Tutorials: Modeling

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Design 2010

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Disclaimer

Modeling Tutorials

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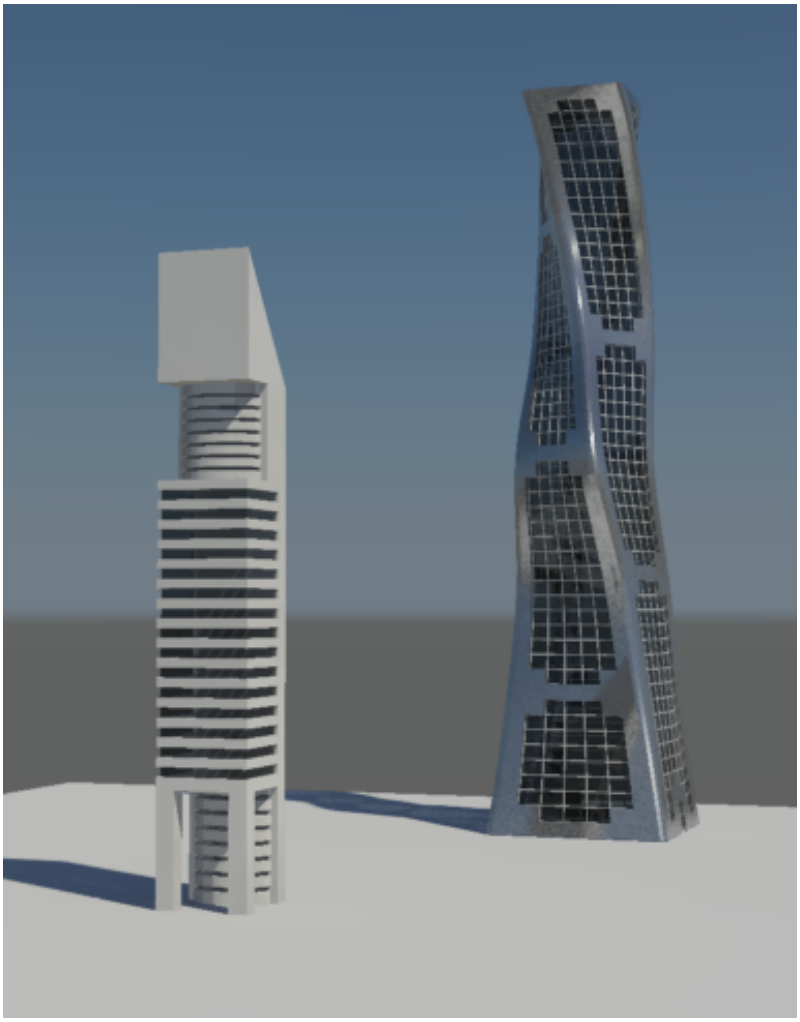
This section shows you how to use 3ds Max Design to quickly model entire buildings, for proof-of -concept renderings or other situations where time is of the essence.

At the other end of the spectrum, you will learn how to produce detailed models of kitchen cabinets, using the convenient array of tools available from the Graphite Modeling Ribbon.



Building models created with 3ds Max Design

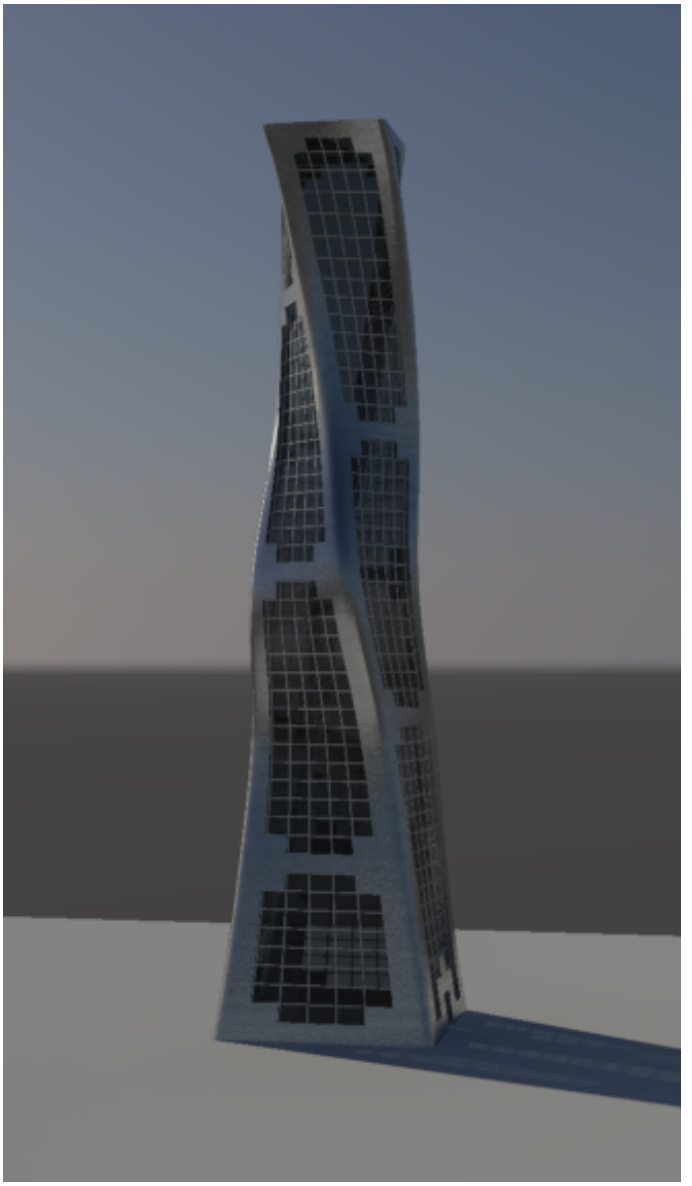
Features Covered in This Section

- Creating primitive objects.
- Using modifiers to alter an object's shape.
- Clone objects to build complex geometry.

- Align objects.
- Create an array of objects.
- Use Boolean operators to change the shape of an object.
- Select and edit polygons and edges.
- Apply materials to polygons by their assigned material ID number.
- Use loops to create new polygon faces.
- Extend polygons using various extrusion techniques.
- Create beveled and inset shapes.
- Use the Symmetry modifier to produce a mirrored duplication of an object.

Modeling Buildings Using Modifiers

In this tutorial, you will model a building with a distinctly organic design. Specially developed modifiers in 3ds Max Design make this task far easier than if it were attempted in a conventional CAD program.



In this tutorial, you will learn how to:

- Create simple geometry.
- Use the Twist, Taper, and FFD modifiers to alter geometry.

- Use polygon selection and editing techniques.
- Clone objects.
- Chamfer edges.
- Assign materials to objects.

Skill level: Beginner

Time to complete: 1 hour

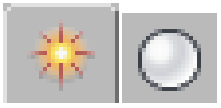
Creating the Tower

In this lesson, you will create the basic geometry of the model, then use 3ds Max Design modifiers to give the object a distinctive shape.

Create the tower object:

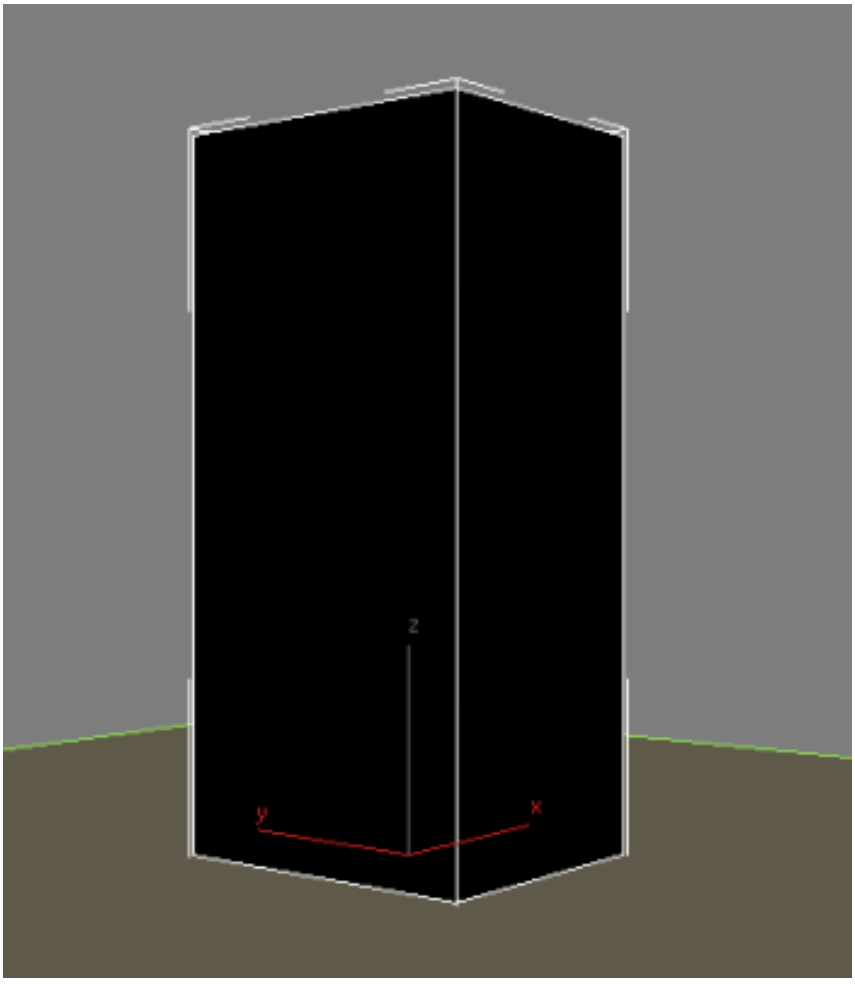
1.  On the Quick Access toolbar, click the Open File button, navigate to the *\scenes\modeling\highrise* folder, and open the scene file *building 1 - start.max*.

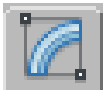
   A daylight system has already been set up, so you can start building your model right away.

2.  On the Create panel, click the Geometry button, then in the Object Type rollout, click Box.

3. In the Perspective view, click and drag diagonally at the center of the ground object to set the width and depth of the box. Release the mouse button and drag upwards to set the height. Click a final time to complete the box.

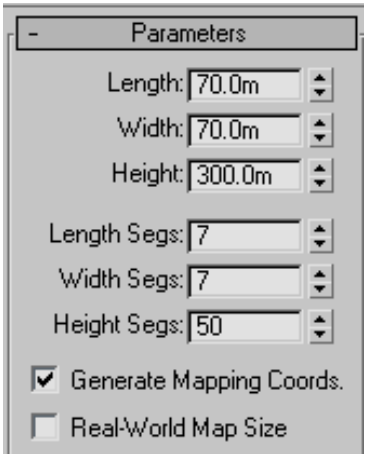
   Do not worry about dragging the box to an exact width, depth, or height. You will set these parameters in the next step.



4  On the Modify panel > Parameters rollout, set the parameters of the box as follows:

- Length=**70 m**
- Width=**70 m**
- Height=**300 m**
- Length Segs=**7**

- Width Segs=**7**
- Height Segs=**50**



The segments are necessary to define the tower floor and window grid.

NOTE Normally, a building 300 meters in height would be divided into 100 height segments to create floors of three meters each, but in this tutorial the value is halved to make for easier polygon selection.

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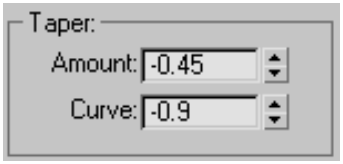
5 On the Name And Color rollout, change the name of the object to **Building 1 - Glazing**.

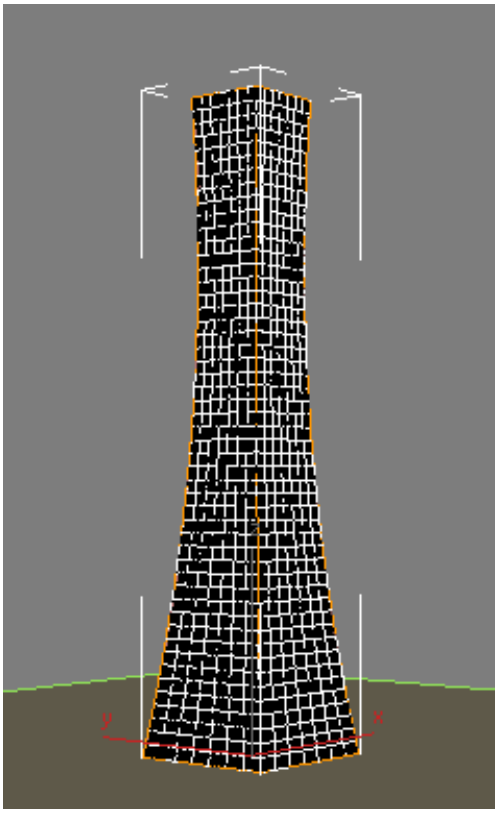
This name change is appropriate, since you will later be applying a glazing material to this object.

6 From the Modifier List > Object-Space Modifiers section, choose Taper.

7 On the Parameters rollout > Taper group, set Amount to **–0.45** and Curve to **–0.9**.



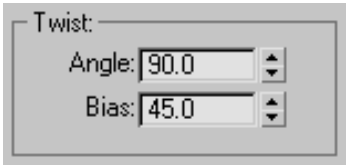
The negative taper amount tapers the building inwards at the top. The negative taper curve pulls the sides of the building in as shown in the next illustration.



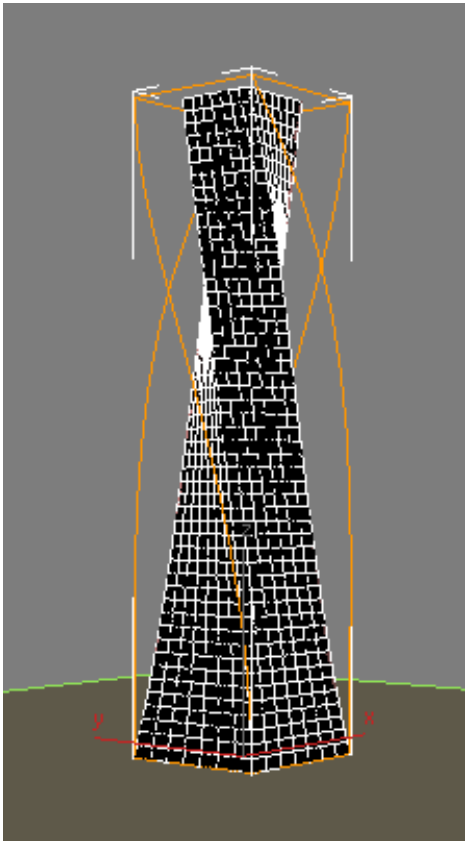
Next, you want to give the tower a twist.

8 From the Modifier List > Object-Space Modifiers section, choose Twist.

9 On the Parameters rollout > Twist group, set Angle to **90** and Bias to **45**.



The 90-degree twist creates a quarter turn of the building. The bias of 45 causes the twist to start part-way up the side of the building, rather than immediately at its base.

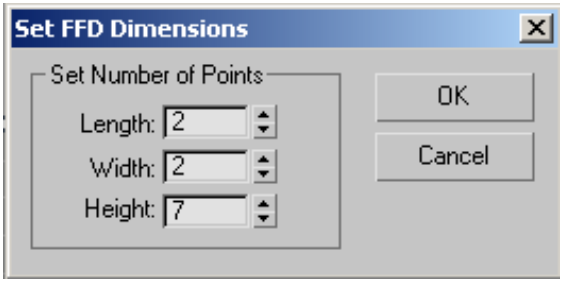


10 To give the building a serpent-like quality, from the Modifier List, choose FFD (Box). FFD modifiers surround the selected geometry with an adjustable lattice box.

11 On the FFD Parameters rollout > Dimensions group, click Set Number Of Points.

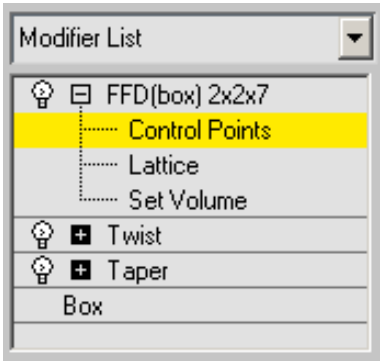
12 In the Set FFD Dimensions dialog, set the parameters as follows to set the number of control points for the lattice used to deform the structure:

- Length=**2**
- Width=**2**
- Height=**7**



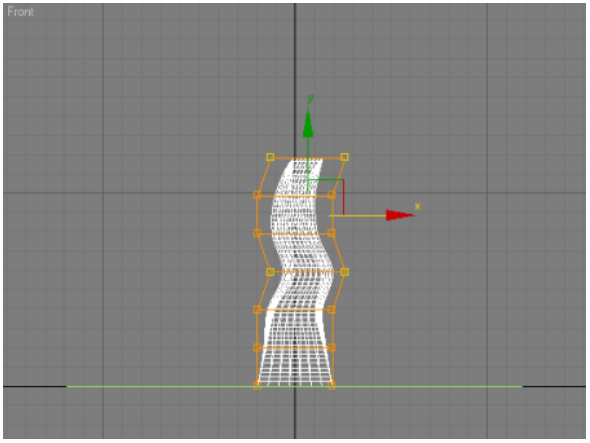
13 In the Modifier stack, expand the FFD (Box) modifier and choose Control Points.

This lets you select and manipulate the lattice control points you defined in the previous step.



14 In the Front view, create the serpent effect by holding Ctrl and selecting the top and fourth row of control points.

15  Enable the Move tool and drag right slightly, as shown in the next illustration.



16 Exit the FFD Control Point sub-object level by clicking the main modifier entry: FFD (Box) 2x2x7 in the Modifier stack.

Now you are ready to create the mullions.

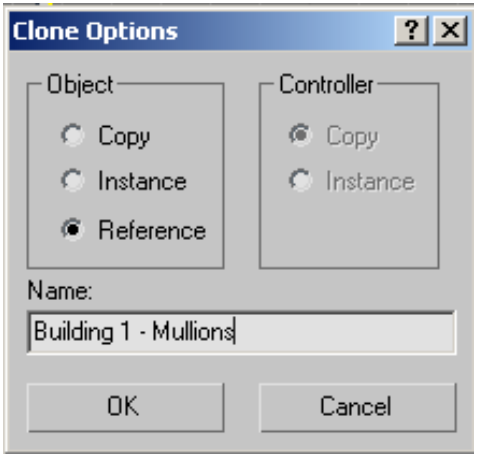
Adding the Mullions

You will start by cloning the object you created in the previous lesson. You will then take the clone, which retains twist, taper, and FFD modifiers, and use polygon editing techniques to create the structure's mullions.

Create the mullions for the building:

1  Continue working on the your scene from the previous lesson, or open the scene *\modeling\highrise\building 1 - glazing.max*.

2 Select the glazing object (the tower) and from the menu bar choose Edit > Clone. In the Clone Options dialog > Object group choose Reference and change the name of the object to **Building 1 - Mullions** and click OK.

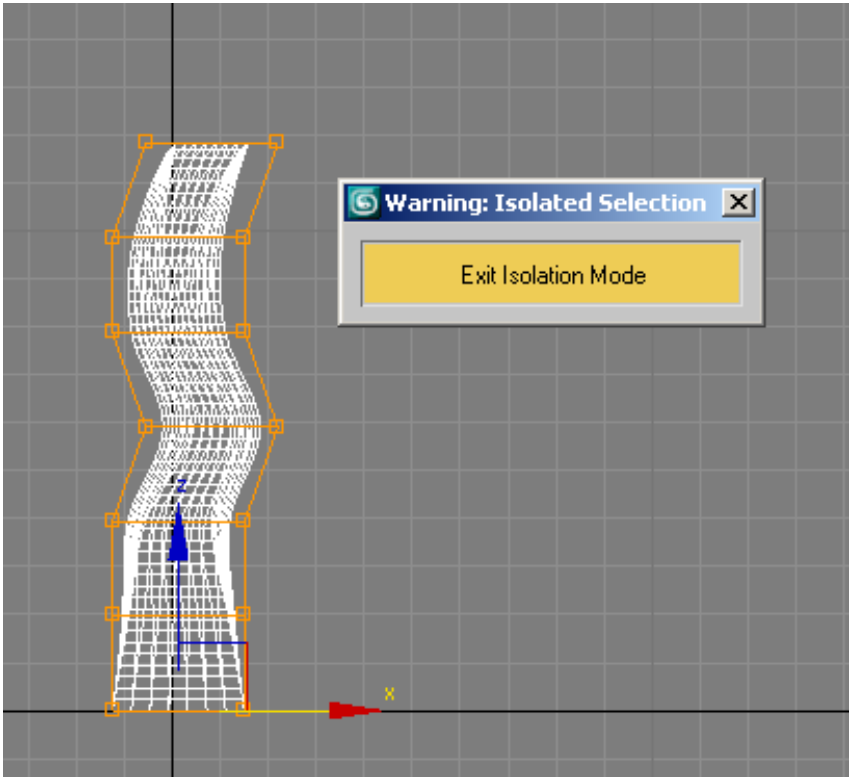


As a reference, the newly created mullions object behaves in a specific way. Any subsequent edits to the mullions object will not affect the glazing object. However, if you modify the glazing object, the mullions object will be affected. This way, any changes to the modifiers that affect the tower structure, which were created in the glazing object, can be carried forward to the mullions. But any polygon edits intended to affect the mullions only, will not affect geometry in the glazing object.

3 If the mullions object was cloned as a *copy* instead of a reference, it would be completely independent of the original.

If the mullions object was cloned as an *instance*, it would be completely dependent on the original, and vice versa: any subsequent edits made to either object would affect the other.

4 With the *Building 1 - Mullions* object selected, right-click the viewport, and from the quad menu, choose Isolate Selection.



Isolation mode ensures you are working on the correct object.

You now want to take the polygons that form the window grid and modify them to take on the characteristics of mullions. You will do so using the Edit Poly modifier.

5 From the Modifier List, choose Edit Poly.

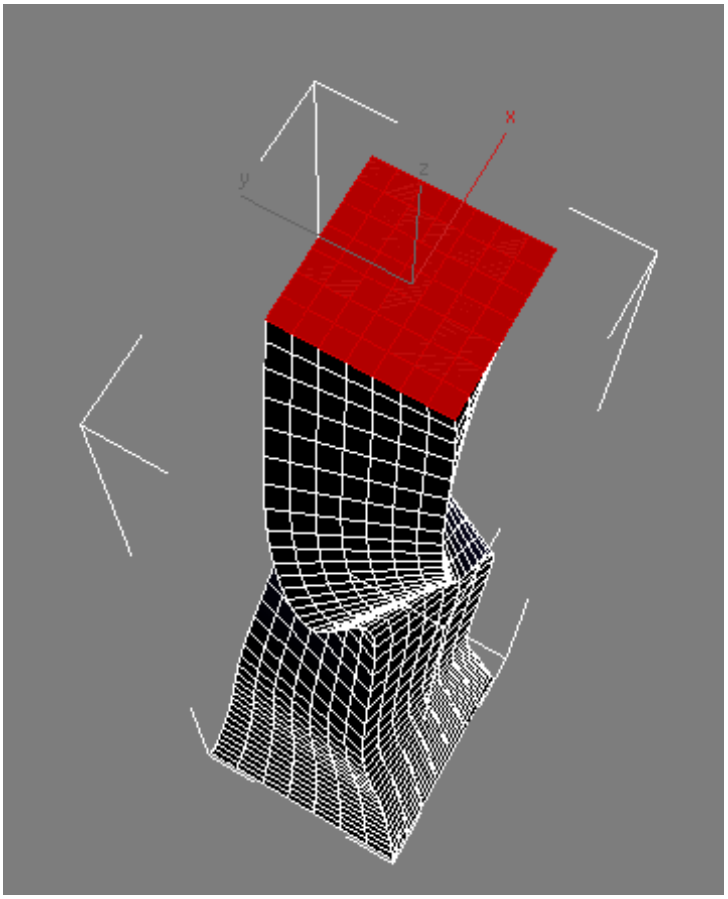
Notice how a gray bar is inserted between the newly added Edit Poly modifier and all other modifiers. The bar indicates that all modifiers

above the bar affect the reference object only and will not affect the original object. This way, you can keep on modifying the mullions object without affecting the glazing object.

Next, you will remove some unneeded polygons.

6  Activate the Perspective viewport. Zoom, orbit, and pan until the roof of the tower is clearly visible, and then on the Selection rollout, click the Polygon button.

7  Select the middle polygon on the roof. On the Selection rollout, click Grow repeatedly until you have selected the entire roof. Press Delete to remove all the selected polygons.



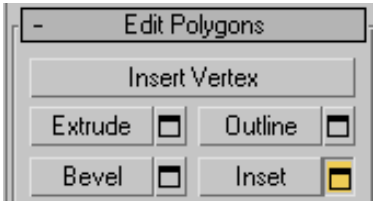
8 Repeat the previous two steps to remove the polygons that make up the bottom of the building.

You will now create insets out of the remaining polygons, which you will use as the window mullions.

9 Press Shift+Z repeatedly to undo the viewport changes, and can now see the entire building in the Perspective viewport, again.

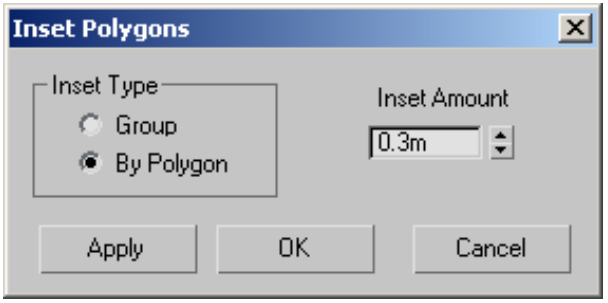
10 Press Ctrl+A to select all the polygons in the building.

11 On the Edit Polygons rollout, click the settings button next to the Inset button (just to the right).



12 On the Inset Polygons dialog > Inset Type group, choose By Polygon and set Inset Amount to **0.3** m. Click OK.

The By Polygon option applies the inset poly edit to each polygon in the selection.

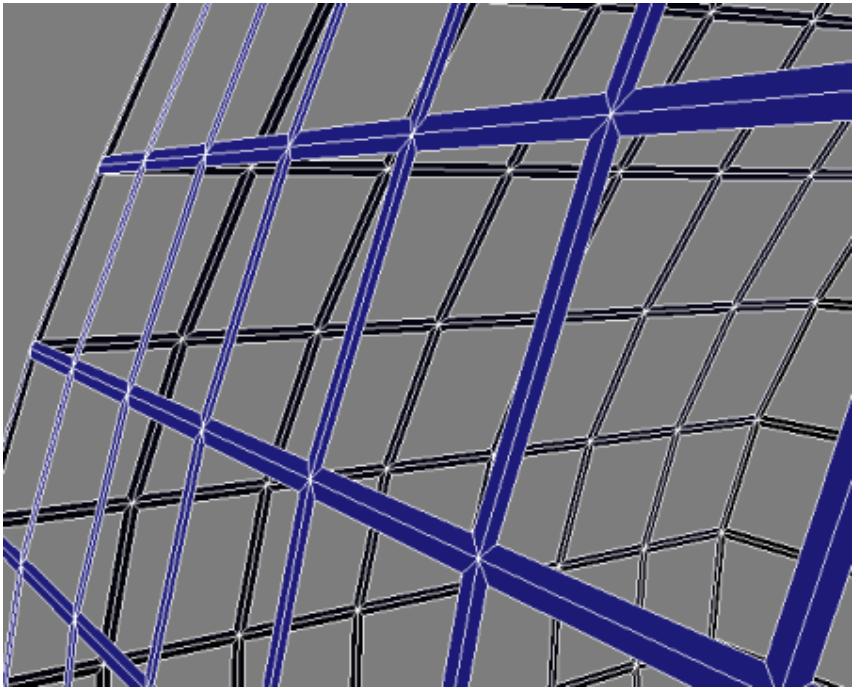


13 Press Delete to remove the selected polygons and keep their insets.

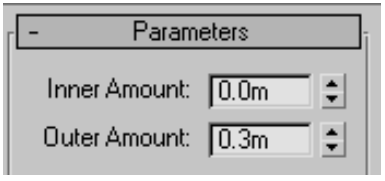
14 On the Selection rollout, click the Polygon button to exit Polygon selection mode.

