.

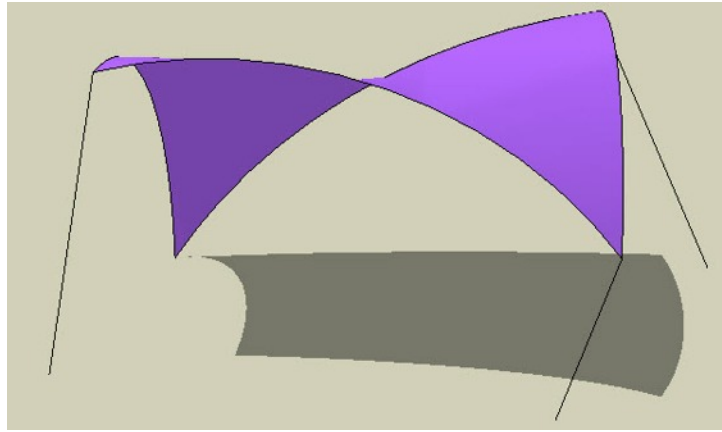


Figure 109. The canopy with material colour applied and wire stays added to 3 corners of the canopy shown here with Shadows activated

- Using **EDIT/Make Component** create a Component of the canopy and call it 'Complex Canopy'.
- Create a layer called 'Complex Canopy', make it the current layer and insert the canopy component at a position in the model as shown in Figure 110. Ensure that the canopy corner without the stay just touches the face of the grass as shown in Figure 110. Don't worry if the stays are too long as they will simply look as if they are attached to the faces at ground level.

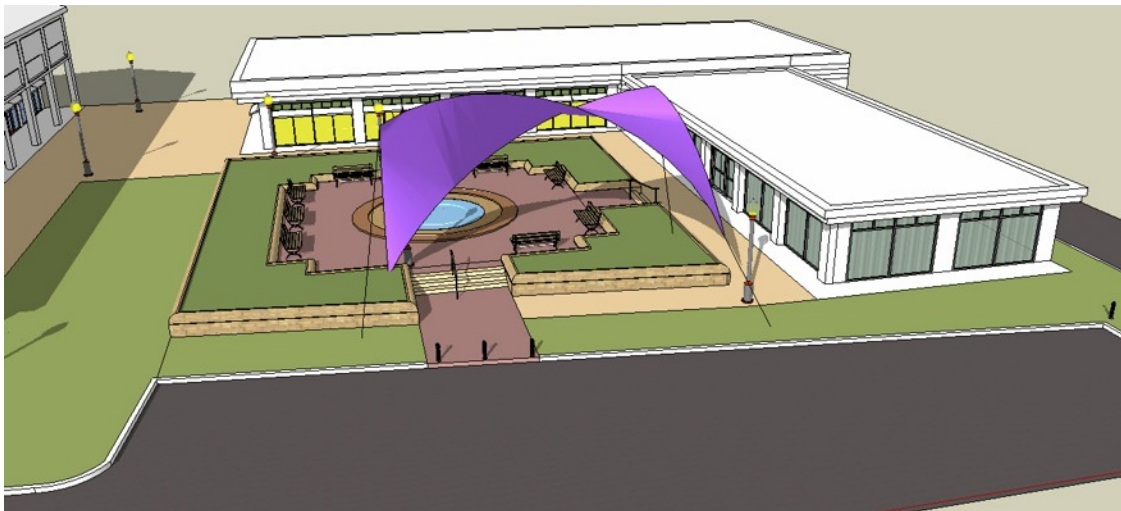


Figure 110. The Canopy component inserted in the model

Creating Public Seating

- Using the techniques you have learned create a seat component and place it in the Plaza at suitable places. It will be helpful if you load a pre-drawn seat from the 3D Warehouse and copy it.
- Remember to create a layer for the seat.