15 In any viewport, zoom in to the mullions you just created.

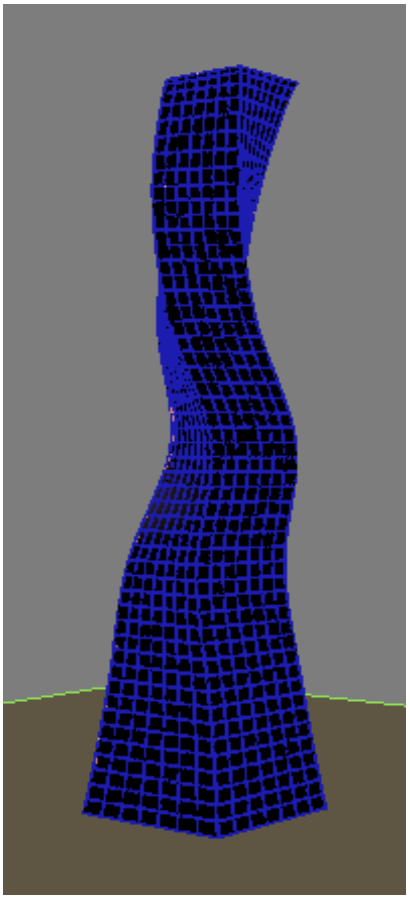
The mullions appear as thin, two-dimensional faces. You need to give them some thickness.



16 From the Modifier List > Object-Space Modifiers section, choose Shell. On the Parameters rollout, set Outer Amount to **0.3**.



17 In the Warning: Isolated Selection dialog, click Exit Isolation Mode to view the glazing and mullion objects together.



You are now ready to create the structure's metallic shell.

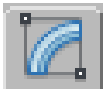
Creating the Metallic Shell

In this lesson, you will create another reference object and apply additional polygon editing techniques that will cloak the building in a metallic shell.

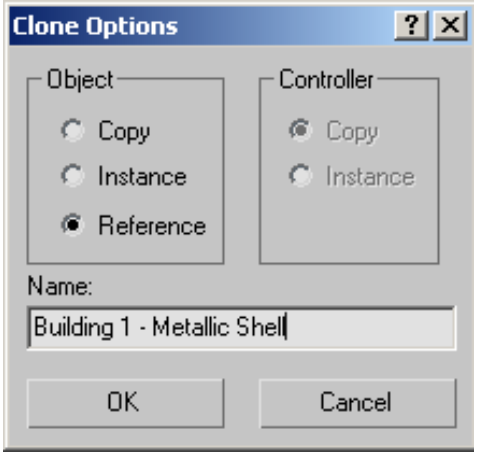
Create a metallic shell for the building:

1  Continue working on the your scene from the previous lesson, or open *\modeling\highrise\building 1 - mullions.max*.

You will start by temporarily deactivating the modifiers on the glazing object, so you can work with the polygons of the shell object more easily.

2  Press H and use the dialog to select the *Building 1 - Glazing* object. On the Modify Panel, in the Modifier stack, click the light-bulb icons to the left of each modifier to turn off the effect of these modifiers.

3 From the menu bar, choose Edit > Clone. In the Clone Options dialog > Object group, choose Reference and change the name of the object to **Building 1 - Metallic Shell**.



4 With the shell object selected, right-click the active viewport and from the quad menu, choose Isolate Selection.

5 From the Modifier List, choose Edit Poly.

6  Right-click the Perspective viewport if it is not already active. Zoom, orbit, and pan until the bottom of the building is clearly visible.

7  On the Selection rollout, click the Polygon button to turn it on.

8  Select the middle polygon on the bottom of the building. On the Selection rollout, click Grow repeatedly until you have the entire bottom selected. Press Delete to remove the polygons.

You now need to remove additional polygons to create the window pattern on the building exterior.

9 Press Shift+Z repeatedly to undo viewport changes until you can see the entire building again.

10 In the Perspective view, click Front on the ViewCube.

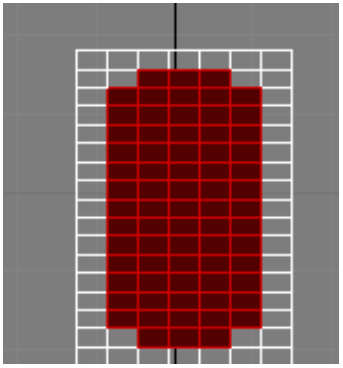
NOTE If the ViewCube is not visible in your viewports, from the main menu choose Views > Viewport Configuration > ViewCube tab > Display Options group > Show The ViewCube.

11 Press Alt+W to maximize the viewport.

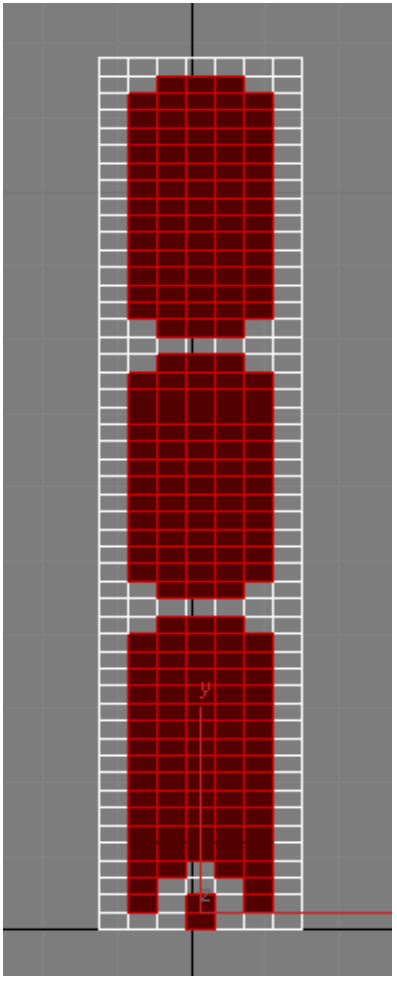
12  Turn on Select Objects. Ctrl+click+drag to select a 5x15 grid of polygons in the upper portion of the model, leaving one row of polygons unselected at each edge of the building.

This selects polygons on both the front and back faces of the model.

13 Alt+drag to select each corner polygon, as shown in the illustration. This removes the selected polygons on the front and back faces of the model.



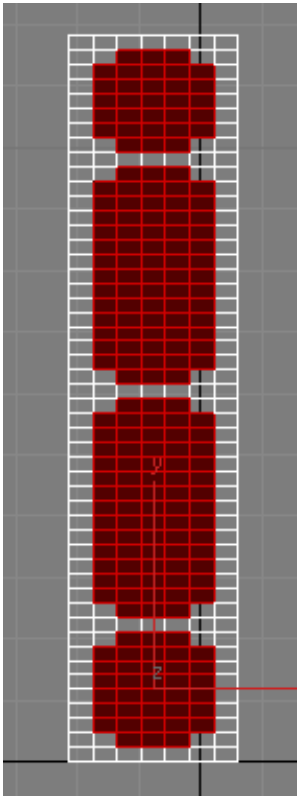
14 Ctrl+click+drag to select the remaining polygons, as shown in the next illustration. Use the Alt+drag technique to remove polygons from the corners as needed.



15 Press Delete to delete all of the selected polygons on the front and back of the building.

Next, you will select the polygons on the side of the building, changing the pattern slightly.

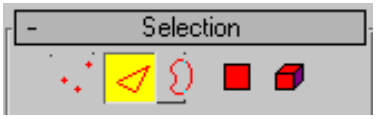
16 Click the Left face of the ViewCube and begin removing polygons following a pattern of 5x7, 5x15, 5x15, and 5x8 as shown in the next illustration.



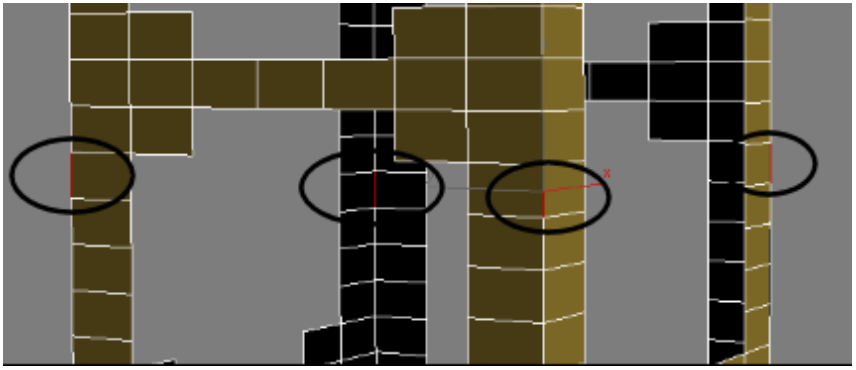
17 Press Delete to delete the polygons, then activate the Perspective viewport.

Next, you will edit the building edges to give them a rounded look.

18 From the Selection rollout, choose the Edge sub-object level.



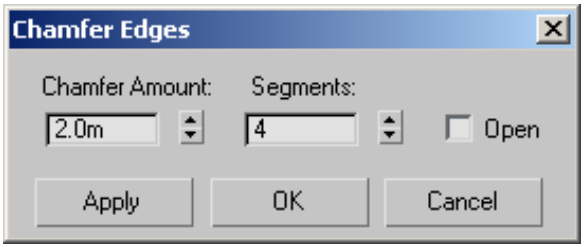
Hold down Ctrl and select four vertical polygon edges, one on each corner of the building.



19 On the Selection rollout, click the Loop button. This selects all four edges of the building in their entirety.

20 On the Edit Edges rollout, click the settings button next to the Chamfer button (just to the right).

21 On the Chamfer Edges dialog, set Chamfer Amount to **2.0m**. This sets the width of the bevel created by the chamfer operation. Set Segments to **4**, to divide the beveled region into four segments. The more segments you set, the more rounded the edge. Click OK.



22 Exit Edge selection mode by clicking the Edge sub-object level button again.

23 From the Modifier List, add a Shell modifier and on the Parameters rollout, set Outer Amount to **2.0m**.

This gives the metallic shell a thickness of two meters.

Now, let's look at the building with the modifiers applied.

24 Exit Isolation Mode.

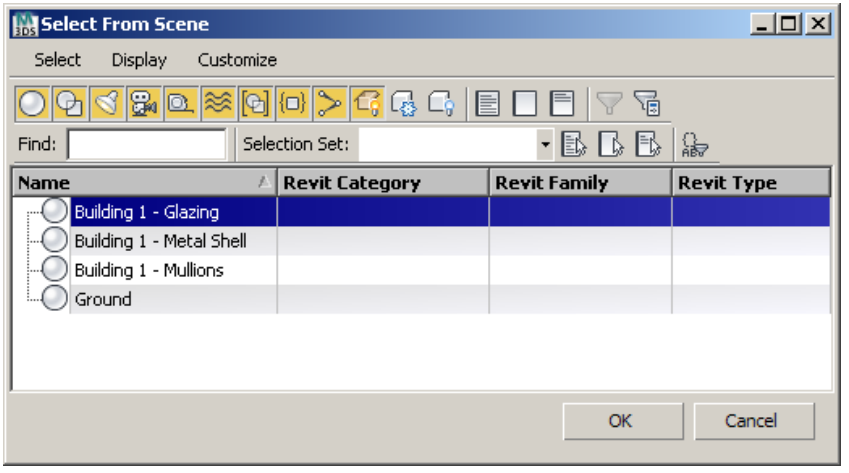
25 Click Alt+W to view all four viewports again.

26 On the Modifier Stack, turn on the three modifiers you turned off earlier: FFD, Twist, and Taper.

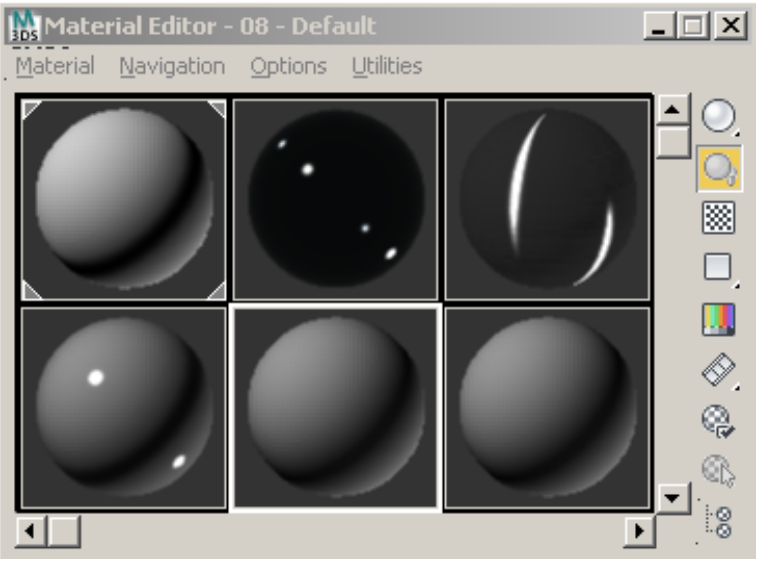
The modeling phase of the building is now complete. Next, you will add materials to the building exterior.

27 Press M to open the Material Editor.

28 Press H and on the Select From Scene dialog, highlight the *Building 1 - Glazing* object, and then click OK.



In the Material Editor, select the Glass material.



29  Click Assign Material To Selection to apply the Glass to the glazing object.

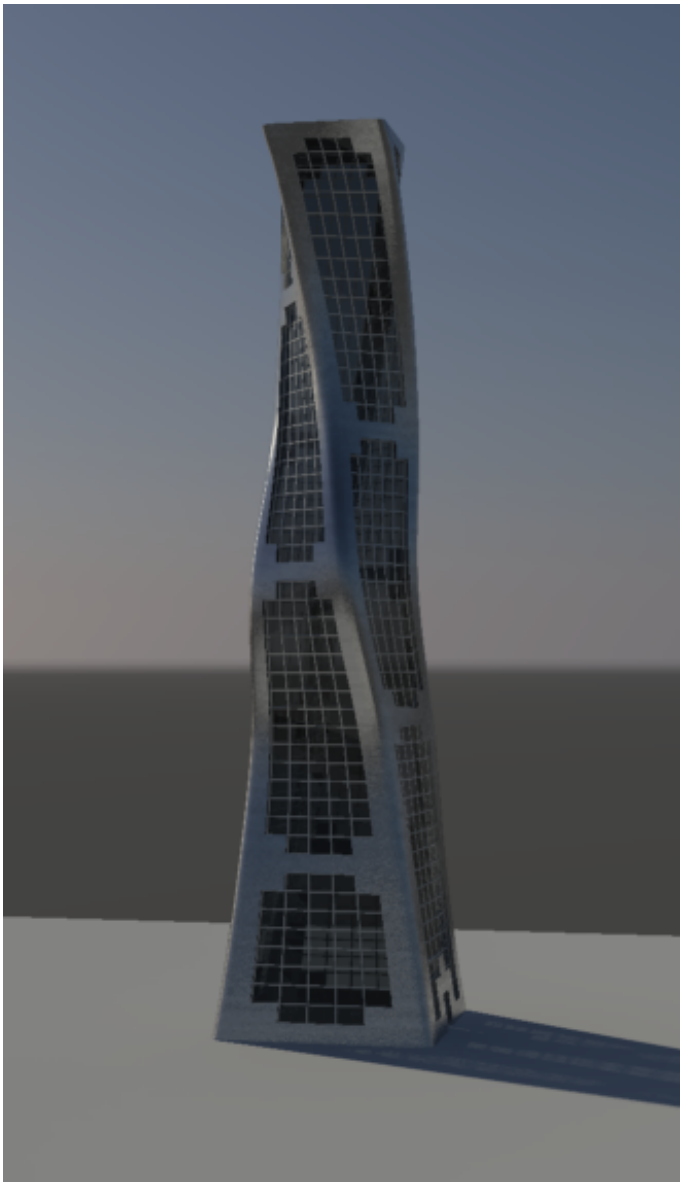
NOTE For this step to work, Options > Propagate Materials To Instances must be active. This option is on by default.

30 On the Select From Scene dialog, select the *Building 1 - Mullions* object, and then in the Material Editor, apply the material called Mullions.

31 On the Select From Scene dialog, select the *Building 1 - Metallic Shell* object and apply the material called Metal.

32  Make sure the Perspective viewport is active, then click Render Production to check your work.

Your scene should look something like this:



33 Save your file as **mybuilding 1 - final.max**.

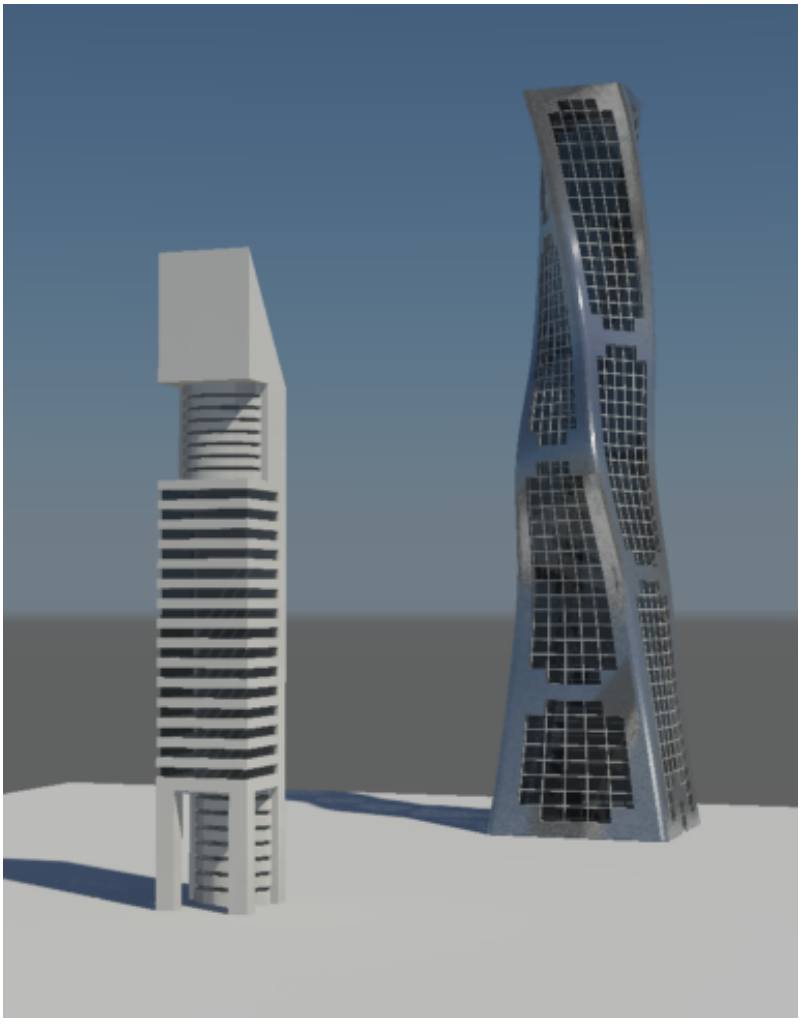
You can use this scene file as your starting point in the tutorial called Modeling Buildings Using Boolean Operations.

Modeling Buildings Using Boolean Operations

Boolean operations are an effective way to create complex shapes out of simple geometric objects. In the case of 3ds Max Design, the Boolean operators are Subtraction, Union, Intersection, and Merge.

In this tutorial, you will learn how to use two Boolean operators, Subtraction and Union, to create an avant-garde model of a sky scraper.

The remaining steps in this tutorial show you how to use the Align tool to accurately move objects into position. You will also learn how to use material ID numbers to instantly assign materials to multiple portions of a model.



In this tutorial, you will learn how to:

- Create simple geometry.
- Align objects.
- Move objects using their XYZ coordinate vales.
- Create an array of objects.
- Use Boolean operators to change the shape of an object.

- Select multiple polygons and edges.
- Edit polygons to create beveled and extruded shapes.
- Assign materials IDs to object polygons.
- Apply materials to object polygons by material ID number.

Skill level: Beginner

Time to complete: 1.5 hours

Creating the Floors

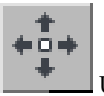
In this lesson, you will create the basic geometry of the model, then create an array of objects that you will use in a Boolean subtraction operation to create a set of floors in the building midsection.

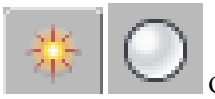
Create the floors for the building:

1.  On the Quick Access toolbar, click the Open File button, navigate to the *\scenes\modeling\highrise* folder, and open the scene file *building 2 - start.max*.

   Alternatively, continue working on the your completed scene in the Modeling Buildings Using Modifiers tutorial.

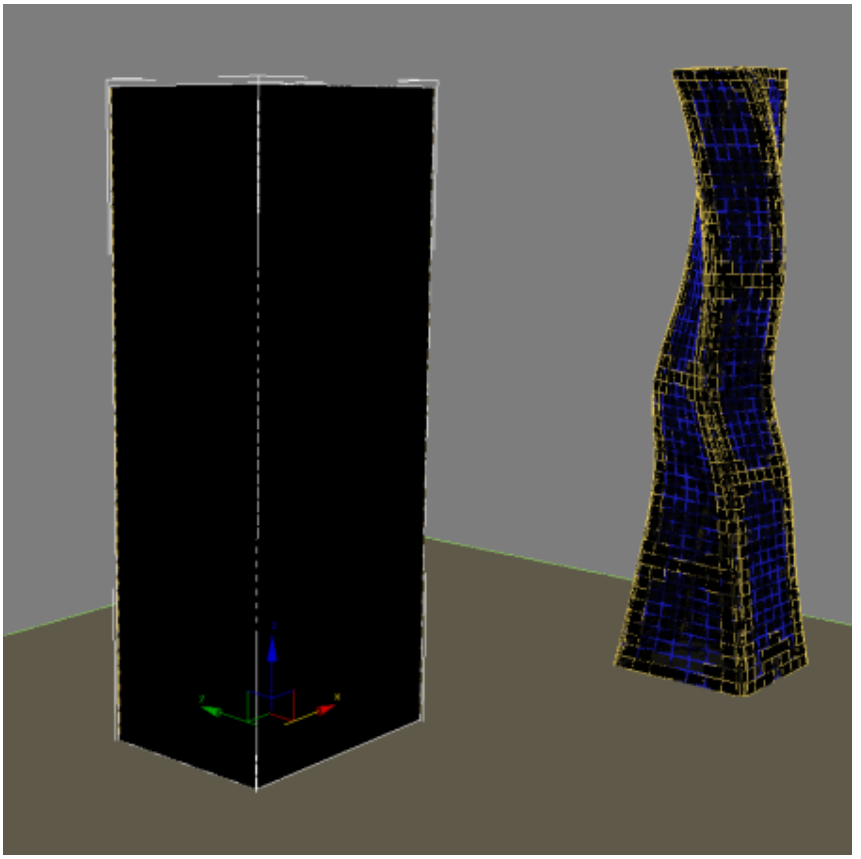
2. Press Alt+W to maximize the Perspective viewport if it is not already maximized.

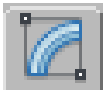
3.  Use the Select And Move tool to select the three objects that comprise the architectural model and move them to the right on the *Ground* object.

4.  On the Create panel, click the Geometry button, then in the Object Type rollout, click Box.

5. At the center of the ground object, click and drag diagonally to set the width and depth of the box. Release the mouse button and drag upwards to set the height. Click a final time complete the box.

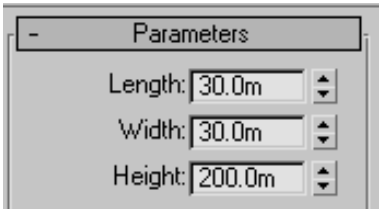
Do not worry about dragging the box to an exact width, depth, or height. These parameters will be set in the next step.



6  On the Modify panel > Parameters rollout, set the parameters of the box as follows:

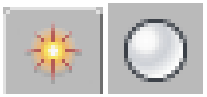
- Length=**30 m**
- Width=**30 m**
- Height=**200 m**

Make sure the Length Segs, Width Segs, and Height Segs fields are all set to 1.

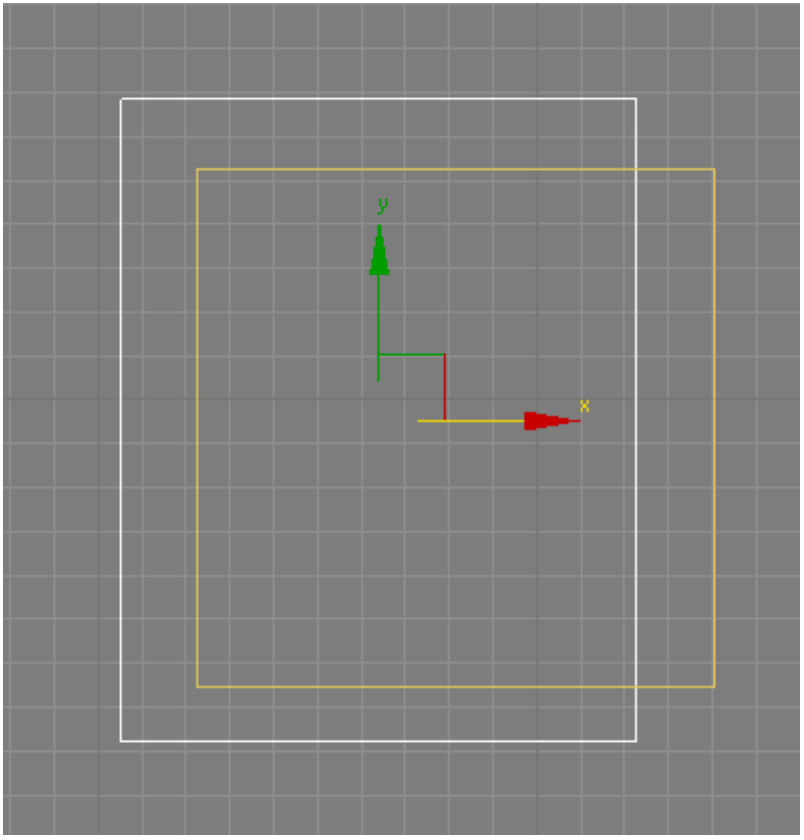


Now that you have defined the footprint of your tower model, you are ready to define the floors in the mid-section of the structure.

7  Press to Alt+W to switch see all four viewports, and in the Top viewport, zoom in to the top of the *Box01* object (the tower object you just created).

8  Go to the Create panel, then drag out a second box so that it is larger on three sides than the *Box01* object, as shown in the next illustration.

The height of the box object is not important.

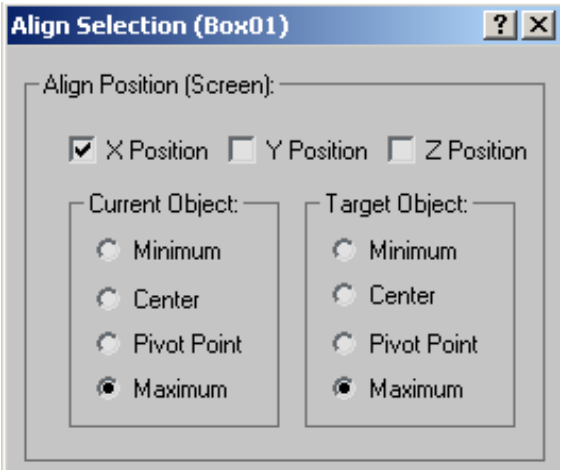


9 This object, *Box02,* will be used to define the tower floors. You now need to align its right side with the right side of the tower object.

10  With the *box02* object selected, click the Align tool, then choose the *Box01* object.

11 In the Align Selection dialog > Align Position group, turn on X Position, so that only the left-right positioning of the two objects is set for alignment.

12 In the Current Object group, turn on Maximum and in the Target Object group turn on Maximum. (Choosing Minimum for both Current and Target objects would align the two boxes on their left sides.) Click OK.

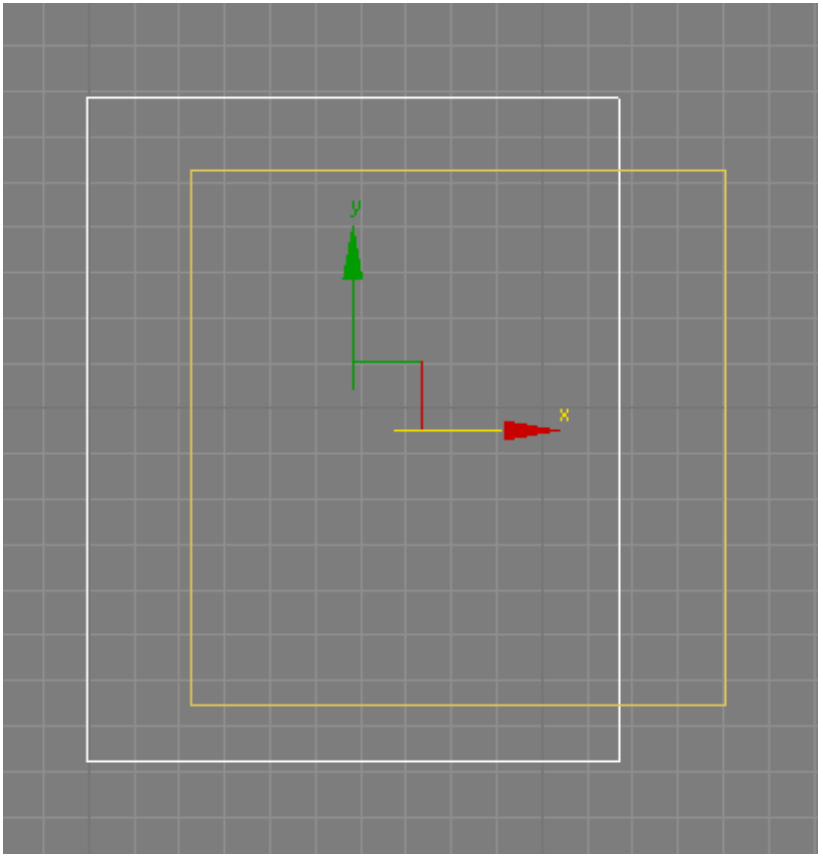


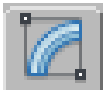
13 Next, you need to move the aligned side of *Box02* to the left by six meters. To do so, you should first switch the coordinate display from absolute values to local values. Absolute values display the scene in world space, a universal coordinate system for all objects in the scene. World space is constant and immovable. Local values use the coordinate system of the selected object.

 Click the coordinate display button to switch the display from Absolute Mode Transform to Offset Mode Transform.

In Offset Mode, the XYZ coordinate values reset to local values, which is 0.

14  Select the *Box02* object, then type **–6** in the X coordinate display box and press Enter. The box automatically repositions itself six meters to the left.



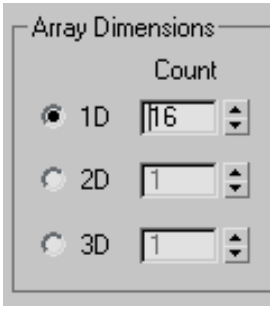
15  In the Modify panel > Parameters rollout, set the height of the box to **3.0m**, the standard height for a typical floor of a building.

16 You want the first floor to start at an elevation of 40 meters, so in the Z coordinates display box, type **40**. This will become the first floor of a total of 15 that will form the midsection of the model.

You will now create an array of boxes that you will later use in a Boolean operation to create all floors above the current one.

17 Right-click the Perspective viewport, press Alt+W to maximize it, and from the main menu, choose Tools > Array.

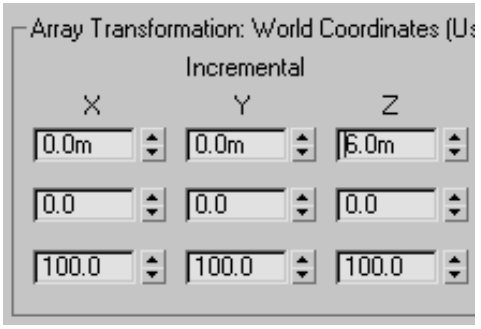
18 In the Array dialog > Array Dimensions group, type **16** in the 1D Count spinner.



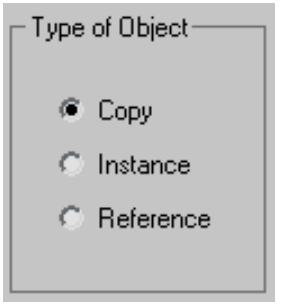
This creates an array of 16 objects to be spread out in one dimension. You want to build your array vertically.

19 In the Array Transformation World Coordinates group > Incremental column go to the Move row, find the Z-axis spinner, and type **6.0**.

20 A distance of six meters in Z space is inserted between each object in the array. This corresponds to the height differential you want to establish between each floor in the building.



21 In the Type Of Object group, choose Copy. Use Copy instead of Instance because one of the array objects will be resized to a height different to the others.



22 Click Preview to see how the array will be placed, then click OK to confirm the placement.

23 The top array object is already selected and ready for editing. On the Parameters rollout, set Height to **30.0**. This box will be used in the next lesson to create a gap in the top segment of the tower.

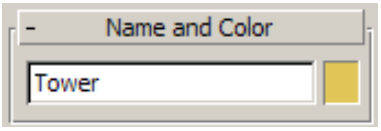
Adding Detail to the Upper Floors

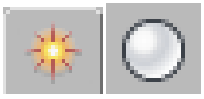
Now that all the array objects have been created, you can use them in Boolean operations to define the tower contours.

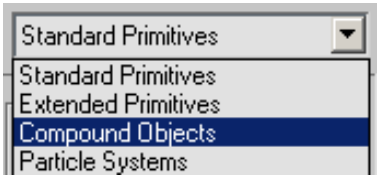
Add detail to the upper floors:

1  Continue working on your scene from the previous lesson, or open the scene called *\modeling\highrise\building 2 - floors.max*.

2 Maximize the Perspective viewport (if it isn't maximized already), select the *Box01* object, and on the Name And Color rollout, rename it **Tower**.

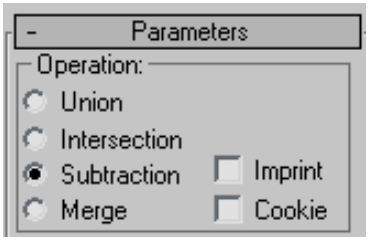


3  On the Create panel > Geometry tab, choose Compound Objects from the drop-down list.

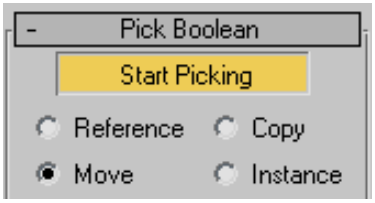


4 On the Object Type rollout, click ProBoolean.

5 On the Parameters rollout > Operation group, choose Subtraction, if it is not already chosen.

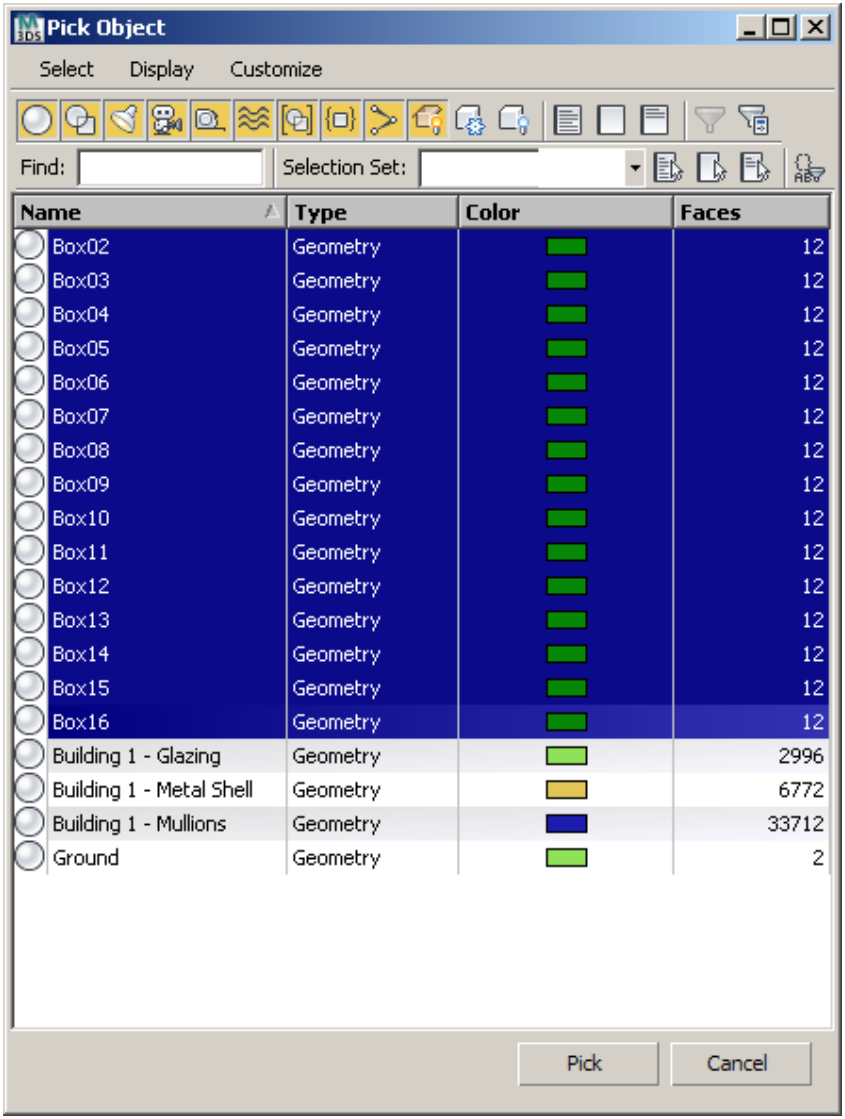


6 On the Pick Boolean rollout, click Start Picking and select the large array box at the top of the tower.



The subtraction Boolean operation subtracts the common area shared by the array box and the *Tower* object. You will later add a design element in the gap you just created.

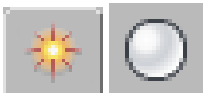
7 Press **H** and on the Pick Object dialog, select all Box objects and click Pick.



The subtraction operation creates gaps for all the selected array boxes.

8 On the Pick Boolean rollout, exit pick mode by clicking the Start Picking button again to turn it off.

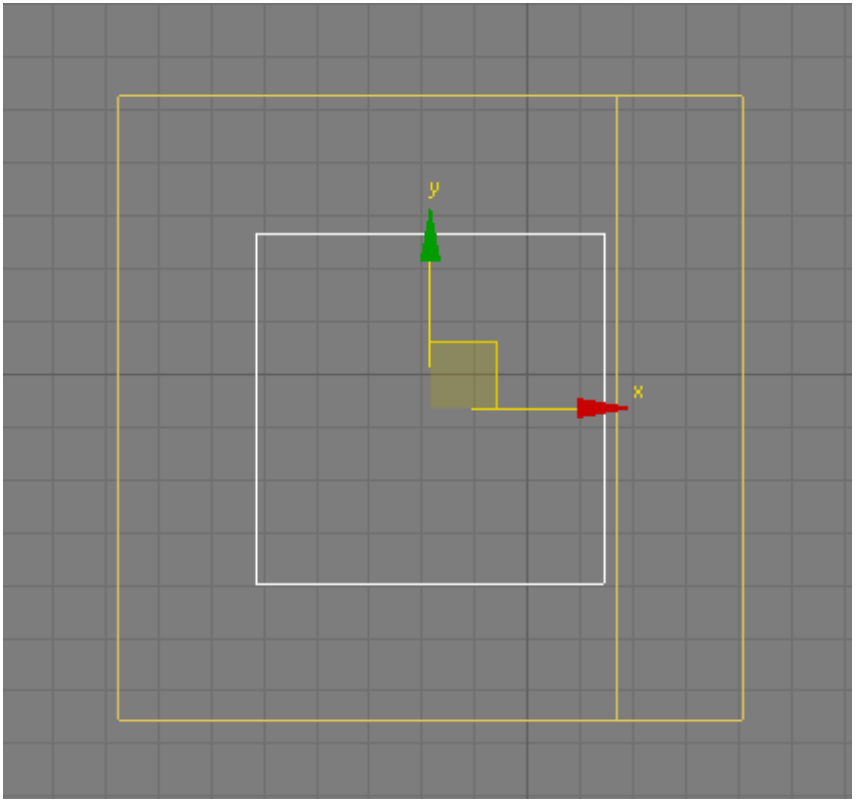
Next, you need to introduce recessed glazing to the first 15 floors created by the Boolean subtraction.

9  On the Create panel, Geometry tab, choose Standard Primitives from the drop-down list. On the Object Type rollout, click Box.

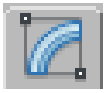
10 Activate the Top viewport and drag out a box within the tower. Exact dimensions are not important at this point.

11  Click the Align tool, then select the *Tower* object to display the Align Selection dialog.

12 In the Align Position group, turn on X Position and Y Position, then turn on Center for both the Current Object and Target Object groups. This aligns the box you just created to the center of the *Tower* object, as shown in the next illustration.

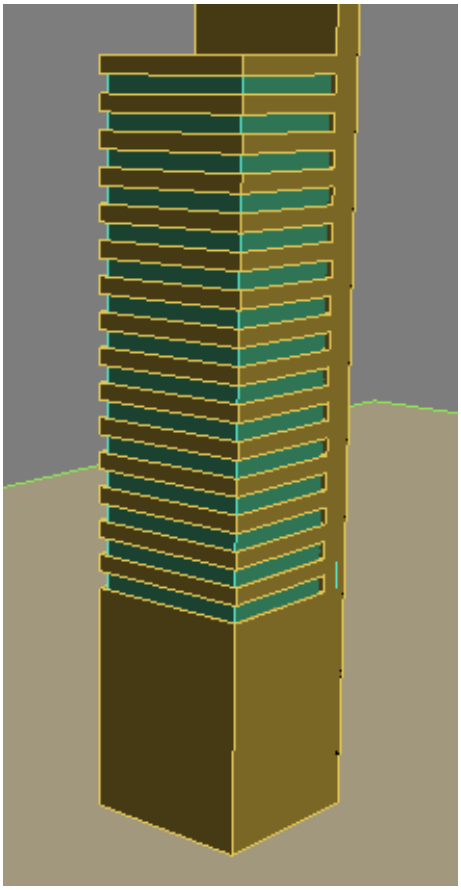


13 Click OK to exit the Align Selection dialog.

14  On the Modify panel > Parameters rollout, set the dimensions of the box as follows:

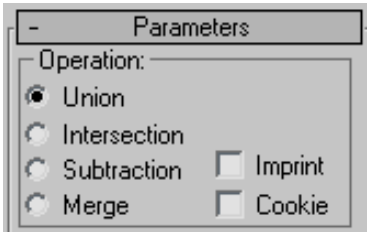
- Length=**28 m**
- Width=**28 m**
- Height=**128 m**

This creates a box object that is two meters inset from the outer walls of the tower, with a height that stops just short of the gap in the tower's upper structure.



The next Boolean operation will join the newly-created box object to the *Tower* object.

15 Select the *Tower* object and from the Parameters rollout > Operations group choose Union.



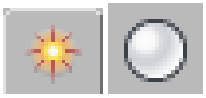
16 From the Pick Boolean rollout, click the Start Picking button and select the box you just created. The box is now incorporated into the *Tower* object.

17 Click the Start Picking button again to turn it off.

Defining the Lower Floors

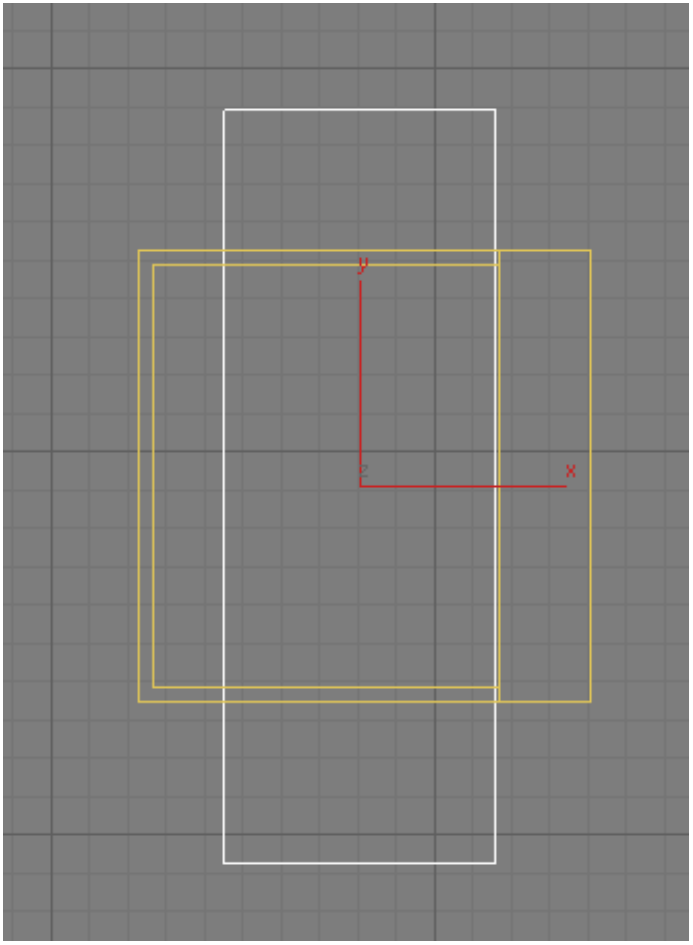
In this lesson, you will use the subtraction Boolean operation to add openings to the lower floors of the building.

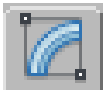
Add an opening to the building entrance:

1  On the Create panel, click the Geometry button, then in the Object Type rollout, click Box.

This box will be used in a subtraction operation to create an opening for the left and right sides of the building.

2 Activate the Top view, drag to create a box as shown in the following illustration, with the upper and lower ends of the box protruding from the top and bottom sides of the *Tower* object. Exact dimensions are not important at this point.



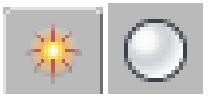
3  On the Modify panel > Parameters rollout, set the dimensions of the box as follows:

- Length=**50 m**
- Width=**18 m**
- Height=**36 m**

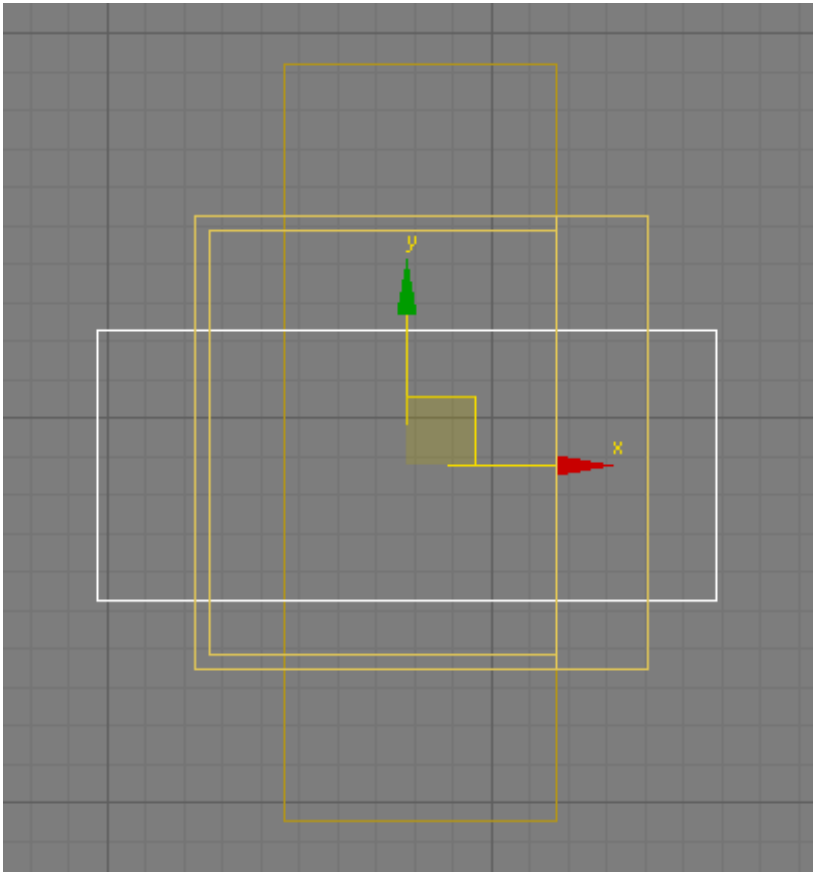
4  Click the Align tool, then select the *Tower* object to display to Align Selection dialog.

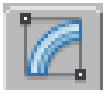
5 In the Align Position group, turn on X Position and Y Position, then turn on Center for both the Current Object and Target Object groups. This aligns the box you just created to the center of the *Tower* object. Click OK.

Next, you need to create a second box that will be used in a subtraction operation to create an opening for the front of the building.

6  On the Create panel, click the Geometry button, then in the Object Type rollout, click Box.

7 Activate the Top view, drag to create a box as shown in the following illustration, with the ends of the box protruding from the left and right sides of the *Tower* object.



8  On the Modify panel > Parameters rollout, set the dimensions of the box as follows:

- Length=**18 m**
- Width=**41 m**
- Height=**36 m**

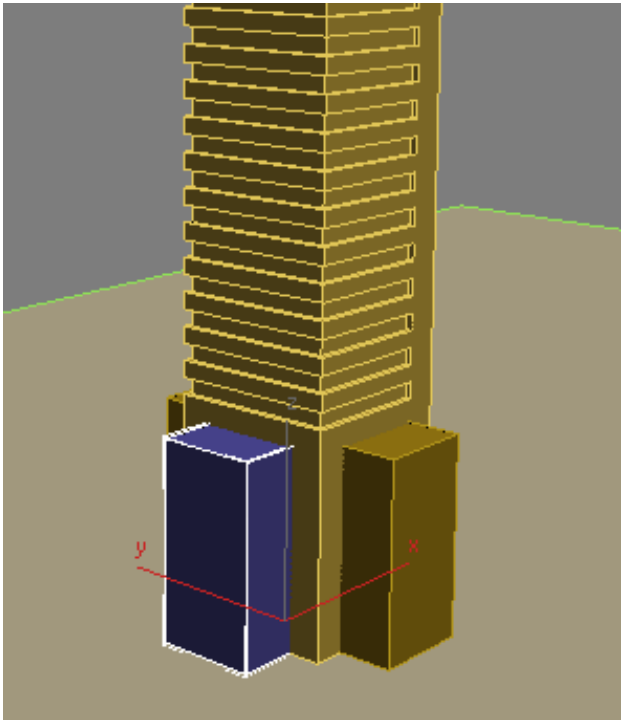
9  Click the Align tool, then select the *Tower* object.

10 On the Align Selection dialog > Align Position group, turn on X Position and Y Position, then turn on Center for both the Current Object and Target Object groups. This aligns the box you just created to the center of the box object. Click OK.

Next, you need to align the right side of the box with the right side of the first box object, to create a back wall for the model.

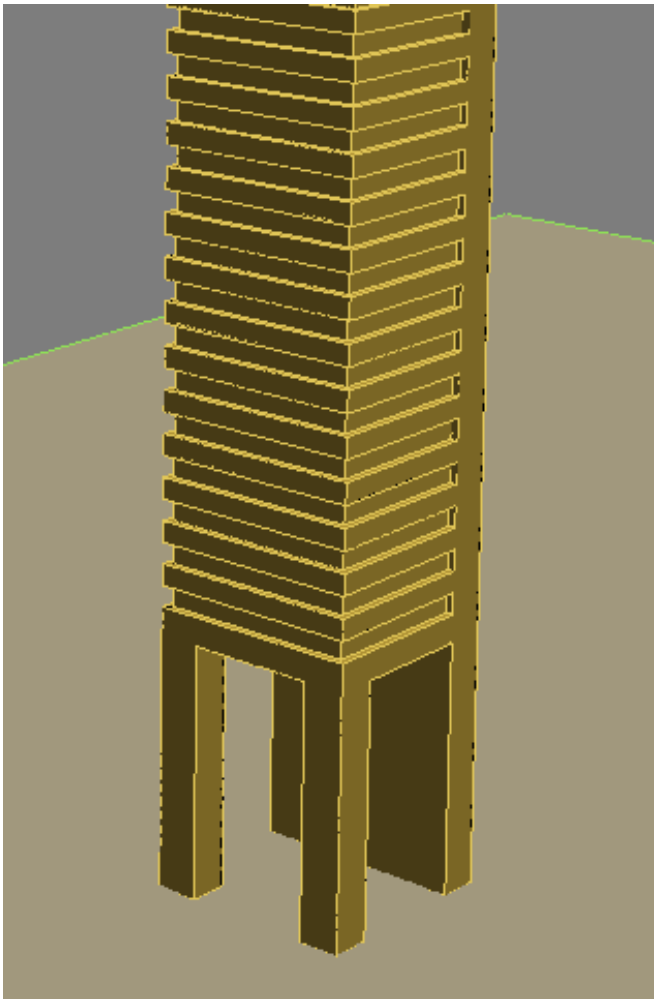
11  Click the Align tool once again, then select the *Box01* object you created in step 2.

12 In the Align Selection dialog > Align Position group, turn on X Position, then turn on Maximum for both the Current Object and Target Object groups. This aligns the box to the right-most edge of the first box object. Click OK.



13 Select the *Tower* object and on the Modify panel > Parameters rollout > Operation group choose Subtraction.

14 On the Pick Boolean rollout, click the Start Picking button, then select the two boxes you created in this lesson. The subtraction operation creates the required gaps for the lower floors.



15 Click the Start Picking button again to turn it off.

Next

Adding Cylindrical Elements on page 130

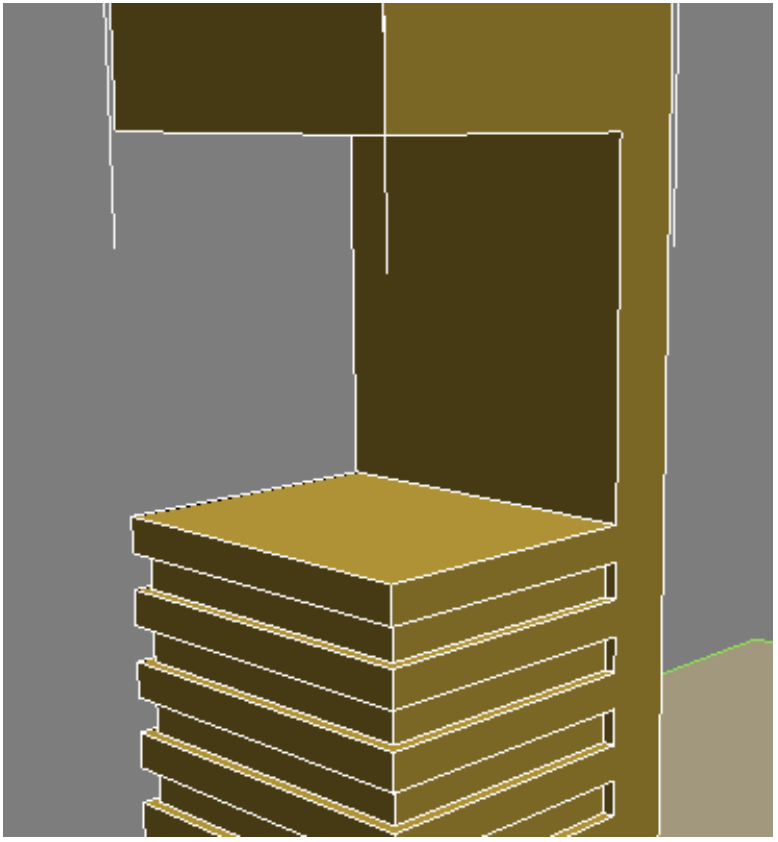
Adding Cylindrical Elements

In this lesson, you will create two cylindrical objects, shape them using polygon edits, then use a union Boolean operation to add them to the *Tower* object.

Add cylindrical elements to the building:

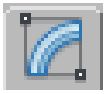
1  Continue working on your scene from the previous lesson or open the scene called *\modeling\highrise\building 2 - tower_contour.max*.

2 Maximize the Perspective viewport and zoom in to the upper section as shown in the next illustration.

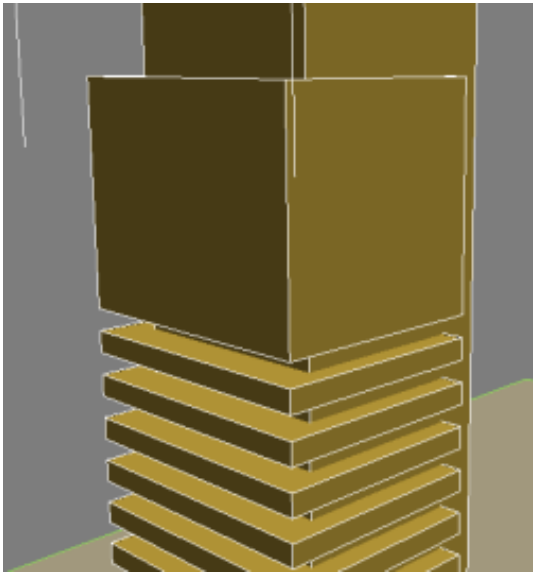


Next, you want to bring the back face of the *Tower* object forward to the midpoint of the structure.

To accomplish this, you will need to edit the operand that was used to expose the back face.

3  Make sure the *Tower* object is selected, and on the Parameters rollout > Display group, choose Operands.

This displays all the box objects, or operands, that were used to modify the *Tower* object.

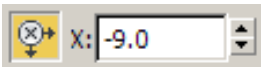


4  In this list of operands, click to highlight the entry "1: Subtr - Box17", then turn on the Select And Move tool.

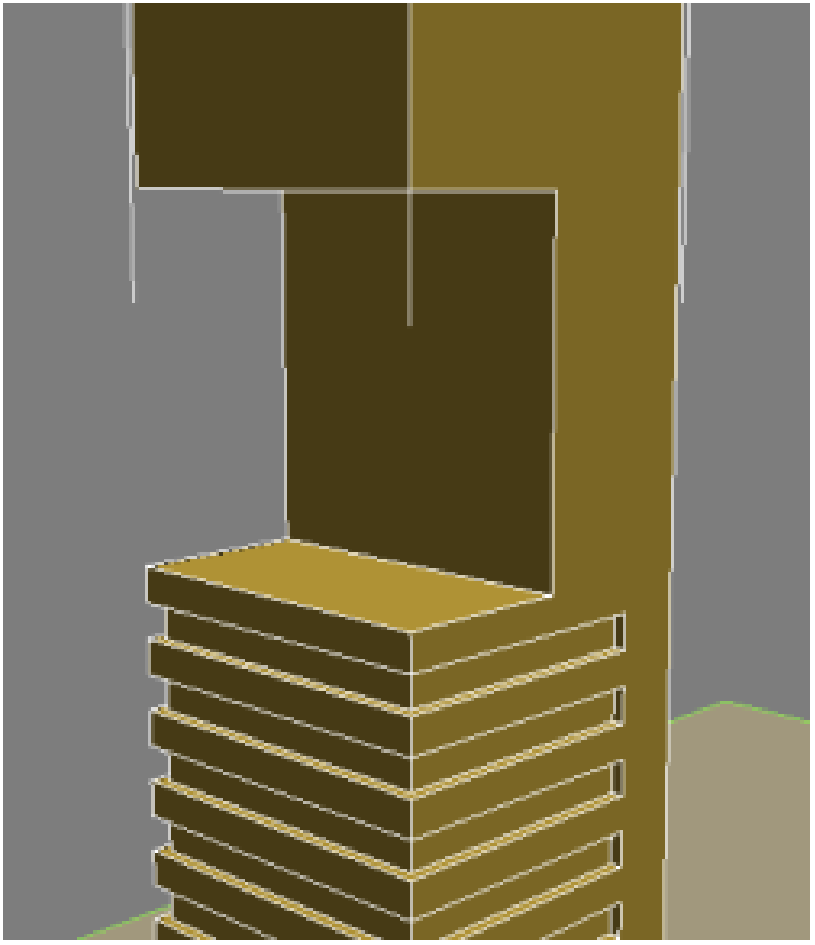
The box named *Box17* (in *building 2 - tower_contour.max*) is the box that was used to make the topmost gap in the tower.

Repositioning the box to the midpoint of the tower involves a simple calculation: at a depth of 30 meters, the tower's midpoint is 15 meters. Earlier, you offset the box from the back of the tower by six meters, so it needs to be repositioned to the left a further nine meters.

5  Make sure the coordinate display is set to relative units of measure (X, Y, and Z spinners all display 0) and type **–9** in the X spinner, then press Enter to move the box to the left by nine meters.

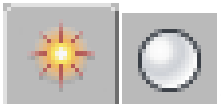


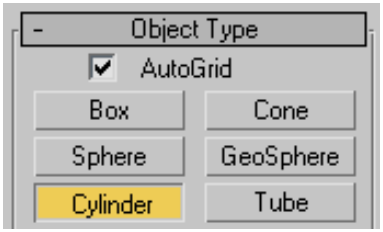
6 On the Parameters rollout > Display group, turn on Result. The back face is now where you want it to be, at the midpoint of the tower.



7 Change the ProBoolean Display type back to Result.

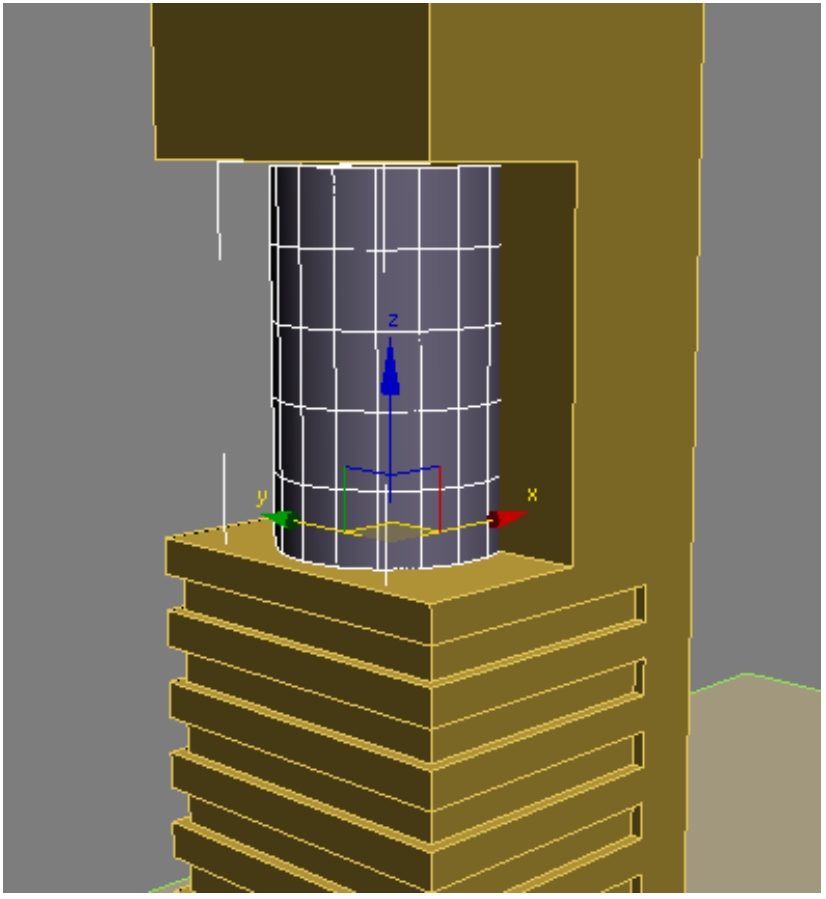
You want to place a cylinder object into the gap between the floors. But rather than create this object at the ground plane as you did with all other objects in this tutorial, you will create this object directly on the upper platform.

8  On the Create panel, click the Geometry button, then in the Object Type rollout, click Cylinder and turn on AutoGrid.



With AutoGrid on, you can create the object on top of an object you select in the scene.

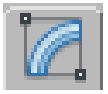
9 Click on the center of the upper platform and drag diagonally to set the cylinder radius. Release the mouse button and drag upwards to set the height, as shown in the next illustration. Click a final time to complete the object. For now, the exact dimensions are not important.



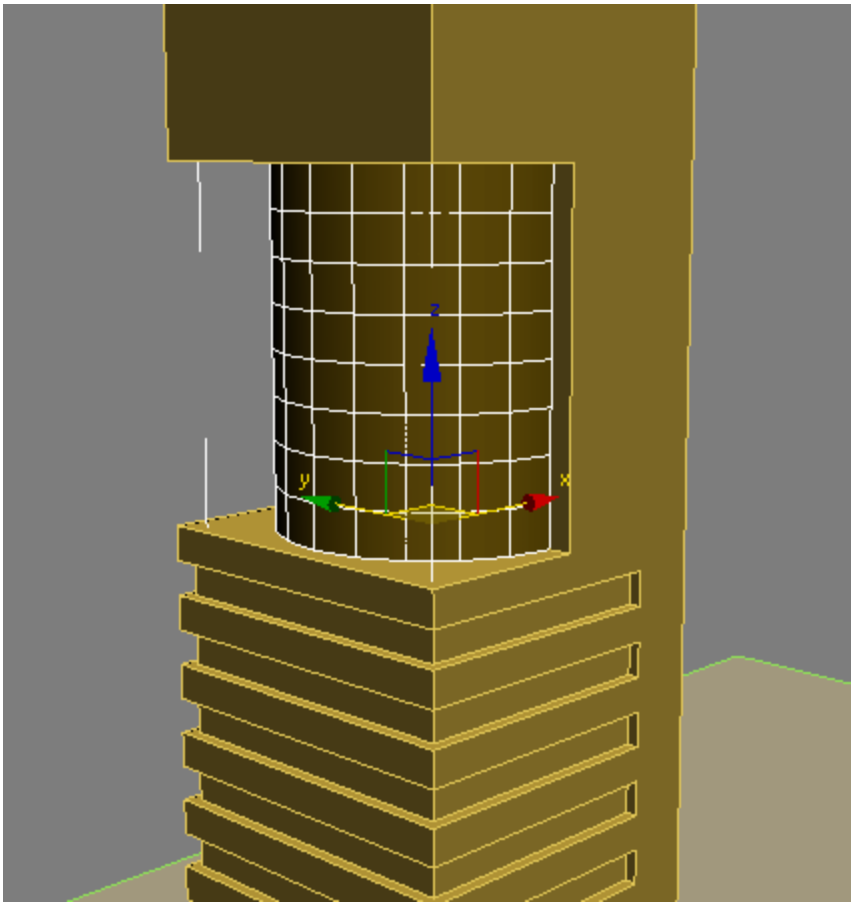
10 Turn off Autogrid.

11  Choose the Align tool, then select the *Tower* object to display the Align Selection dialog.

12 In the Align Position group, turn on X Position and Y Position, turn off Z Position, then choose Center in both the Current Object and Target Object groups. This aligns the cylinder you just created to the center of the *Tower* object. Click OK.

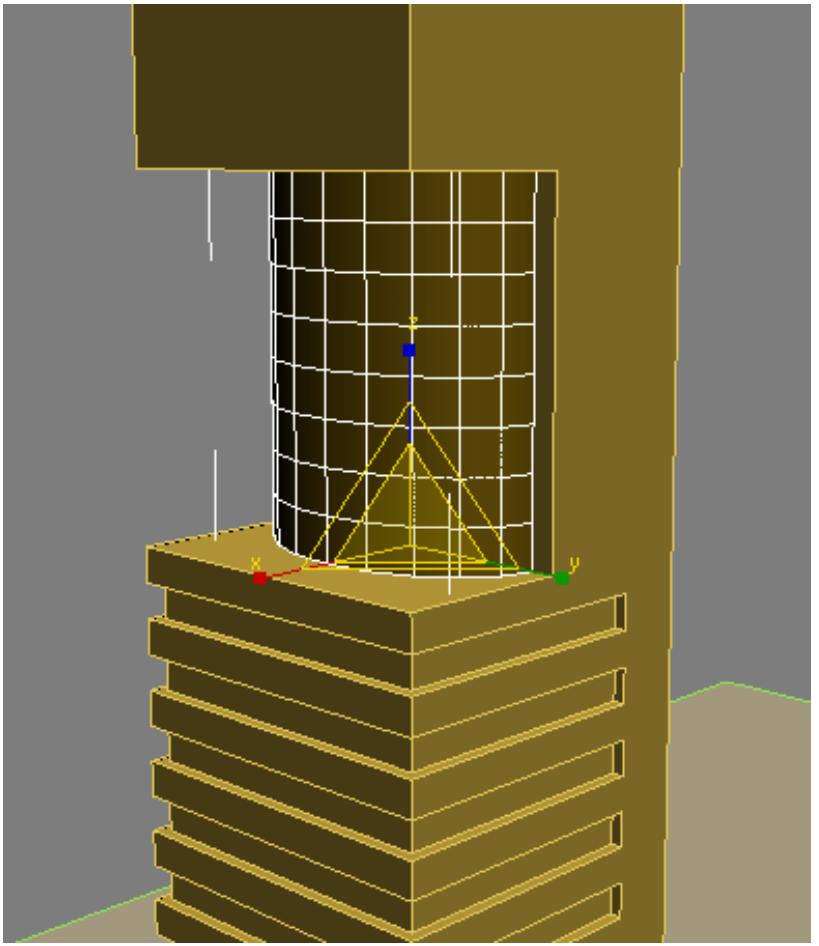
13  On the Modify panel > Parameters rollout, set the parameters of the cylinder as follows:

- Radius=**13 m**
- Height=**30 m**
- Height Segments=**8**
- Sides=**20**



14  Click the Select And Uniform Scale tool and in the Top viewport, drag the X gizmo to the right. As you drag the gizmo, the X coordinate spinner updates dynamically. When the spinner displays a value of 70, stop dragging.

The cylinder shape should now resemble that shown in the next illustration.

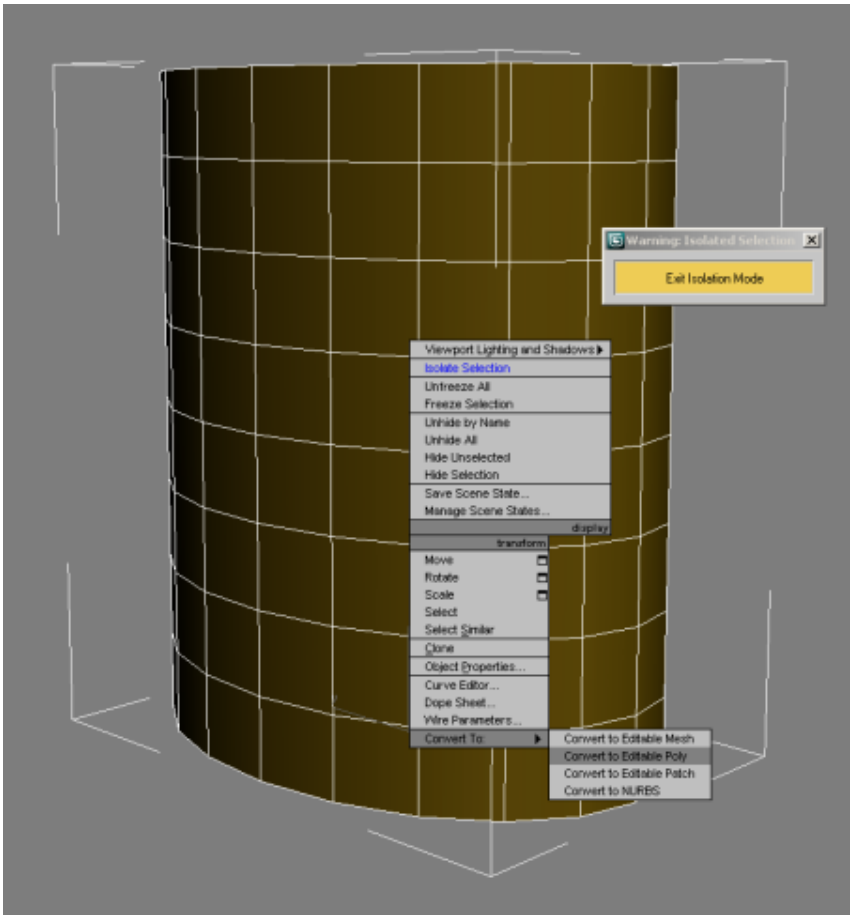


Next, you will use some polygon editing techniques to add architectural detail to the cylinder object.

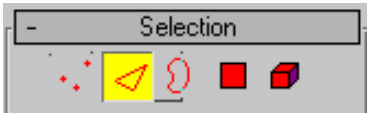
15  Click the Select Object tool.

16 Right-click the cylinder object and choose Isolate Selection from the quad menu.

17 Right-click the cylinder object again, and from the quad menu choose Transform > Convert To > Convert To Editable Poly.

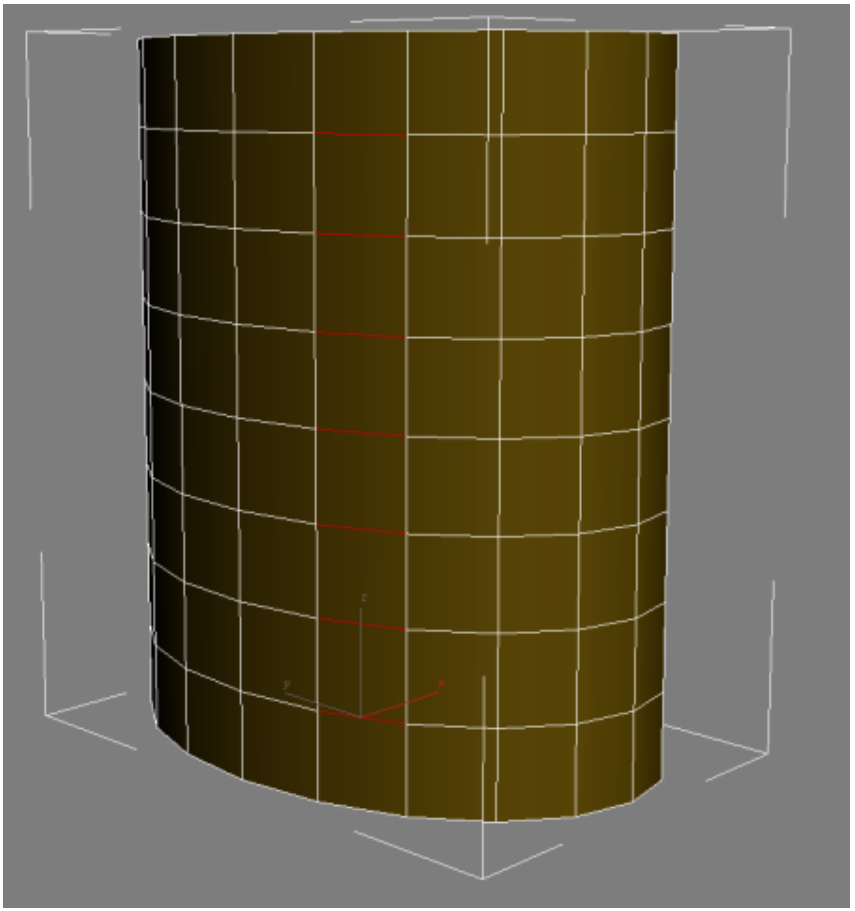


18 On the Selection rollout, choose the Edge tool, select any horizontal edge in the cylinder, then click the Ring button.



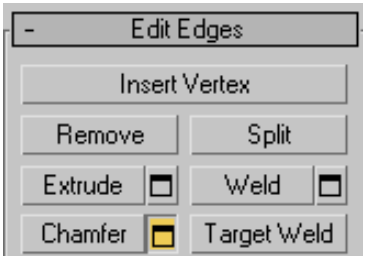
All horizontal edges above and below the selected edge are also selected.

19 Alt+select the top- and bottom-most edges to deselect them.

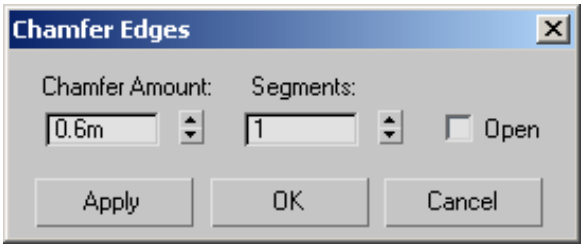


20 Click Loop to select all horizontal edges, excluding the top and bottom rows.

21 On the Edit Edges rollout, click the Settings button to the right of the Chamfer button.



22 In the Chamfer Edges dialog, change the Chamfer Amount to **0.6,** and click OK.



23 On the Selection rollout, click the Polygon selection tool.

24 Display the ViewCube if it is not already visible, choose the Left face of the ViewCube, then right-click and choose Orthographic.

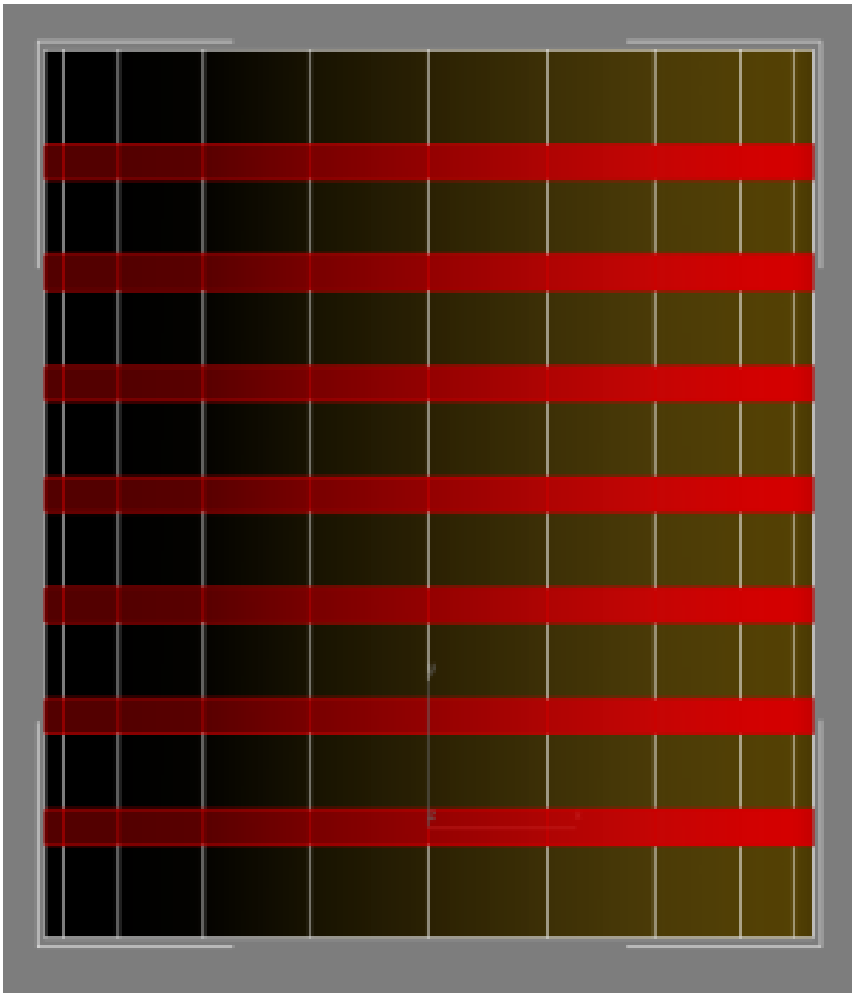
---

25 **NOTE** If the ViewCube is not visible in your viewports, from the main menu choose Views > Viewport Configuration > ViewCube tab > Display Options group > Show the ViewCube.

---

26  If the orthographic view zooms in too closely, click Zoom Extents.

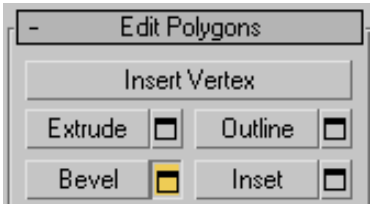
27 Hold down the Ctrl key, click just outside the cylinder object, and drag across each band created by the chamfer operation, as shown in the next illustration.



28 On the ViewCube, click Home to exit Orthographic view.

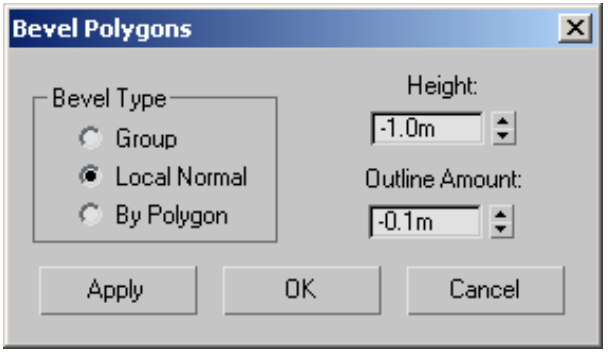
29 Click Zoom Extents again.

30 On the Edit Polygons rollout, click the Settings button to the right of the Bevel button.



31 In the Bevel Polygons dialog > Bevel Type group, choose Local Normal.

32 In the Height spinner, type **-1.0,** and in the Outline Amount spinner, type **–0.1** to give the bevel a very slight downward slope. Click OK.



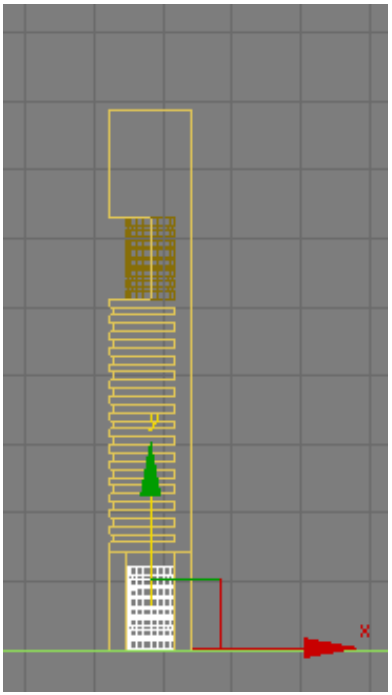
33 Click Exit Isolation Mode to redisplay all the scene elements and on the Selection rollout, click the Polygon selection tool to deselect it.

34 Minimize the Perspective viewport to see all four views.

35 Zoom so you can see all of the tower.

36  Turn on Select And Move.

37 In the Front viewport, hold down Shift and drag the cylinder on its Y axis to the bottom of the tower.



38 In the Clone Options dialog > Object group, turn on Copy, then click OK.

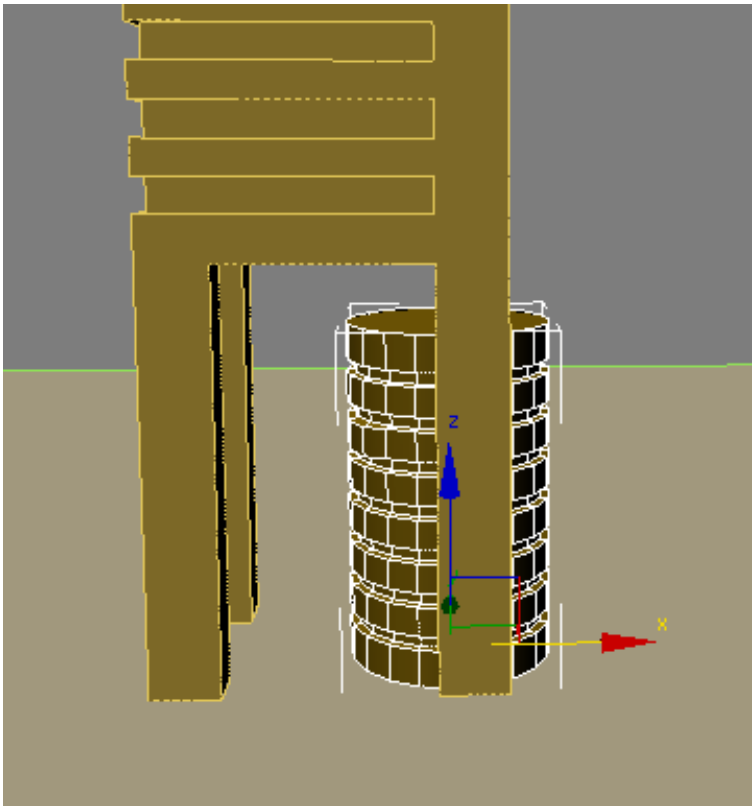
This way, any changes you make to the newly copied object will not affect the upper cylinder.

39 Switch the coordinates display to Absolute Mode and type **0.0** in the Z coordinates spinner to position the object at ground level.

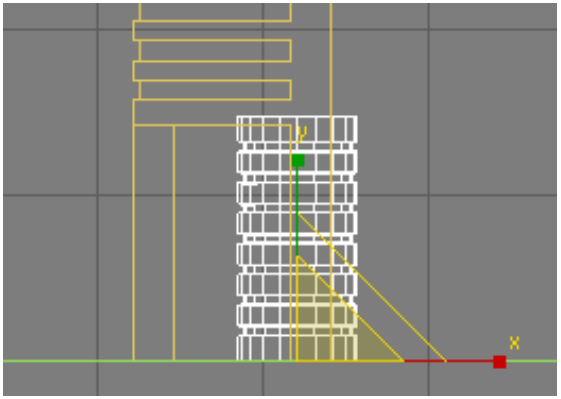
TIP You can also right-click the Z spinner arrows to set this value to zero.

---

40 Activate the Front viewport and drag the cylinder to the right on its X axis, until it straddles the back face of the *Tower* object, as shown in the next illustration.



41  Choose the Select And Uniform Scale tool and drag the Y axis gizmo upward until the cylinder slightly penetrates the *Tower* object. (The cylinder must come into contact with the *Tower* object before you can perform the next Boolean operation.)



42 Select the *Tower* object and on the Modify panel > Parameters rollout > Operation group, choose Union.

43 From the Pick Boolean rollout, click the Start Picking button and select the two cylinder objects to join them to the tower.

44 Click the Start Picking button again to turn it off.

Next

Using Extrusion to Shape the Roof on page 145

Using Extrusion to Shape the Roof

In this lesson, you will use polygon edit techniques and the Extrude modifier to create and add detail to a sloped roof.

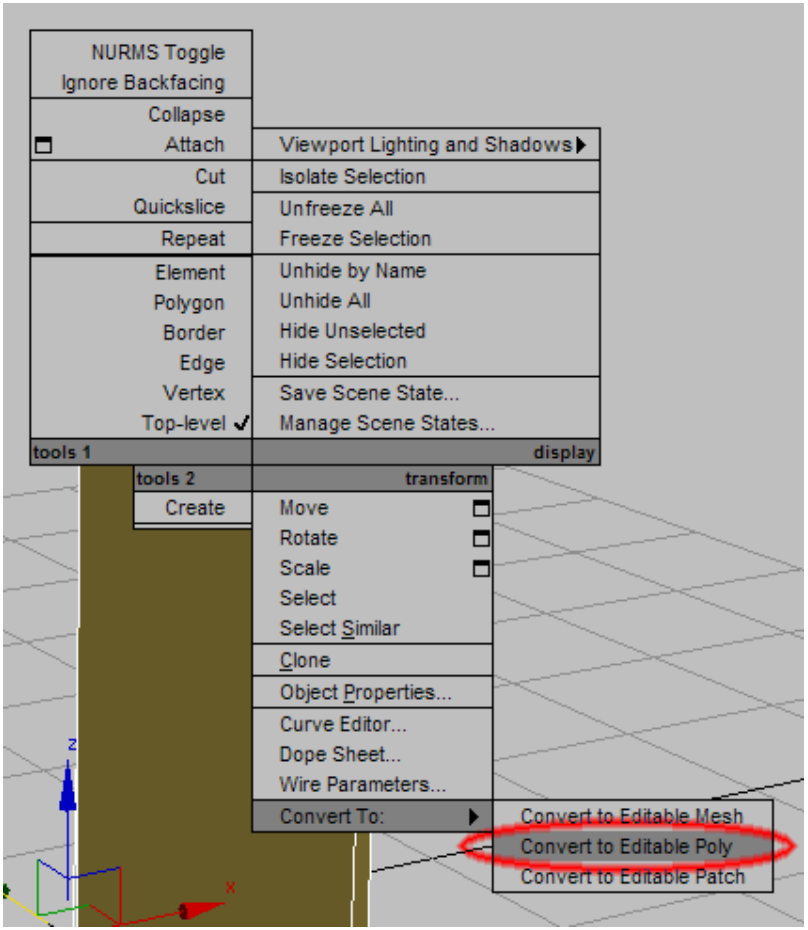
Use extrusion to shape the roof:

1  Continue working on the your scene from the previous lesson or open the scene called *\modeling\highrise\building 2 - Boolean - complete.max*.

At this point, you could create another box object on top of the *Tower* object, rotate it by 45 degrees, and use it in yet another Boolean operation to create a sloped roof.

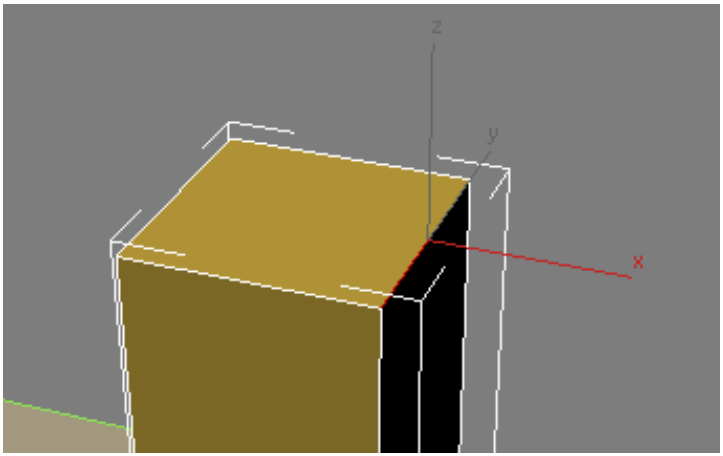
In this case however, a simpler approach is to create the roof line by editing the tower as an editable poly object.

2 Activate the Perspective viewport, right-click the *Tower* object, and from the quad menu choose Transform > Convert To > Convert to Editable Poly.

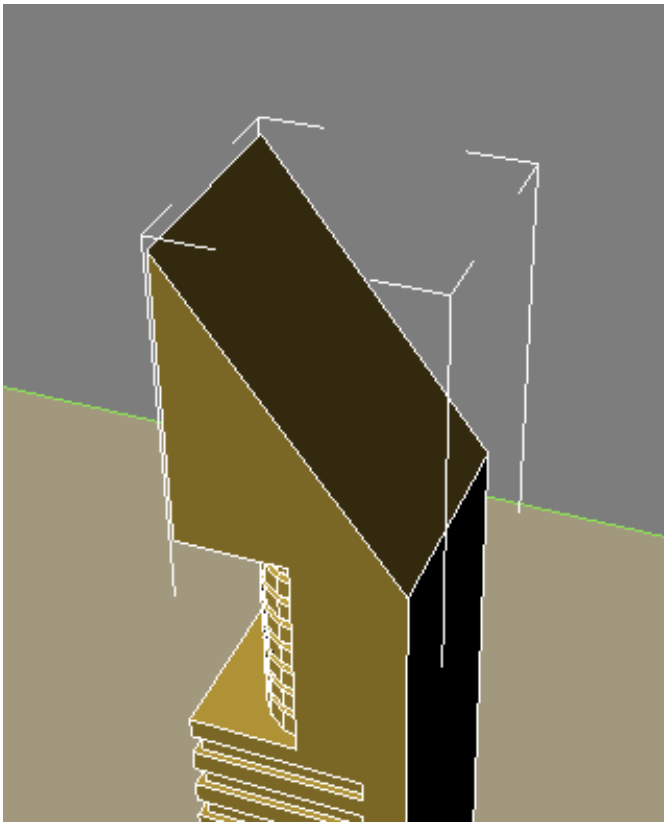


3  Zoom, orbit, and pan the Perspective viewport until you can see the roof of the building.

4  On the Selection rollout, choose the Edge sub-object level, and then use the Select And Move tool to select the edge at the back of the tower roof, as shown in the next illustration.

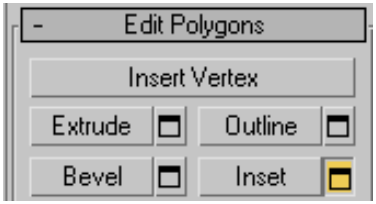


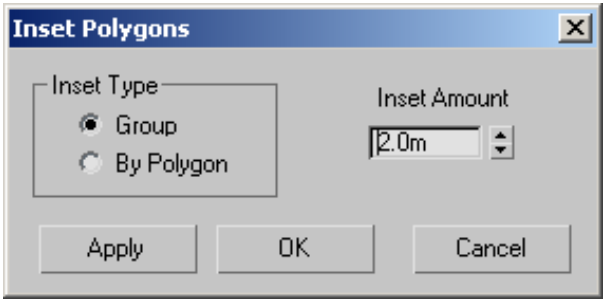
5 In the Z coordinates spinner, change the value from 200 to **160**. This sets the slope of the roof, as shown in the next illustration.



6 On the Selection rollout, choose the Polygon selection tool and select the roof polygon.

7 On the Edit Polygons rollout, click the settings button next to Inset to open the Inset Polygons dialog.





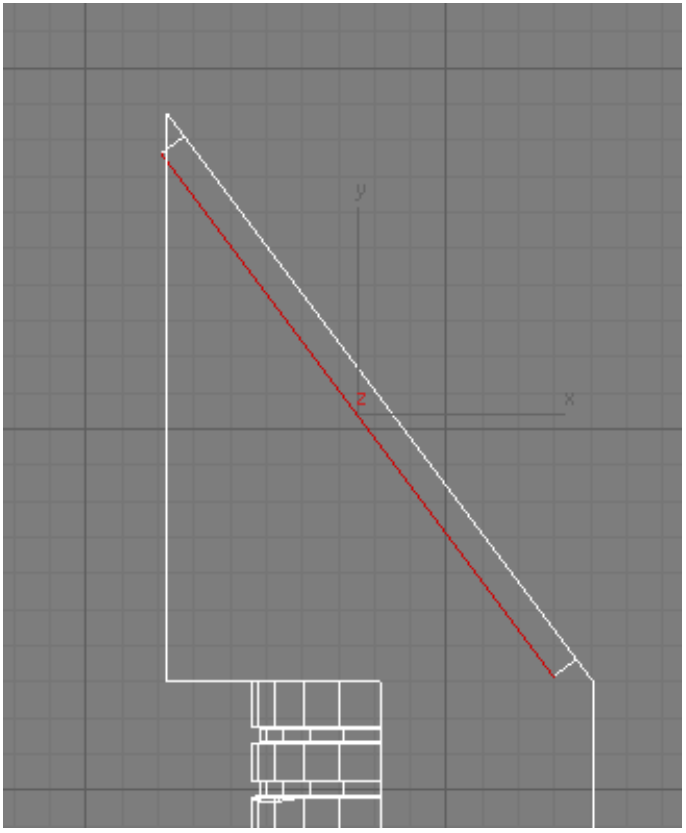
8 Set the Inset Amount spinner to **2.0** and click OK.

The inset operation creates a polygon two meters smaller in X and Y space than the roof polygon, then centers it. You can now extrude this newly created polygon.

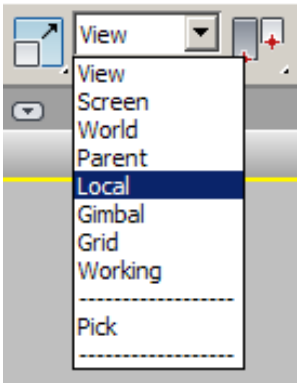
9 On the Edit Polygons rollout, click the settings button next to Extrude.

10 On the Extrude Polygons dialog, set Extrusion Height to **–2.0**.

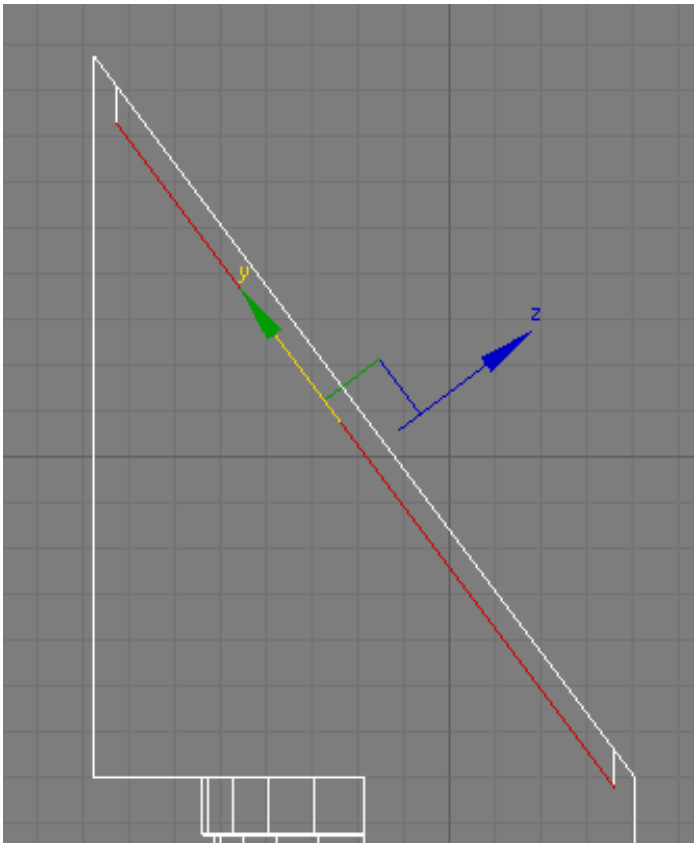
A closer look at the top of the building in the Front viewport shows that the extrusion needs to be fine tuned.



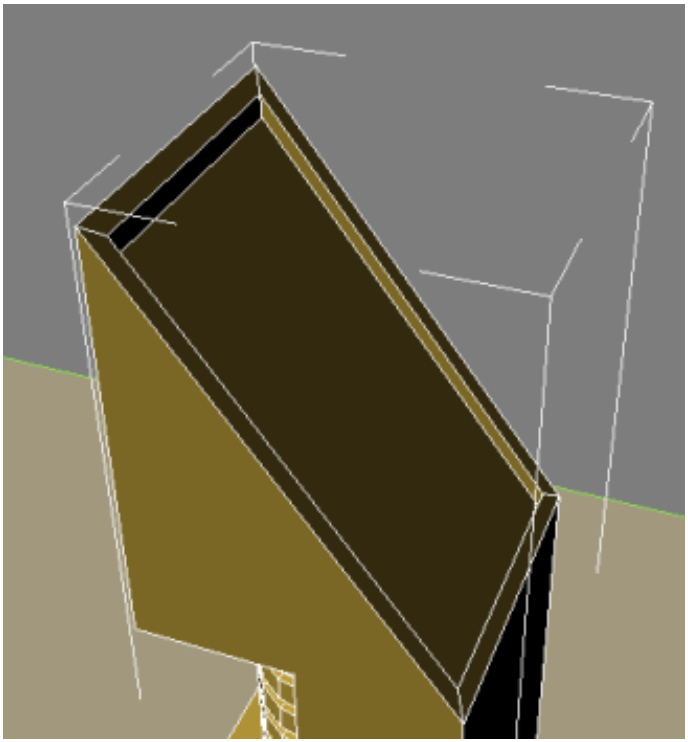
11  Click the Select And Move tool, then choose Local from the Reference Coordinates drop-down list.



12 Drag the roof polygon until its top and bottom bevels are at a 90-degree angle to the ground plane, as shown in the next illustration.



Your roof should look something like this:



Next

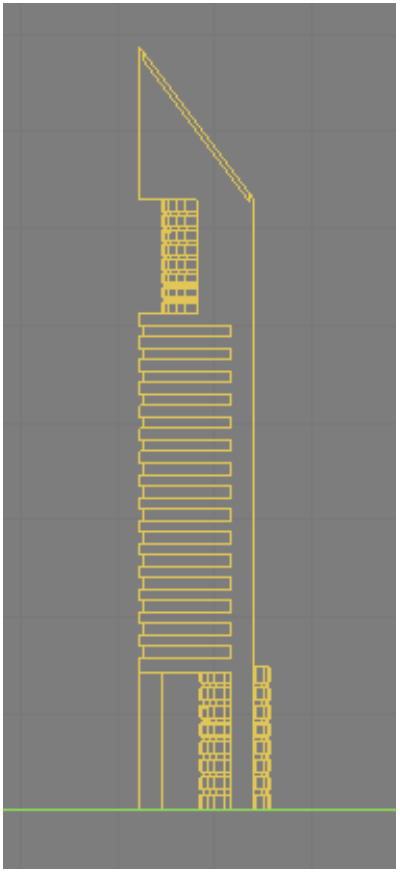
Assigning Materials to the Building on page 152

Assigning Materials to the Building

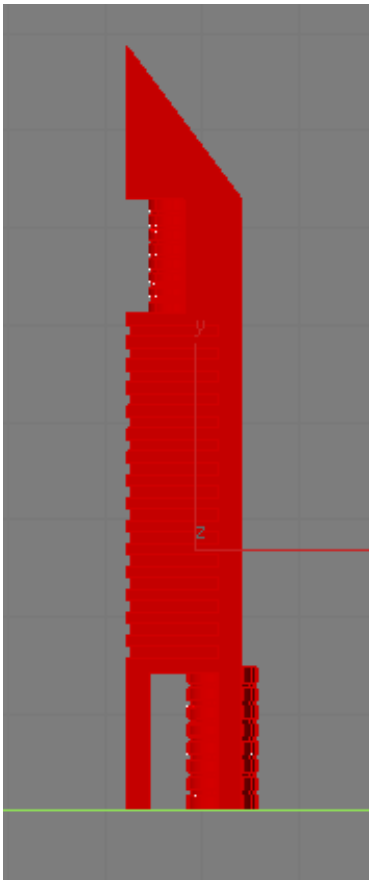
In this final lesson, you will assign a material identification number to each polygon in the model. You can then use these ID numbers to assign materials to specific parts of the model.

Assign materials to the building:

1. Maximize the Front viewport and zoom out until the entire tower is visible. Make sure you are in View mode.



2 Select the *Tower* object and on the Modify panel > Selection rollout, choose the Polygon selection tool, then press Ctrl+A to select all the polygons in the *Tower* object.



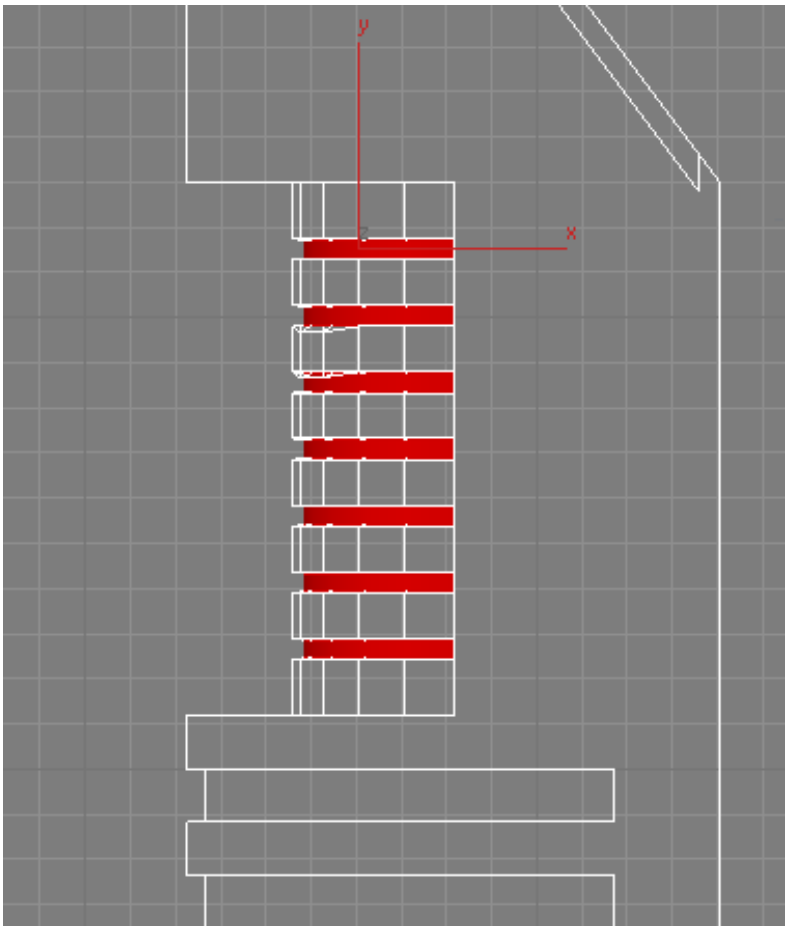
3 Scroll down to the Polygons: Material IDs rollout and in the Set ID spinner, check that all polygons are assigned a value of 1.

In its current state, if a material was assigned to any part of the *Tower* object, all its polygons would receive the same material. This is because they all have the same material ID number.

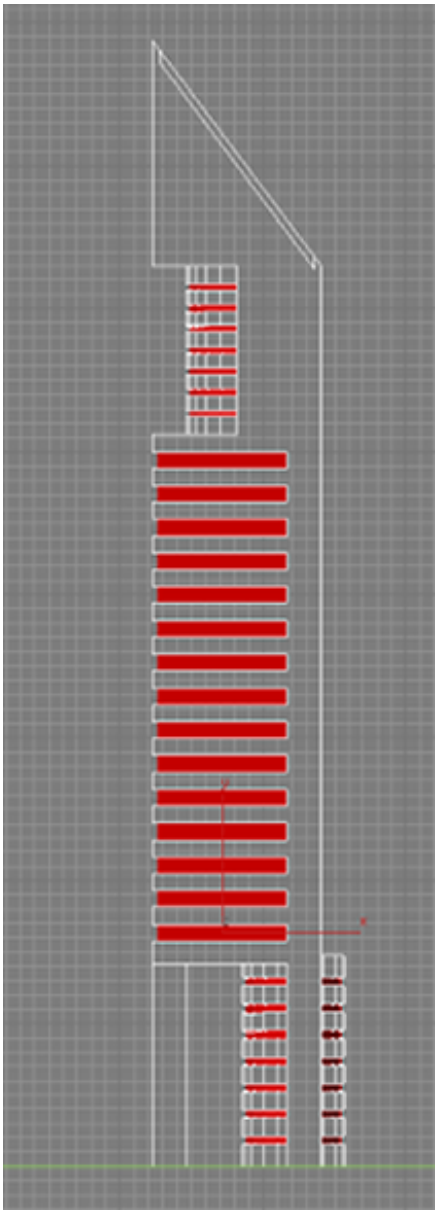
4 Click anywhere outside the *Tower* object to deselect the polygons.

5 Zoom in to the upper section of the tower and begin to Ctrl+click the polygons that represent the glazing in the cylinder, as shown in the next illustration.

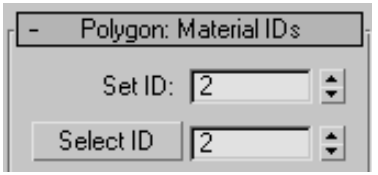
Start your selection by clicking outside the tower and dragging right, across all the glazing polygons. Starting your selection outside the tower ensures that all glazing polygons on the other side of the *Tower* object are also selected.



6 Zoom out and continue to Ctrl+click all the glazing in the lower floors using the same selection technique as described in the previous step. Be sure to include the glazing polygons in the bottom cylinder. The result is shown in the next illustration.

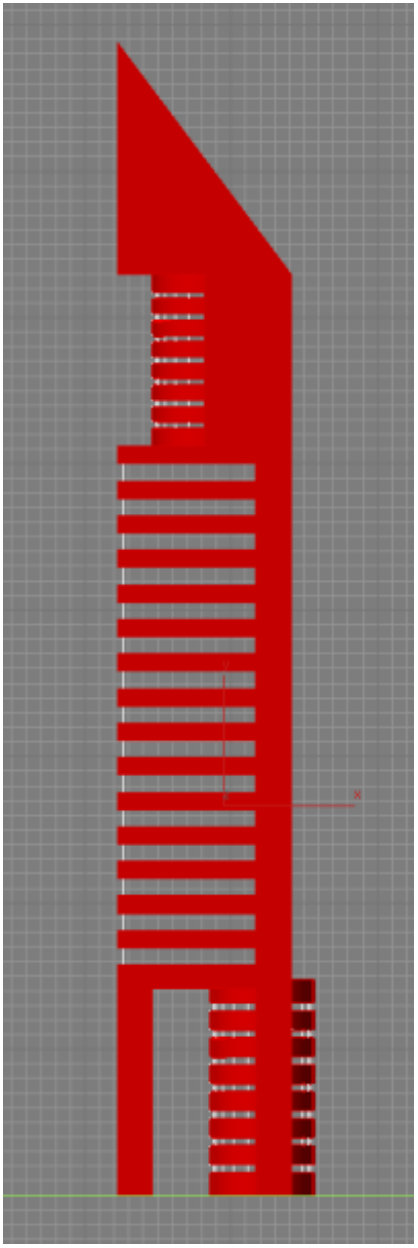


7 On the Polygon: Material IDs rollout, click the Set ID up spinner arrow once, so the box is set to **2**.



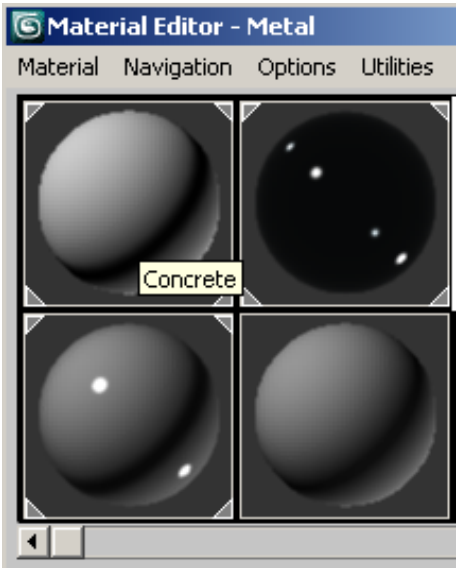
Now, the *Tower* object can be assigned up to two different materials.

8 On the Polygon: Material IDs rollout > Select ID spinner, type **1** and click Select ID. All all the material 1 polygons are now selected in the viewport.



9 Press M to open the Material Editor.

10  Choose the Concrete material from the sample slot and click the Assign Material To Selection button.



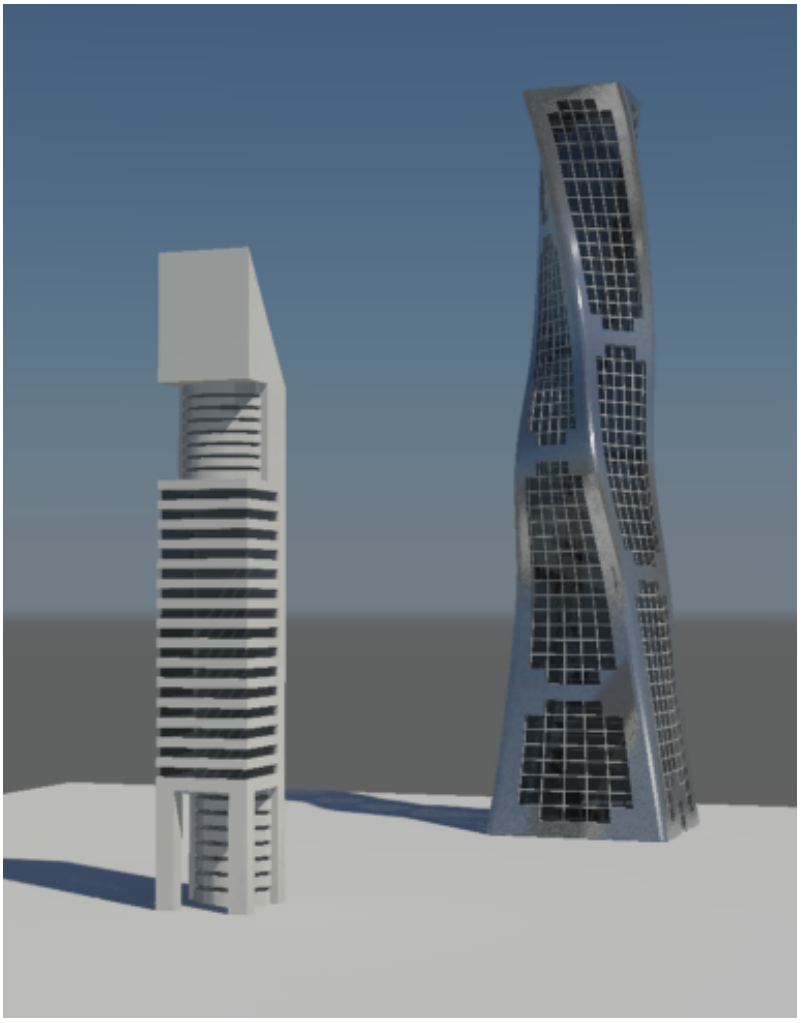
Concrete material is applied to all polygons that have ID 1 assigned to them.

11 Repeat the previous three steps for material ID 2 and apply the glass material to the selected polygons.

12 On the Selection rollout, deselect the Polygon selection tool and maximize the Perspective viewport.

13  Adjust the perspective so that the two tower models are clearly visible, then click Render Production to view the result.

Your rendered image should look something like this:



Summary

This tutorial introduced you to the concept of Boolean operations and how they can be used to produce complex shapes from simple geometry. You also learned some polygon editing techniques, and how to instantly apply materials to multiple surfaces, by assigning material ID numbers to their respective polygons.

Modeling Cabinets Using the Ribbon

The Graphite Modeling Ribbon, referred to in this tutorial simply as the "Ribbon", is a fully customizable toolbar designed to provide you with all the tools you need to edit mesh and polygonal objects.

The lessons in this tutorial show how to use the tools available in the Ribbon to create a set of kitchen cabinets.

In this tutorial, you will learn how to:

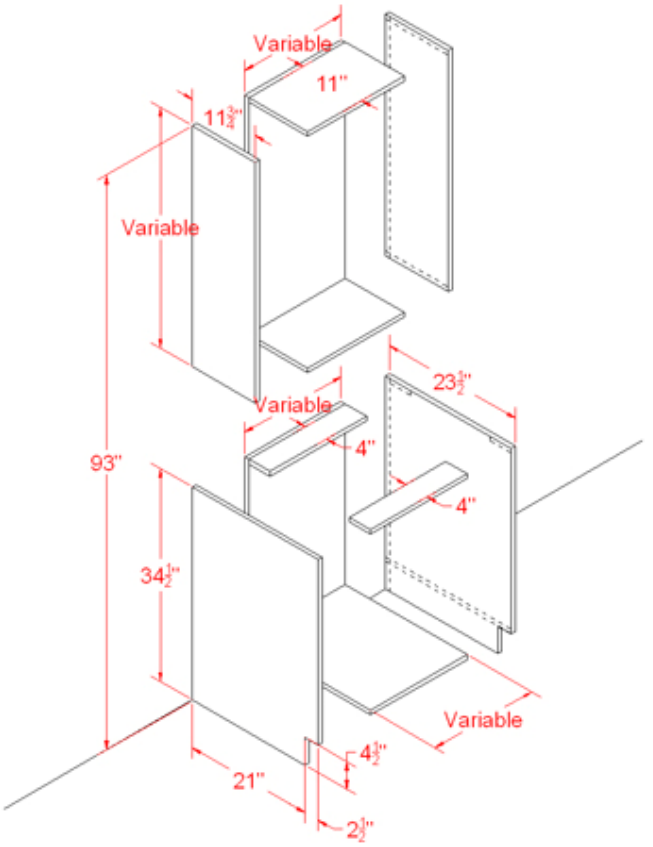
- Create loops by connecting polygon edges.
- Extend polygons using various extrusion techniques.
- Create beveled and inset shapes.
- Use the Symmetry modifier to produce a mirrored duplication of an object.

Skill level: Intermediate

Time to complete: 2 hours

Using Basic Polygon Editing to Create a Base Cabinet

The kitchen cabinets you will create in this tutorial are based on the dimensions provided in the next diagram. In North America, the standard for kitchen cabinet height and width is inches, in increments of three. This diagram therefore uses feet and inches rather than metric units of measure.



Line diagram showing kitchen cabinet dimensions

The diagram includes variable dimensions to account for varying cabinet width and height.

Possible cabinet width starts at 9 inches and increases incrementally by 3 inches to a total of 36 inches per cabinet.

The height of wall cabinets can be as little as 12 inches, increasing by 3 inches up to 30 inches, with one more dimension possible at 39 inches.

The standard height of a base cabinet is 34.5 inches, plus 1.5 inches for the countertop.

For most structures, 93 inches is the maximum height from the top of a variable-sized wall cabinet to the floor.

With the diagram as a guide, you will use modeling tools from the Ribbon to create a group of cabinets of various sizes.

To start, you will build a base cabinet 18 inches wide.

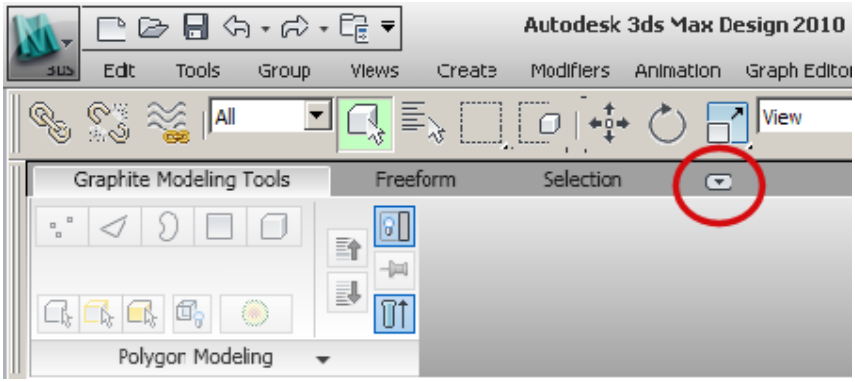
Create the left cabinet board:

1  On the Quick Access toolbar, click the Open File button, navigate to the *\scenes\modeling\kitchen_cabinets* folder, and open the scene file *kitcab_start.max*.

By default, a minimized version of the Graphite Modeling Ribbon displays directly below the main toolbar.

NOTE This lesson provides descriptions for workstations using a default Ribbon toolbar display. The Ribbon on your workstation might display differently if you customized it in previous 3ds Max Design sessions.

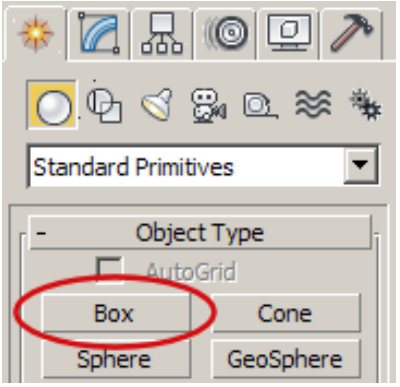
2 Click the expand/minimize icon a few times until the full Ribbon displays.



The Polygon Modeling tab displays with deactivated tools, since no polygon model exists in the scene.

3 Activate the Perspective viewport, then press Alt+W to maximize it.

4  On the Create panel > Object Type rollout, click Box.

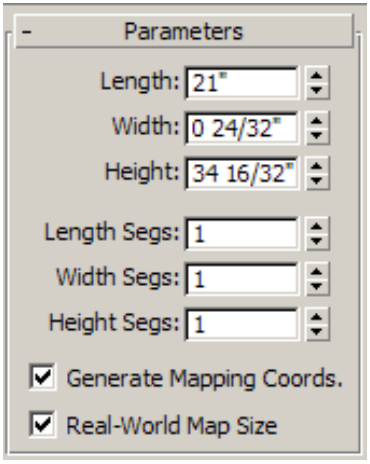


5 In a viewport, drag out a box of any size.

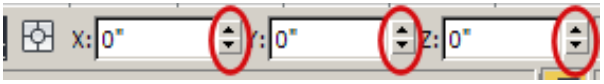
6  Go to the Modify panel, and on the Parameters rollout, set Length to **21.0**, Width to **0.75**, and Height to **34.5**.

As soon as you type in the values, they are converted to fractions of 32, based on the unit setup specified in the scene file.

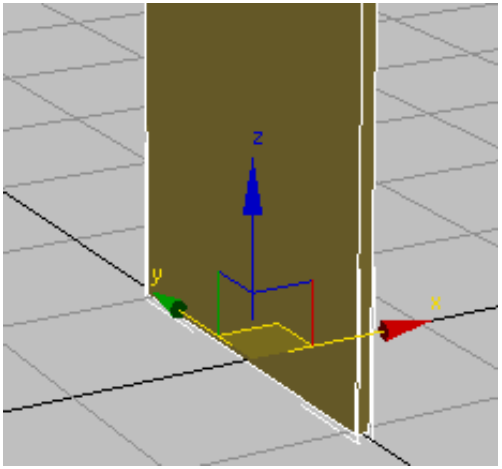
TIP As you go through these lessons, it might help to remember that 0.75" = 24/32".



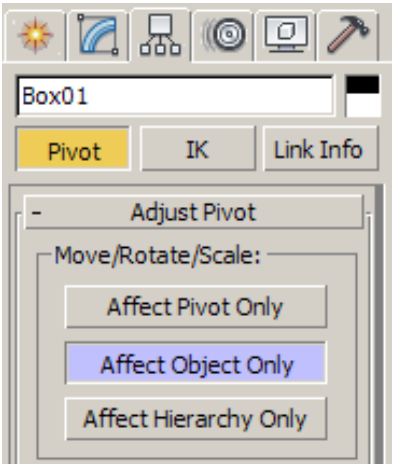
7  On the main toolbar, click Select And Move, then right click the X, Y, and Z transform spinners to set each of them to **0.0**.



The center of the box is now at the center of the world coordinates.

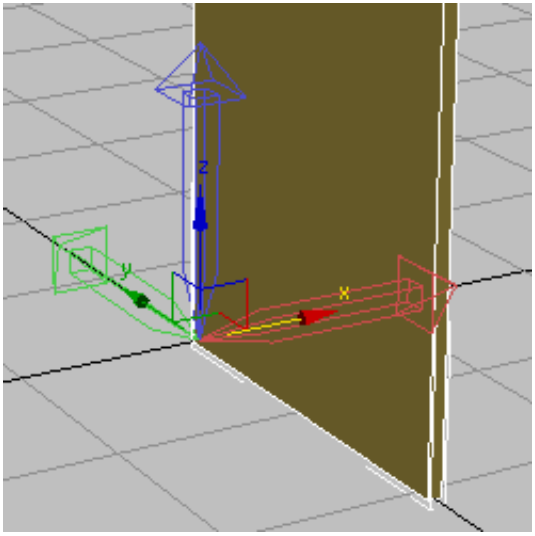


8  Go to the Hierarchy panel, and in the Adjust Pivot rollout > Move/Rotate/Scale group, click Affect Object Only.



Now, if you move the object, its geometry moves but its pivot point remains unchanged at the center of the world.

9 On the Y transform box, type **–10.5**, which is equal to half the length of the box, and press Enter.



Box with pivot point repositioned to center of world coordinates (0,0,0)

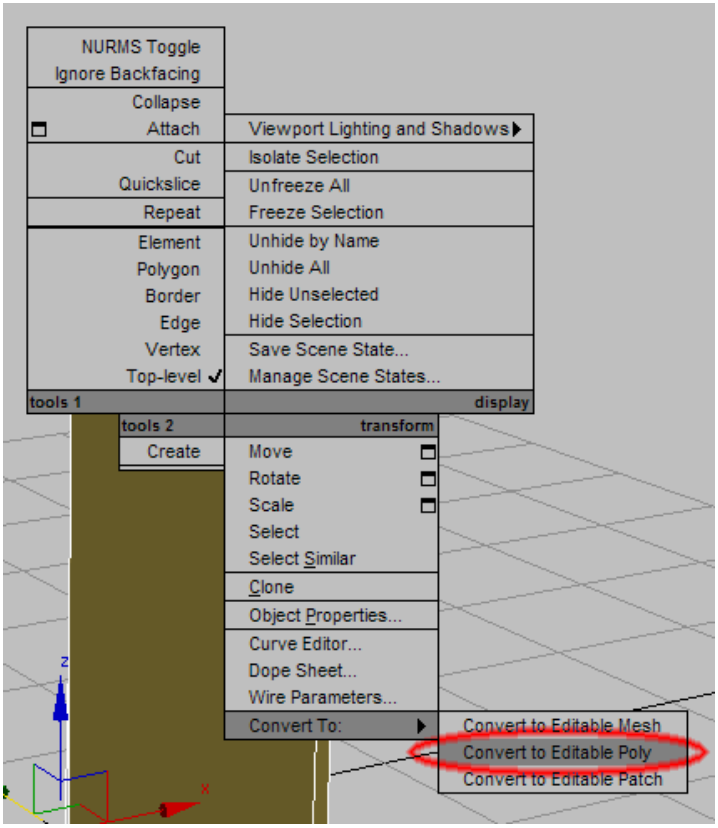
The back face of the box and the pivot point are now both at the center of the world. The cabinet you are about to create from this object will now be much easier to manipulate.

10 Click Affect Object Only again to turn it off.

Add polygon edges:

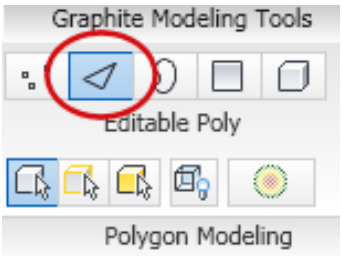
Next, you'll add edges to your object. These edges will create the polygon faces you will need for extrusions later in the modeling.

1 Make sure the box is selected, right-click it, and choose Convert To > Convert To Editable Poly.

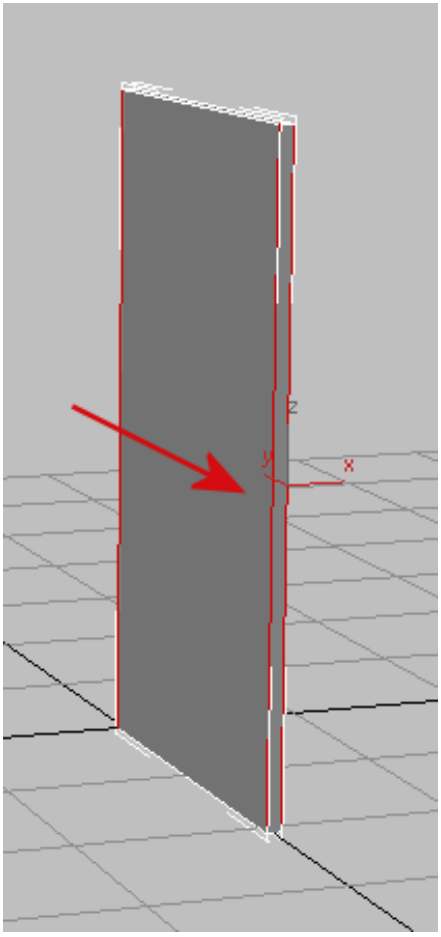


The Ribbon updates to display a range of polygon-editing tools.

2 On the Ribbon > Polygon Modeling panel, activate Edge selection mode.

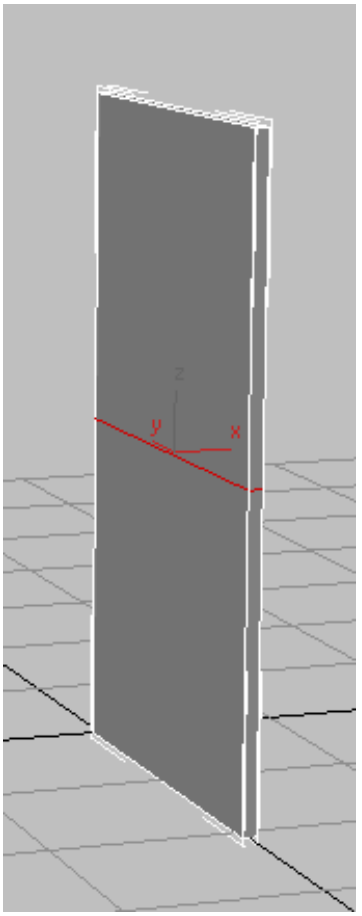


3 Region-select from left to right across the center of the box to select all its vertical edges.



4 On the Loops panel, click Connect.

This connects all selected edges by drawing a loop around them through their midpoints.

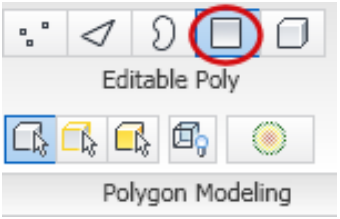


Loop created from selected edges

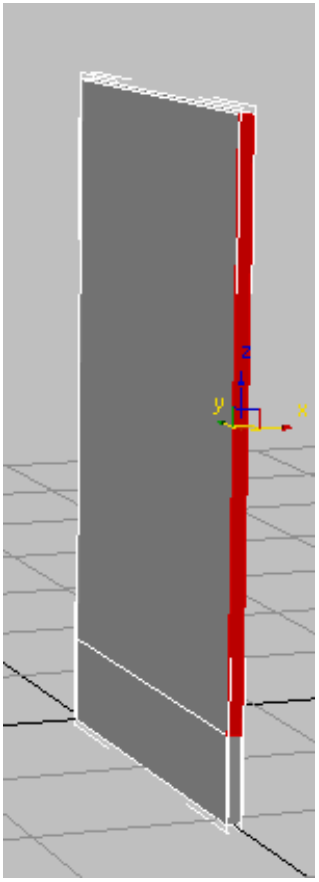
5  On the main toolbar, click Select And Move, and in the Z transform field, type **4.5**, then press Enter.

This moves the new connecting edges closer to the floor.

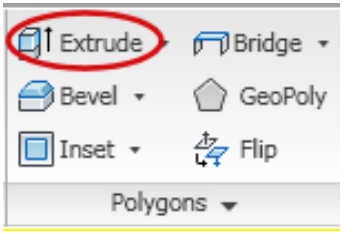
6 On the Ribbon > Polygon Modeling panel, activate Polygon selection mode.



7 Select the upper face on the front of the panel.

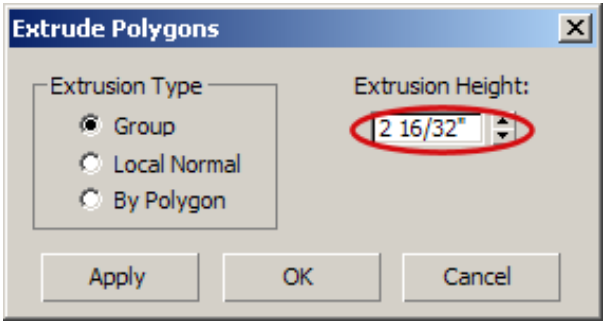


8 On the Polygons panel, Shift+click Extrude.



(When you Shift+click one of these tools, 3ds Max Design displays the settings dialog for that tool.)

9 On the Extrude Polygons dialog, set Extrusion Height to **2.5**, then click OK.



You now need to add more detail to the side of the box so you can later connect this component to the rest of the model.

You will continue by adding an edge toward the rear of the box to allow for the inclusion of a back panel to the cabinet that is 0.75 inches thick.

10  On the Ribbon > Polygon Modeling panel, activate Edge selection once more.

11 On the Ribbon > Edit panel, click the Swift Loop tool.

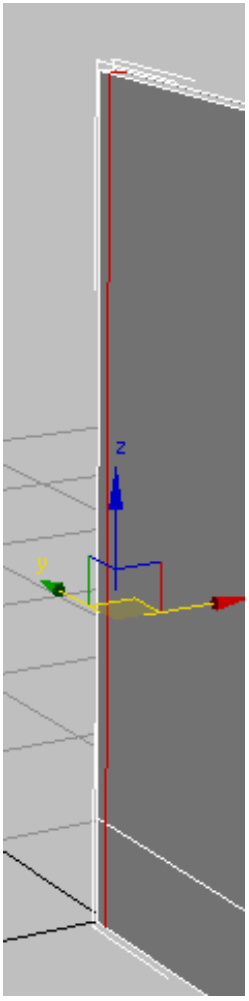
Now, as you position your cursor near an edge, a green virtual loop displays. This helps you visualize the placement of the loop.

12 In the viewport, click a horizontal polygon edge.

A loop is automatically created perpendicular to the selection point. This method is a fast way to create and position a loop on a model.

Based on the diagram, you want the loop to be positioned 0.75 inches from the back edge of the box.

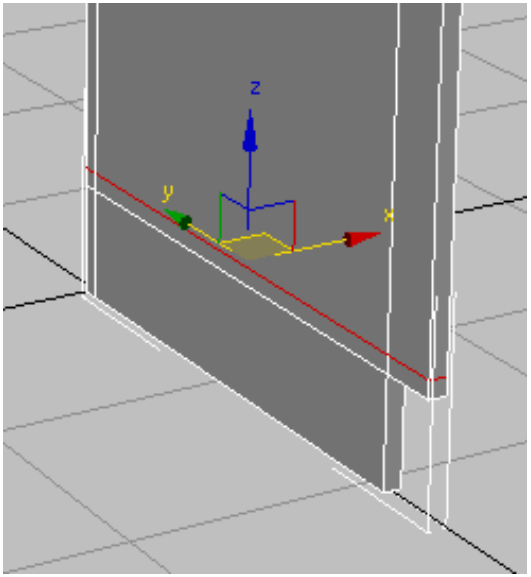
13  On the main toolbar, turn on Select And Move, then in the Y transform field, type **–0.75**.



14 On the Ribbon > Edit panel, click the Swift Loop button to turn it on again.

15 In the viewport, click a vertical edge anywhere in the upper part of the panel.

16  On the main toolbar, click Select And Move, then in the Z transform field, type **5.25**.

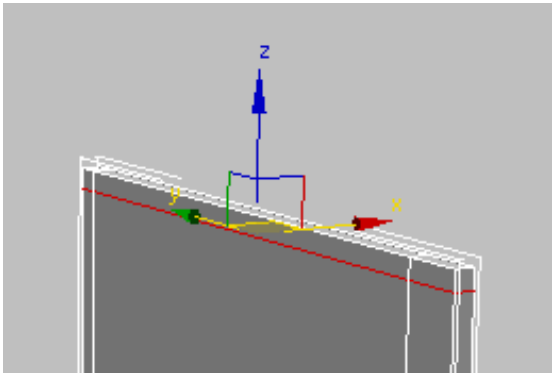


This value represents the height of the toe space created by the extrusion in step 7, plus the thickness of the cabinet floor board you will soon create.

17 On the Ribbon > Edit panel, click the Swift Loop tool again.

18 In the viewport, click a vertical edge anywhere in the upper part of the panel.

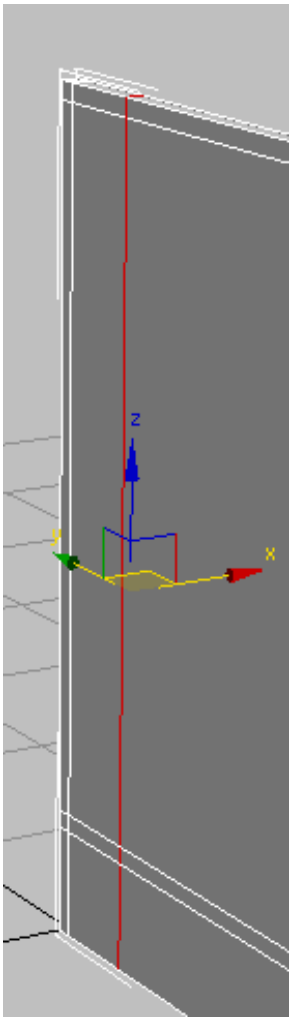
19  On the main toolbar, click Select And Move, then in the Z transform field, type **33.75**.



This value represents the height of the base cabinet, less the 0.75 inch thickness of the four inch support boards you will soon create.

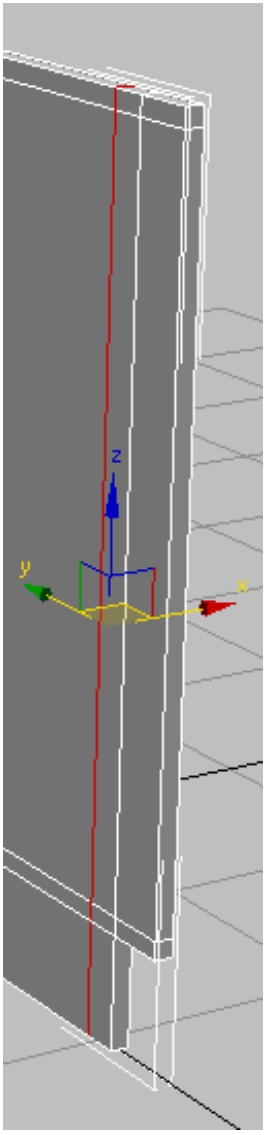
20 On the Ribbon > Edit panel, click the Swift Loop tool, then select a horizontal edge anywhere around the mid point of the panel.

21  On the main toolbar, click Select And Move, then in the Y transform field, type **–4.75**.



This represents the width of the support board, plus the thickness of the rear cabinet board.

22  Repeat step 19, then on the main toolbar, click Select And Move, and in the Y transform field, type **–19.5**.



This represents the width of the support board, less the length of the side cabinet board.

You now have all the divisions required to build upon this cabinet component.

Create the opposite side of the cabinet:

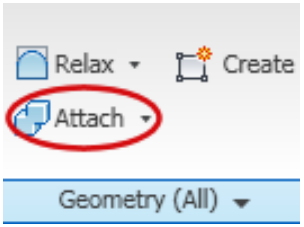
1  On the Ribbon > Polygon Modeling panel, click Edge selection mode to exit sub-object selection.

2 From the Edit menu, choose Clone. In the Clone Options dialog > Object group, turn on Copy, and then click OK.

3  On the X transform box, type **17.25**.

The width of the cabinet you are building is 18 inches, measured from the outside left of the cabinet to the outside right. Therefore, the value of 17.25 represents the full 18 inches, less half the width of the left and half the width of the right cabinet boards (which combined, equal 0.75 inches).

4 In the viewport, select the left cabinet board, and on the Ribbon > Geometry panel, click Attach to turn it on.



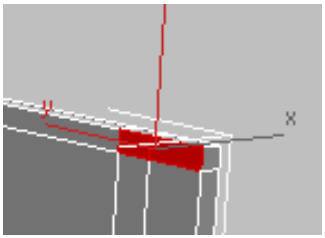
5 In the viewport, click the right (cloned) cabinet board.

This combines both boards into a single object.

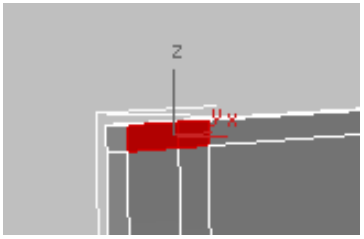
Create the counter supports, back cabinet board and bottom shelf:

1  On the Ribbon > Polygon Modeling panel, activate Polygon selection mode, then click an empty part of the viewport to make sure no polygons are selected.

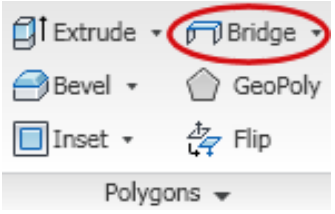
2 Ctrl+click the two polygons that cover the counter support attachment points on the inside front right panel.



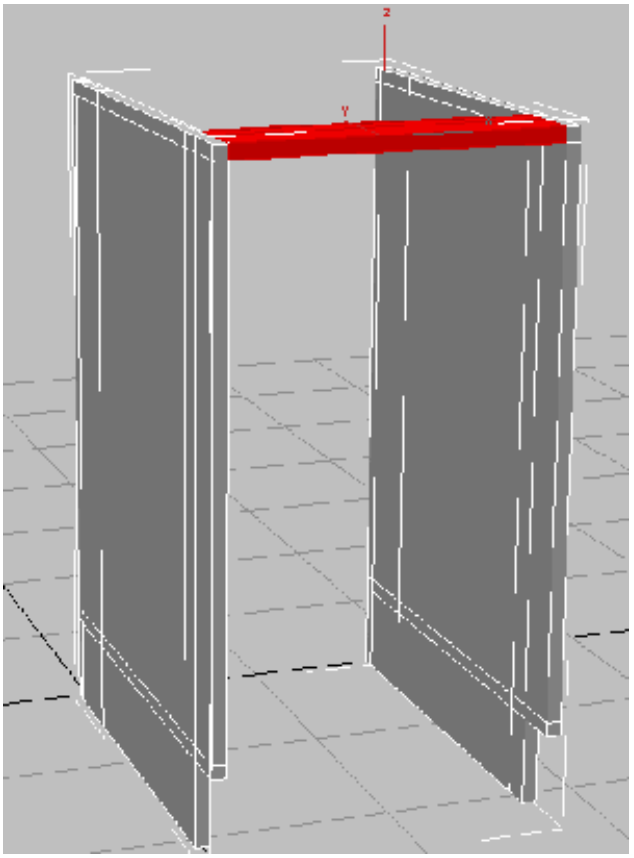
3 Orbit so you can see the two polygons that cover the attachment points on the inside front left panel, then Ctrl+click to select these as well.



4 On the Ribbon > Polygons panel, click the Bridge tool.

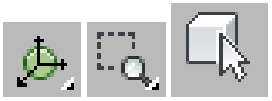


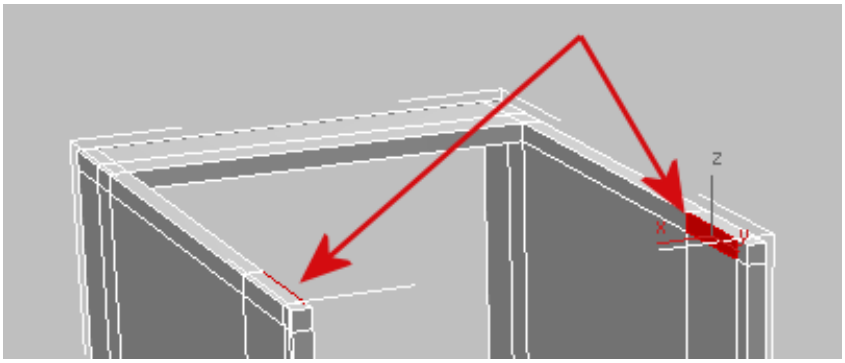
The selected polygons connect to one another.



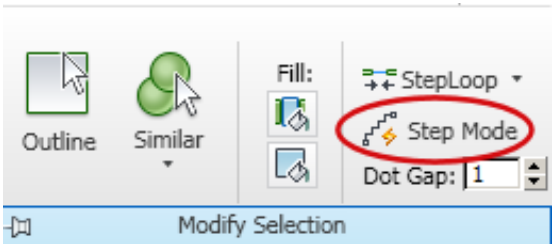
Front support created from selected polygons

5 Press Shift+Z to undo the view change.

6  Orbit the viewport and zoom so you can see the two polygons that cover the attachment points for the rear counter support. Click and Ctrl+click to select both polygons, and then click Bridge again.

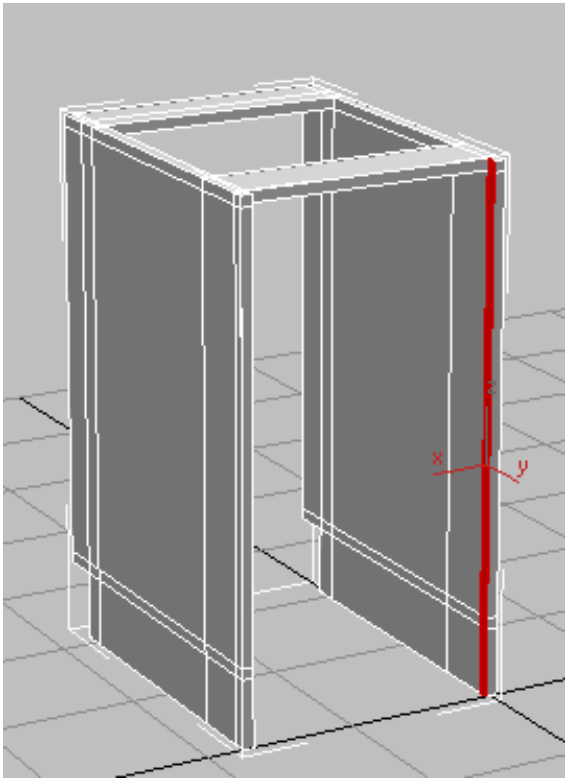


7 Click an empty area of the viewport to deselect the polygons from the previous step, and on the Modify Selection drop-down panel, click Step Mode to turn it on.

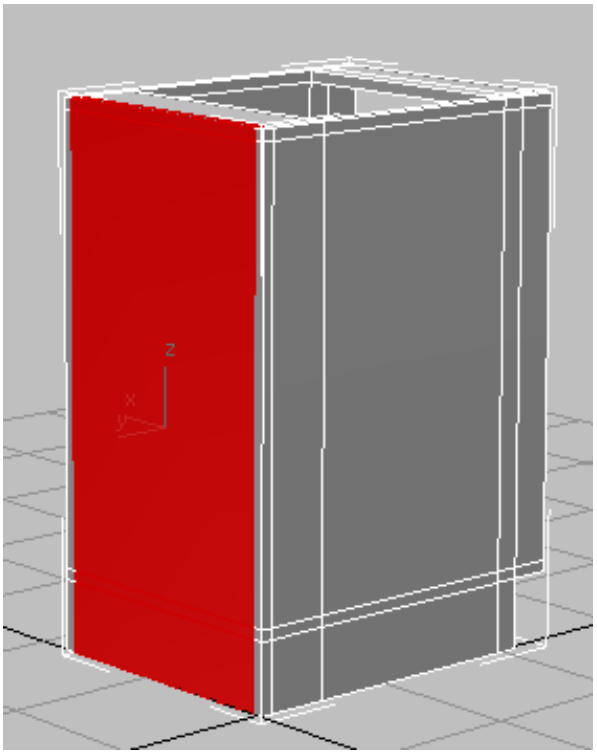


When Step mode is on, selecting two sub-objects (in this case, polygons) also selects the polygons aong the shortest path between the two sub-objects.

8 Click the inside top-left polygon at the back of the cabinet, then Ctrl+click the inside bottom-left polygon.



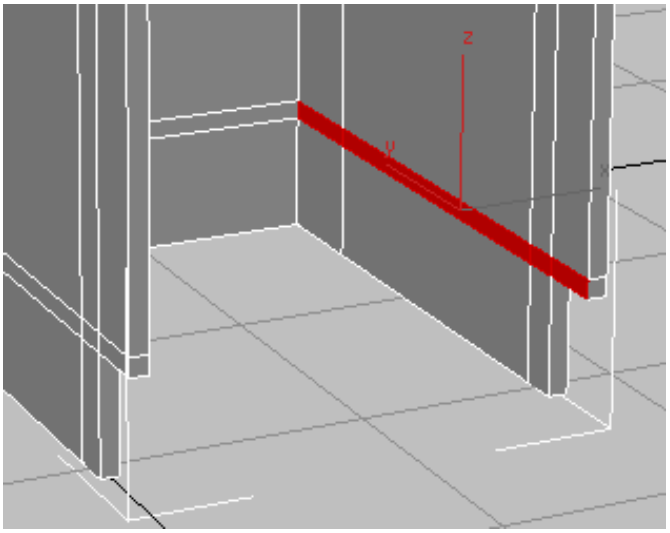
9  Orbit, then Ctrl+click to select the corresponding polygons on the opposite side of the back of the cabinet, and then click Bridge.



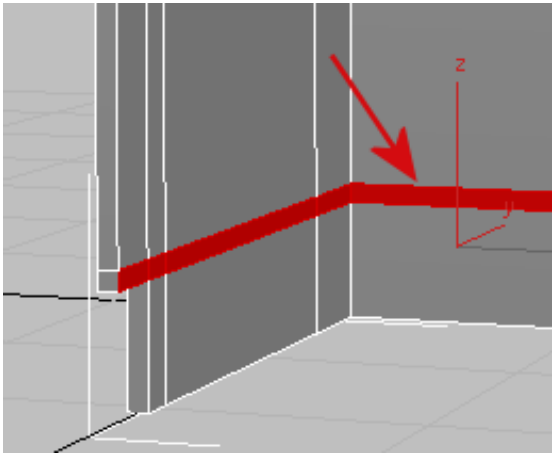
Back panel created from selected polygons

10  Deselect the back cabinet board you just created, then orbit so you can see the front of the cabinet again (or press Shift+Z a number of times to undo your view changes).

11 Ctrl+click to select the inside polygons shown in the next illustration.



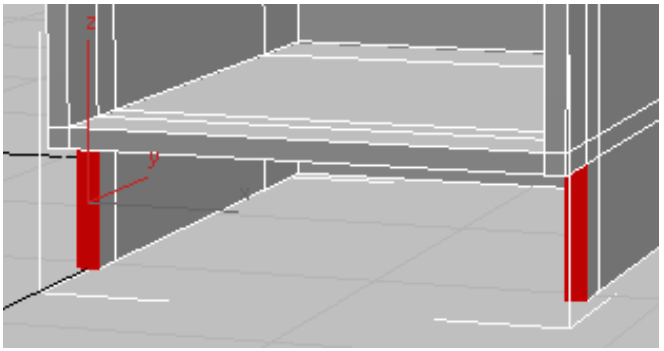
12  Orbit, then Ctrl+click to select the corresponding polygons on the other side of the cabinet. Alt+click the polygon on the back of the to deselect it, and then click Bridge.



13 Click Step Mode again to exit this selection mode.

The only task that remains to complete the cabinet body is the kick plate.

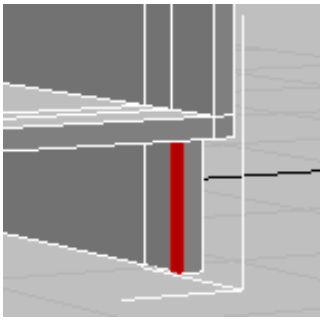
14 Click and Ctrl+click the left and right polygons at the base of the cabinet.



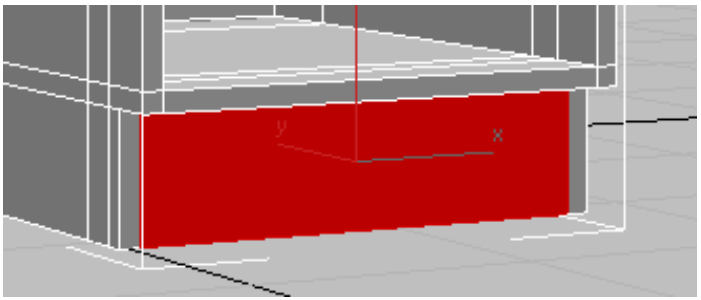
15 On the Ribbon > Polygons panel, Shift+click the Extrude tool.

16 On the Extrude Polygons dialog, set Extrusion Height to **0.75** and click OK.

17 Click on an empty area of the viewport to deselect all polygons, then click and Ctrl+click the inside face of the left and right polygon extrusions you just created.



18 On the Ribbon > Polygons panel, click Bridge.

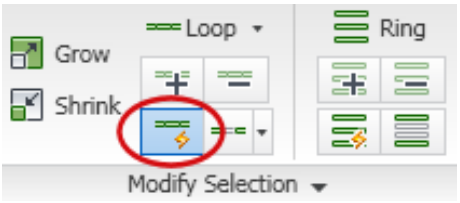


Next, you will remove a number of edges that, while important to this point for polygon creation, are no longer needed.

Remove excess edges:

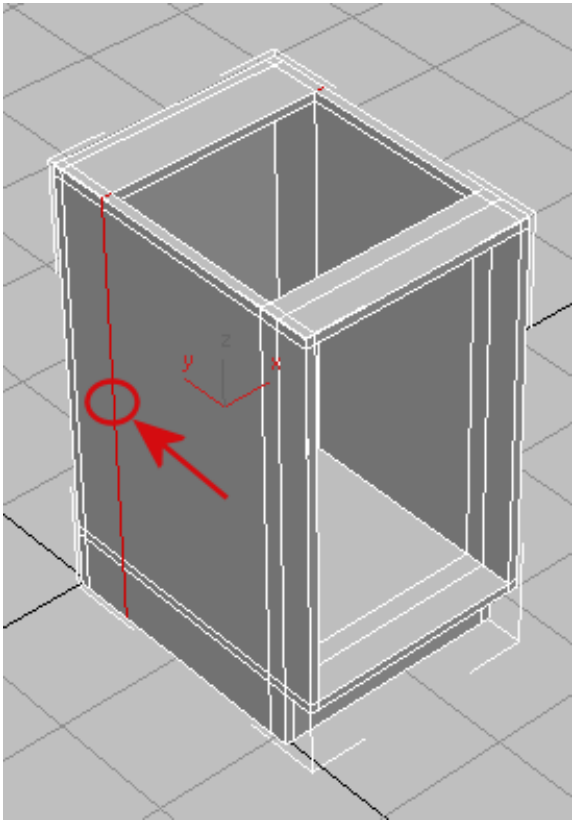
1  On the Ribbon > Polygon Modeling panel, activate Edge selection mode.

2 On the Modify Selection panel, click the Loop Mode tool.



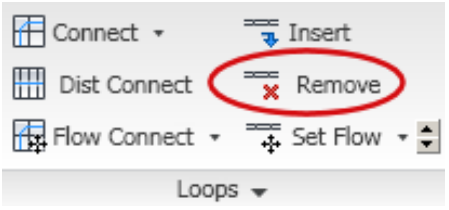
Any edge you now select, will also select all the other edges in the loop it is part of.

3 Select the edge shown in the next illustration.

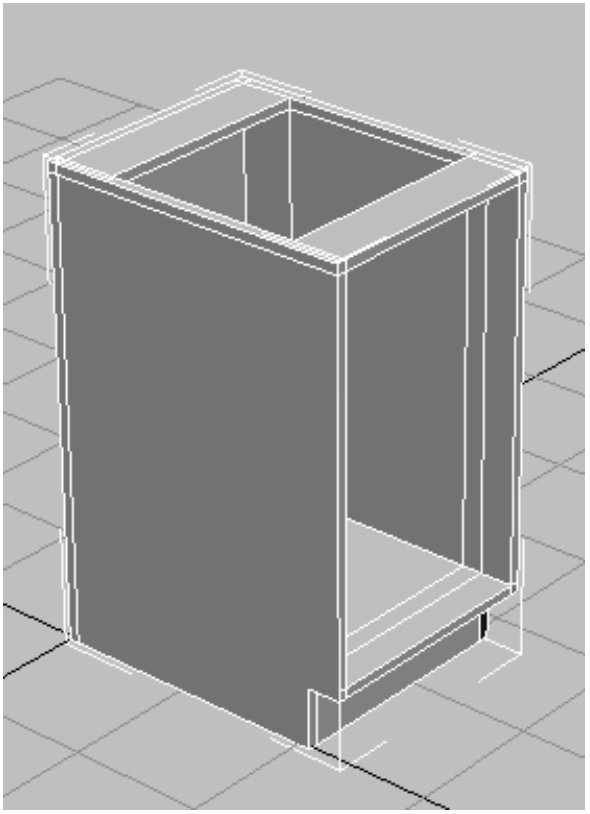


4 On the Ribbon > Loops panel, Ctrl+click Remove.

By Ctrl+clicking, you are removing both the loop, and any vertices created by the loop.

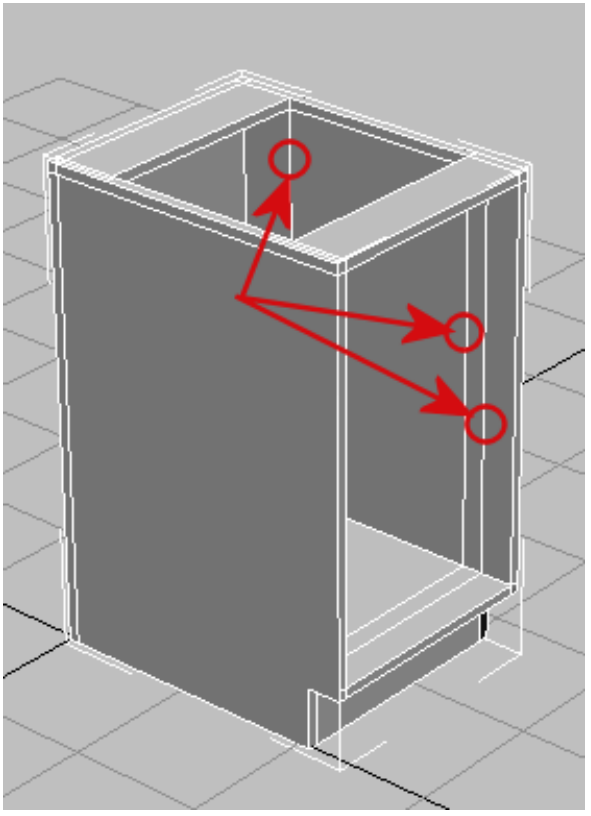


5 Continue to select the edges on the side of the cabinet and Ctrl+click Remove until the only edges visible on the board are those that define the back and top panels, as shown in the next illustration.

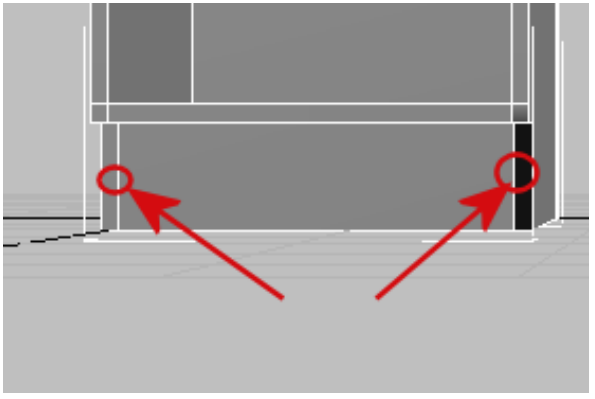


Left side of cabinet with all extra edges removed

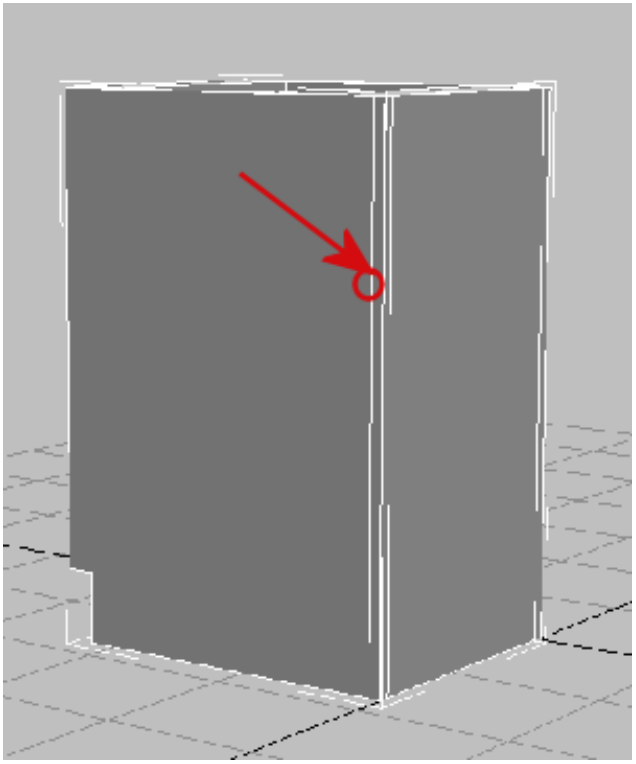
6 Remove the inside edges of the cabinet as you did in the previous step.



7 Ctrl+click the edge on each side of the kick plate and Ctrl+click Remove.



8  Orbit the cabinet to see its opposite side, and remove the loop toward the back of the board.



9  On the Ribbon > Polygon Modeling panel, click Edge to exit this sub-object mode.

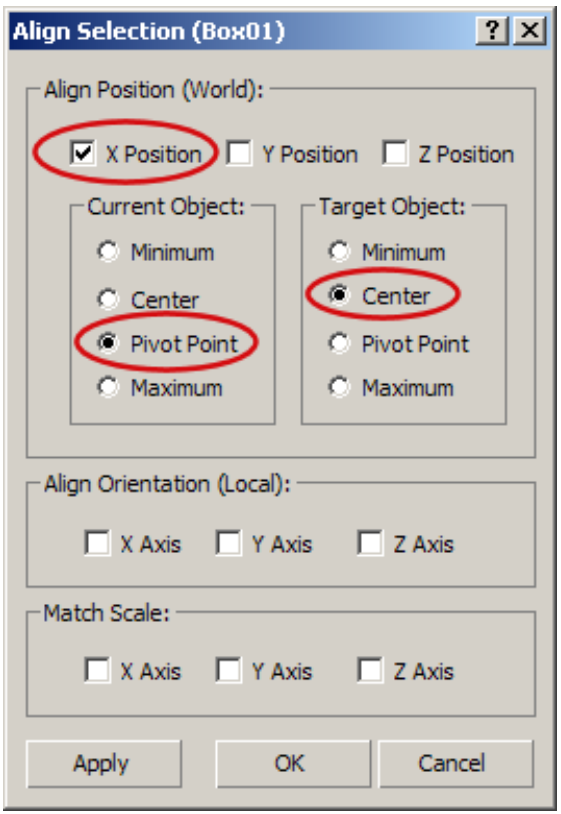
Reposition the pivot point:

Now you will move the pivot point from its current position at the bottom-left corner of the cabinet to the bottom midpoint of its backboard. By doing this, you will make it easier to attach the cabinet to its required position in a scene.

1  Go to the Hierarchy panel, and in the Adjust Pivot rollout > Move/Rotate/Scale group, click Affect Pivot Only to turn it on.

2  On the toolbar, click the Align tool, then in the viewport, click the cabinet.

3 In the Align Selection dialog > Align Position (World) group, make sure X Position is on and Y Position and Z Position are off.



4 In the Current Object group, choose Pivot Point and in the Target Object choose Center, then click Apply.

5 Turn on Y Position and in the Target Object choose Maximum, then click OK.

6 Click Affect Pivot Only again to exit pivot-translation mode.

7  With Move active, in the X transform field, right-click the spinner arrows to move the cabinet back to the world origin coordinates (0,0,0).

Create a shelf:

1  On the Create panel > Object Type rollout, click Box.

2 In the viewport, drag out a box of any size.

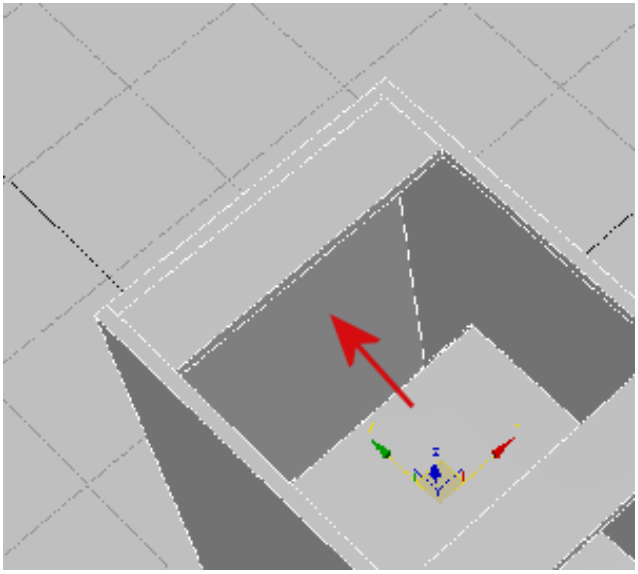
3 In the Parameters rollout, set Length to **12.0**, which will be the depth of the shelf. Set Width to **16 3/8**, and Height to **0.75**, which is the thickness of the cabinet boards.

The Width is based on the full width of the cabinet (18 inches), less the 3/4 inch width of each side board, less another 1/8 inch space to provide room to remove the shelf, if needed.

4  On the main toolbar, click the Align tool, then in the viewport, click the cabinet.

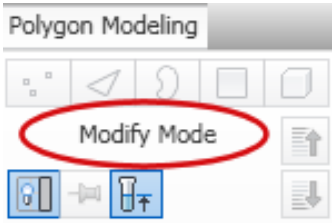
5 In the Align Selection dialog > Align Position (World) group, turn on X Position, Y Position, and Z Position. In the Current Object and Target Object groups, choose Center, then click OK.

6  On the main toolbar, click the Select And Move tool, then translate the shelf on its Y axis until it is touching the backboard.



7 Select the cabinet.

8 On the Ribbon > Polygon Modeling panel, click Modify Mode.



When active, Modify Mode makes the entire array of Graphite Modeling Tools available.

9 On the Geometry panel, click the Attach tool, then in the viewport, click the shelf.

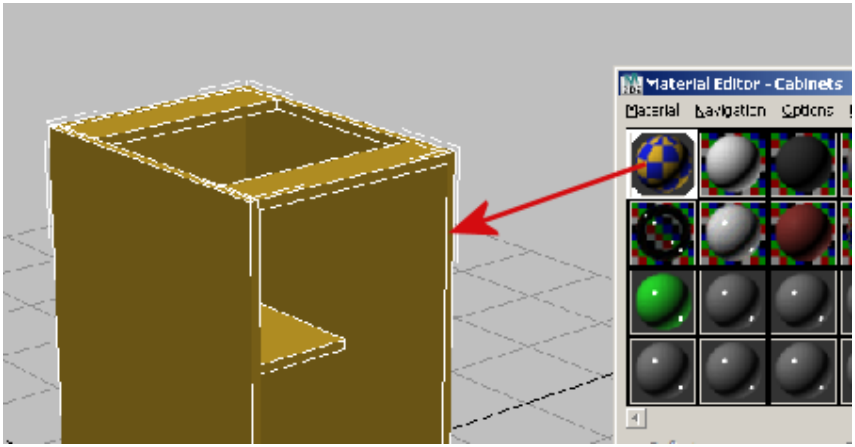
This makes the shelf and the cabinet both part of a single object.

Assign material IDs:

You will now assign material IDs to the cabinet polygons so they can receive different types of materials.

1 Press M to open the Material Editor.

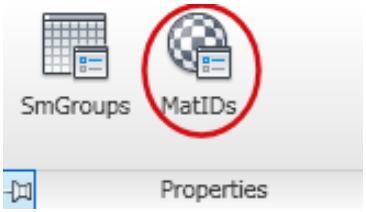
2 Drag the top-left sample slot to the cabinet to apply this material (*Cabinets)* to the cabinet.



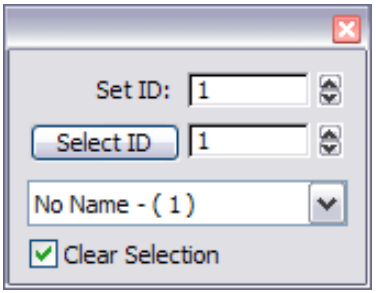
3  On the Ribbon > Polygon Modeling panel, activate Polygon selection mode.

4 Drag a selection box (or press Ctrl+A) to select all the polygons in the cabinet.

5 On the Ribbon > Properties drop-down panel, click the MatIDs tool to turn it on.

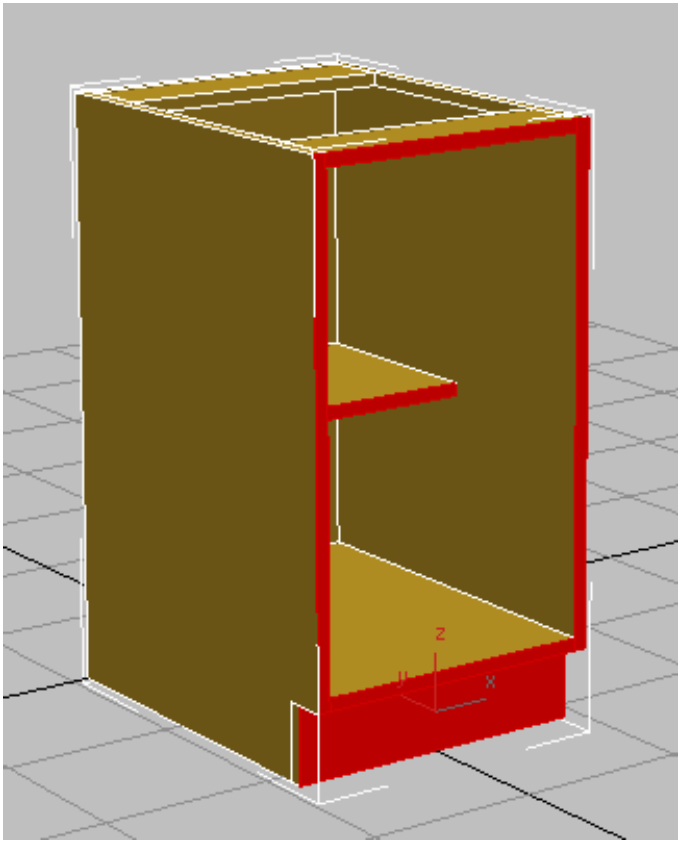


6 On the Set ID dialog, type **1** in the Set ID field.



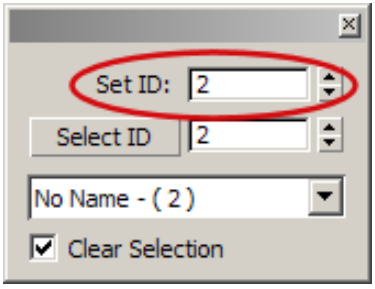
7 Close the Set ID dialog.

8 Click on an empty part of the viewport to deselect all polygons, then click and Ctrl+click to select the polygons that face outward, as shown in the next illustration.



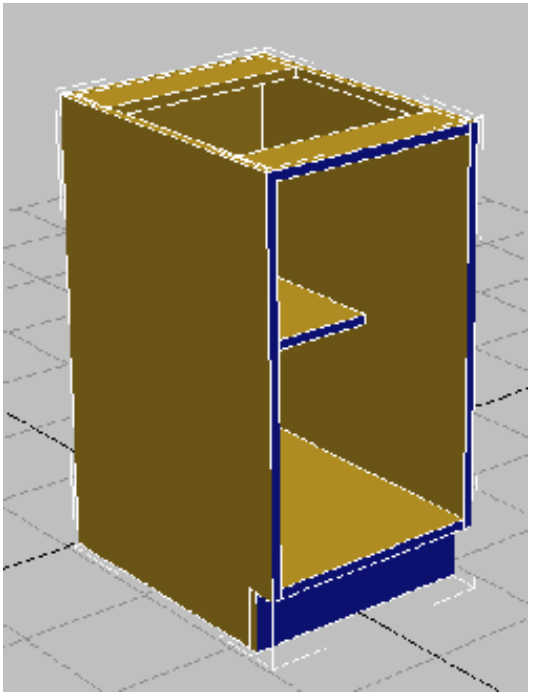
9 On the Ribbon > Properties drop-down panel, click the MatIDs tool to turn it on once more.

10 On the Set ID dialog that displays, type **2** in the Set ID field.



11 Close the Set ID dialog.

12 Click an empty part of the viewport to deselect the polygons.



The front faces of the cabinet change color, indicating they are set to a different material ID number than the rest of the cabinet.

The front faces of the cabinet are now ready to receive a material of their own.

13  On the Ribbon > Polygon Modeling panel, click Polygon again to exit this sub-object selection mode.

Using Basic Polygon Editing to Create an Upper Cabinet

You will now use many of the techniques from the previous lesson to create an upper cabinet.

Create the upper left cabinet board:

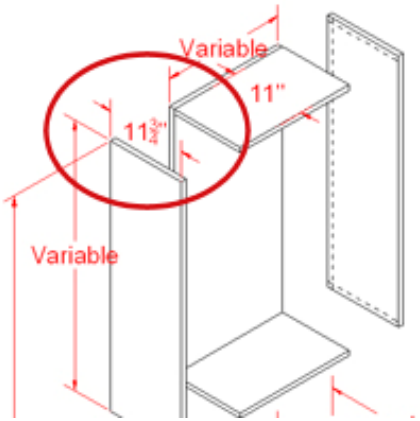
1 Continue working from the previous section, or open the scene file *kitcab_1.max*.

2 In the viewport, select the base cabinet and on the Modify panel, rename the object **LoCab_18**.

3  On the Create panel > Object Type rollout, click Box.

4 In a viewport, drag out a box of any size.

Referring to our diagram, you can see that the length of the board you will specify in the next step should be 11 3/4".



The height for upper cabinets of this design is variable, to account for the presence of appliances, sinks, windows, and so on. In this case, the upper cabinet will be installed on a wall with nothing between it and the base cabinet, so you will give it a height of 39". You will specify this height as a negative value, so you can better position the cabinet as part of the total 93" allowable space.

5  Go to the Modify panel, and on the Parameters rollout, set Length to **11.75**, Width to **0.75**, and Height to **–39.0**.

Keep in mind that as soon as you type in the values, 3ds Max Design converts the decimal portions to multiples of 1/32".

6  On the main toolbar, turn on Select And Move, then set the Z transform value to **93.0**.

The top of the box is now above the base cabinet at the proper height.

7  Click Zoom Extents.

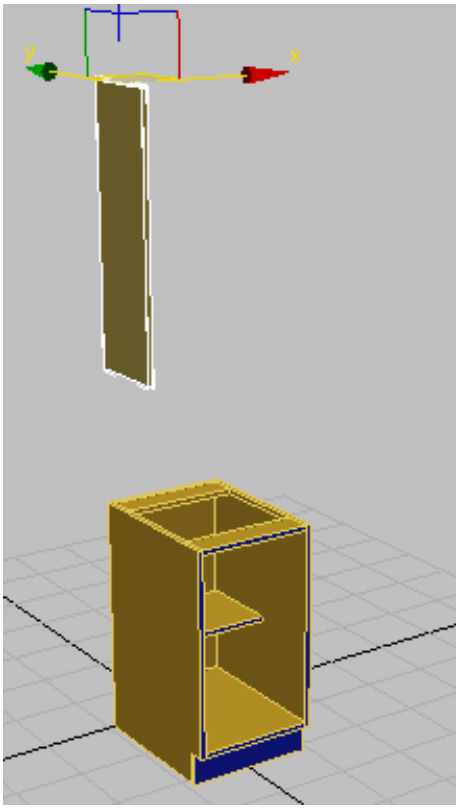
Now you need to align the box with the left side of the lower cabinet.

8  On the main toolbar, click the Align tool, then in the viewport, click the lower cabinet.

9 In the Align Selection dialog > Align Position (World) group, make sure X Position is on and Y Position and Z Position are off.

10 In the Current Object group, choose Minimum and in the Target Object choose Minimum, then click Apply.

11 Turn on Y Position and in the Current Object and Target Object, choose Maximum, then click OK.



Left panel of upper cabinet aligned with left panel of lower cabinet

Add polygon edges:

1 In the viewport, right-click the box and choose Convert To > Convert To Editable Poly.

2  On the Ribbon > Polygon Modeling panel, activate Edge selection mode.

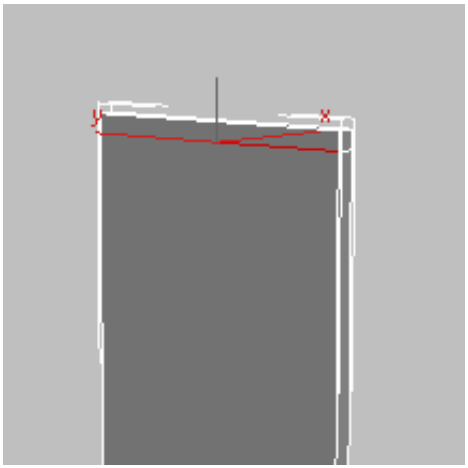
3 

On the Geometry panel, click the Swift Loop tool to turn it on.

A green virtual loop will now display as you position your cursor near an edge, to help you visualize loop placement.

4 In the viewport, click a vertical polygon edge.

A loop is automatically created perpendicular to the selection point.



5  On the main toolbar, turn on Select And Move, then set the Z transform spinner to **92.25**.

6 On the Geometry panel, click the Swift Loop tool again.

7 Click another vertical edge, using the green virtual loop as a guide.

8  On the main toolbar, turn on Select And Move, then set the Z transform spinner to **54.75**.

This value represents the distance from the floor to the top of the board, (93”), less the height of the board itself (39”), plus the width of the board cut line you want to create (–0.75”).

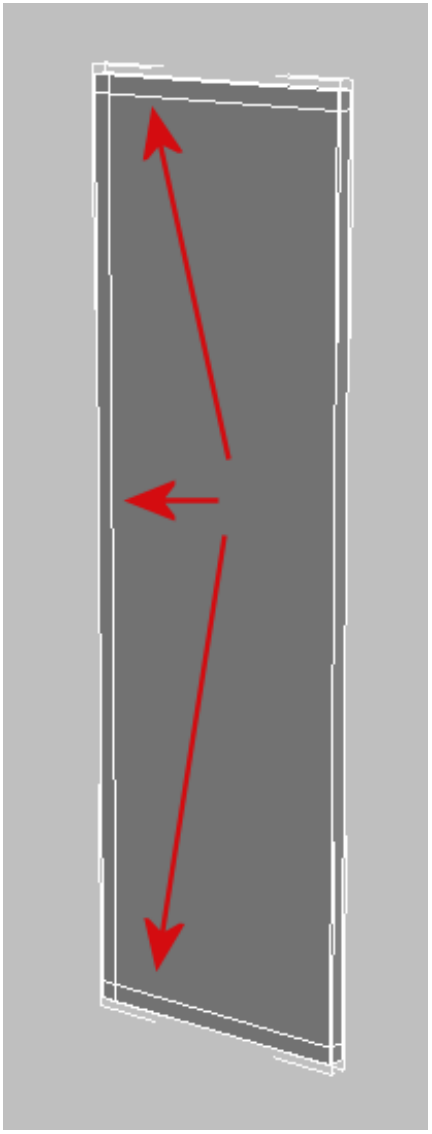
9 On the Geometry panel, click the Swift Loop tool again.

10 Click a horizontal edge.

11  On the main toolbar, turn on Select And Move, then set the Y transform spinner to **–0.75**.

This value represents the cut line for the 0.75 inch back board you will soon create.

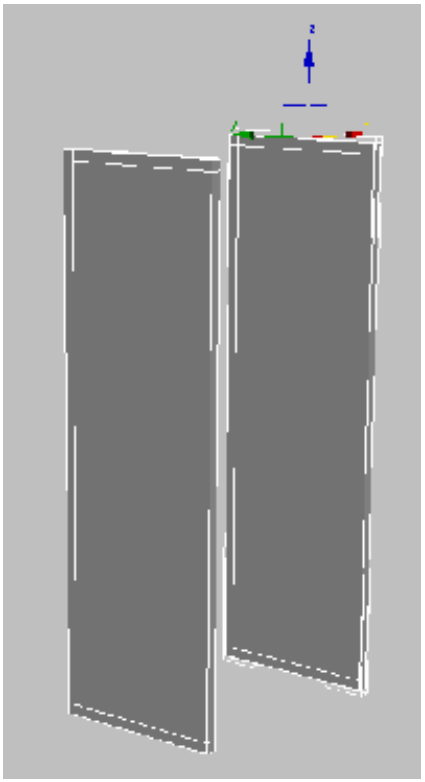
You now have all the divisions required to build upon this cabinet component.



12  On the Ribbon > Polygon Modeling panel, click Edge to exit this sub-object selection mode.

Create a second cabinet board:

1. On the Edit menu, choose Clone. In the Clone Options dialog > Object group, choose Copy, and then click OK.
2.  Drag the cloned board on its X axis slightly to the right.



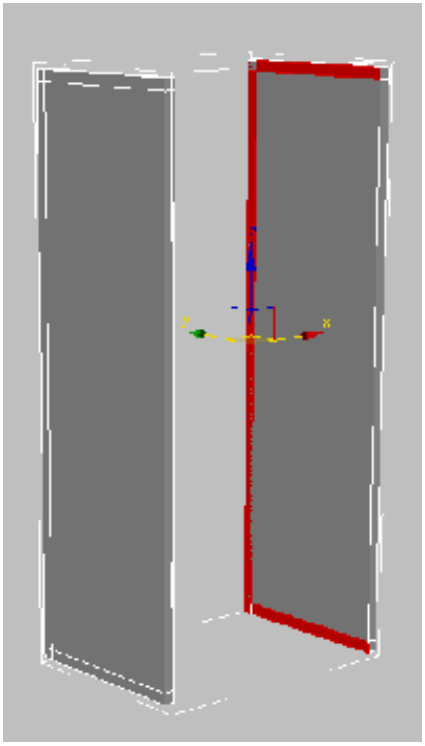
3.  On the main toolbar, click the Align tool.
4. In the viewport, click the lower cabinet and in the Align Selection dialog > Align Position (World) group, make sure X Position is on and Y Position and Z Position are off.
5. In the Current Object group, choose Maximum and in the Target Object choose Maximum, then click OK.

6  Select the upper left-hand cabinet board, and in the Ribbon > Geometry panel, click the Attach tool, then click the cloned board.

Create the top, bottom, and back boards:

1  On the Ribbon > Polygon Modeling panel, activate Polygon selection mode.

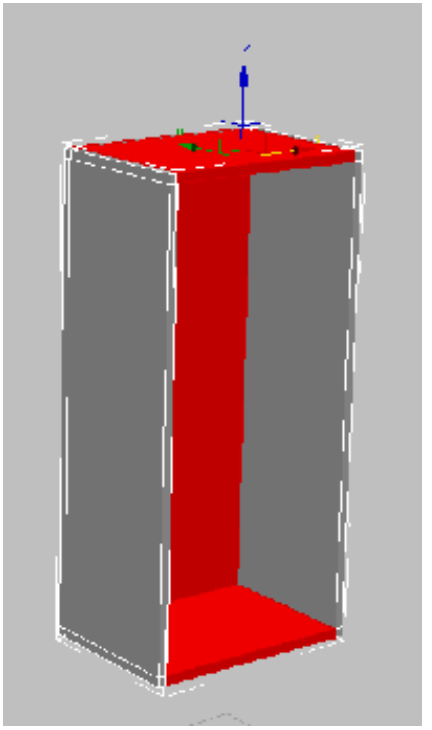
2  Click and Ctrl+click to select the polygons that form the attachment points for the right-hand board.



3  Orbit the view, then Ctrl+click to select the corresponding polygons on the left panel.

4 On the Ribbon > Polygons panel, click the Bridge tool.

The selected polygons connect to one another.

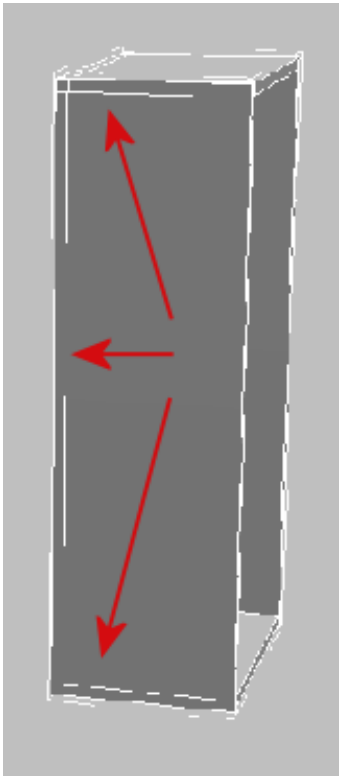


Bottom, top, and back panels created from selected polygons

5  On the Ribbon > Polygon Modeling panel, activate Edge selection mode.

6 On the Modify Selection panel, click the Loop Mode tool.

7 In the viewport, select the loops shown in the next illustration and on the Ribbon > Loops panel, Ctrl+click Remove to remove the loops and their vertices.



Create shelves:

1 Orbit the scene until the front of the cabinet is visible.

2  On the Create panel > Object Type rollout, click Box.

3 In the viewport, drag out a box of any size.

4 In the Parameters rollout, set Width to **16 3/8**.

Like the shelf you created for the base cabinet, this value represents the full width of the cabinet (18 inches), less a 3/4 inch width of each side

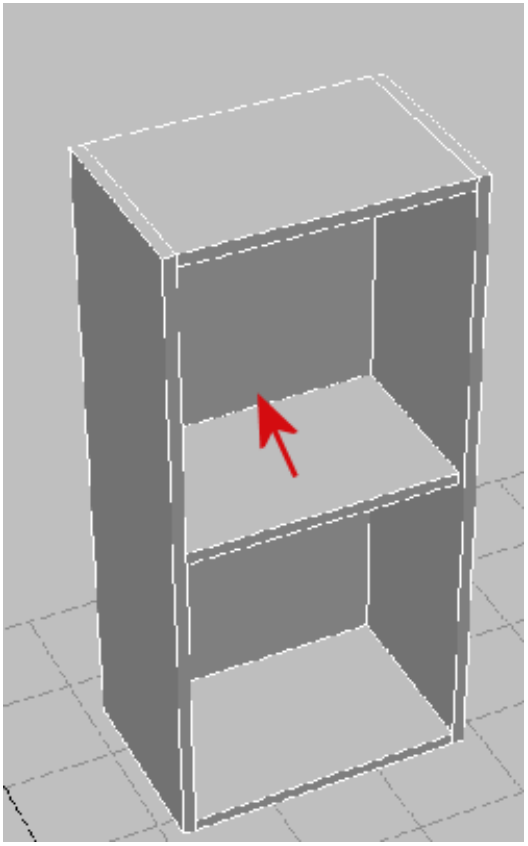
board, less another 1/8 inch space to provide room to remove the shelf, if needed.

5 Set Length to **10.5**, which will be the depth of the shelf, and Height to **0.75**, which is the thickness of the cabinet boards.

6  On the main toolbar, click the Align tool, then in the viewport, click the upper cabinet.

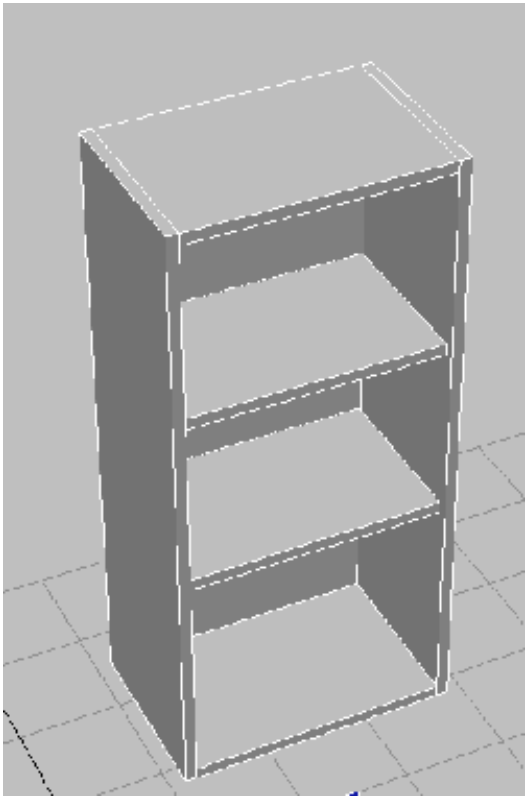
7 In the Align Selection dialog > Align Position (World) group, turn on X Position, Y Position, and Z Position, and in the Current Object and Target Object groups, choose Center, then click OK.

8 Translate the shelf on its Y axis until it touches the backboard.



9 Shift+ drag the shelf on its Z axis upward, and in the Clone Options dialog > Objects group, make sure Copy is on, then click OK.

10 Adjust the height of the two shelves until they are equally spaced apart.



11 Select the cabinet.

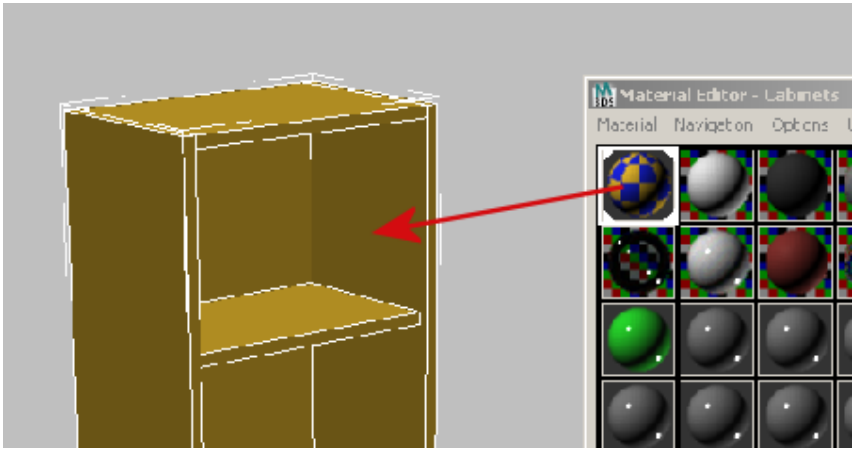
12 On the Ribbon > Polygon Modeling panel, click Modify Mode to turn it on. On the Geometry panel, click the Attach tool, then Ctrl+click the two shelves.

Next, you will assign material IDs to the polygons so they can receive different types of material.

Assign Material IDs:

1 Press M to open the Material Editor.

2 Drag the top-left sample slot to the cabinet to apply its material.



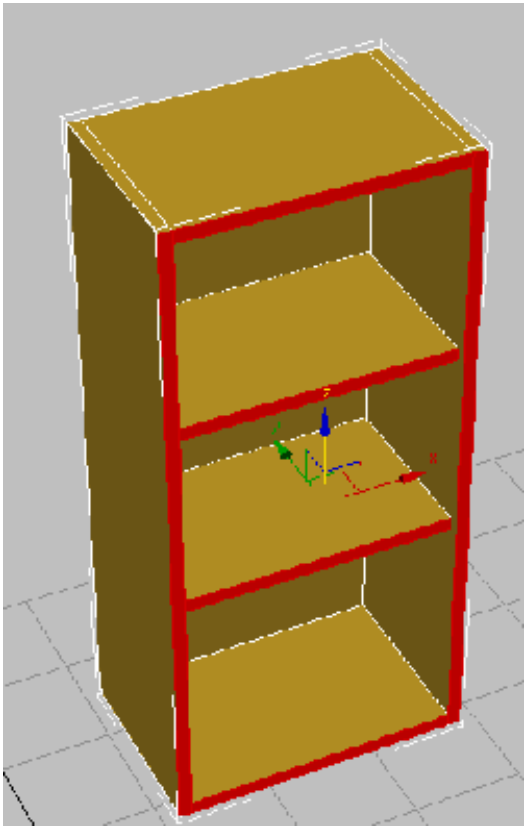
3 On the Ribbon > Polygon Selection panel, activate Polygon selection mode.

4 In the viewport, drag across the entire cabinet so that all its polygons are selected.

5 On the Ribbon > Properties drop-down panel, click the MatIDs tool.

6 On the Set ID dialog, type **1** in the Set ID field.

7 In the viewport, click and Ctrl+click the polygons that face outward, as shown in the next illustration.



8 On the Properties drop-down panel, click MatIDs once more, and on the Set ID dialog, type **2** in the Set ID field.

9 Click an empty part of the viewport to deselect the polygons.

10  On the Ribbon > Polygon Selection panel, click Polygon to exit this sub-object selection mode.

Adjust the pivot:

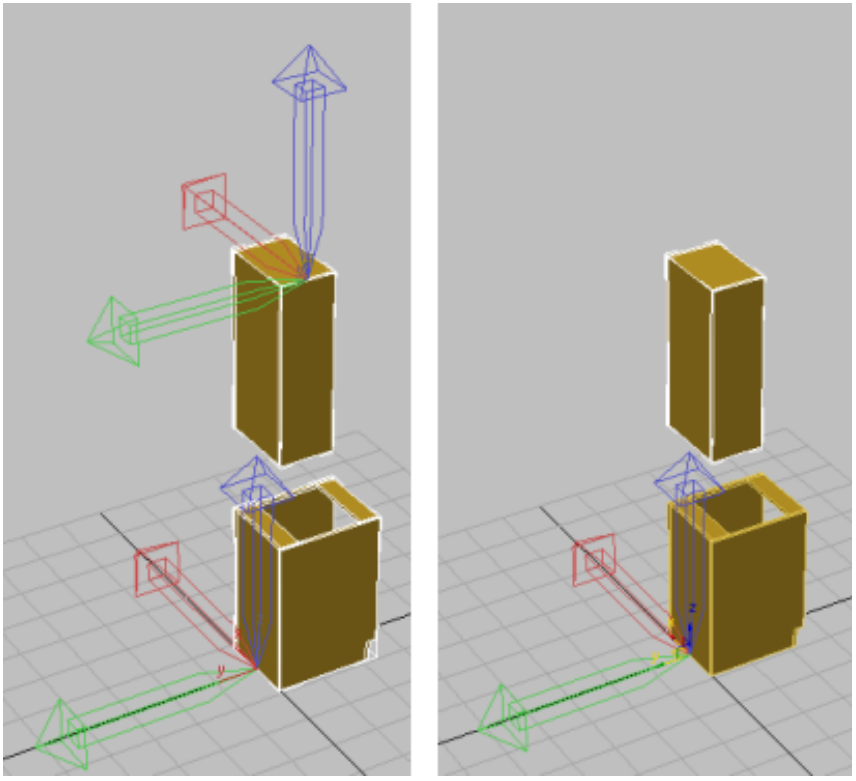
Finally, modify the upper cabinet so that its local coordinates, represented by its pivot point, are the same as those of the lower cabinet. This way, the next

time you want to place the upper cabinet in the scene, it will be positioned at the correct height in relation to the floor and in line with the lower cabinet.

1  Go to the Hierarchy panel, and in the Adjust Pivot rollout > Move/Rotate/Scale group, click to turn on Affect Pivot Only.

2  On the main toolbar, click the Align tool, then select the lower cabinet.

3 In the Align Selection dialog > Align Position (World) group, turn on X Position, Y Position, and Z Position and in the Current Object and Target Object groups, choose Pivot Point, then click OK.



Left: Upper cabinet before pivot alignment Right: Upper cabinet after pivot alignment

4  On the Hierarchy panel > Adjust Pivot rollout > Move/Rotate/Scale group, click to turn off Affect Pivot Only.

5  In the viewport, select the cabinet and on the Modify panel, rename the object **HiCab_18_39**.

6 Close your scene and save your work as **my_kitcab_2.max**.

Using Extrusions and Bevel Profiling to Create Cabinet Doors

If your cabinet doors require flat, uniform surfaces, you can create them using the polygon modelling techniques covered so far in this tutorial. However, if you need to add more detail, you can use extrusions and bevel profiling as this lesson shows.

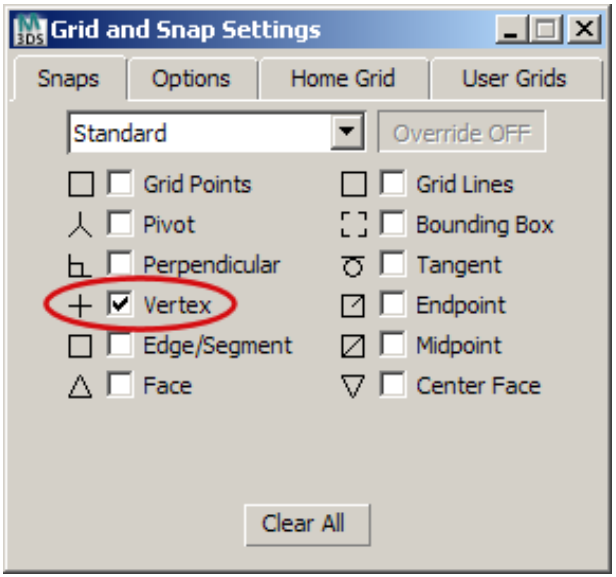
Create a basic door:

1 Open the scene file *kitcab_2.max* or continue working on your scene from the previous lesson.

2 In the viewport, switch to Front view in Wireframe mode.

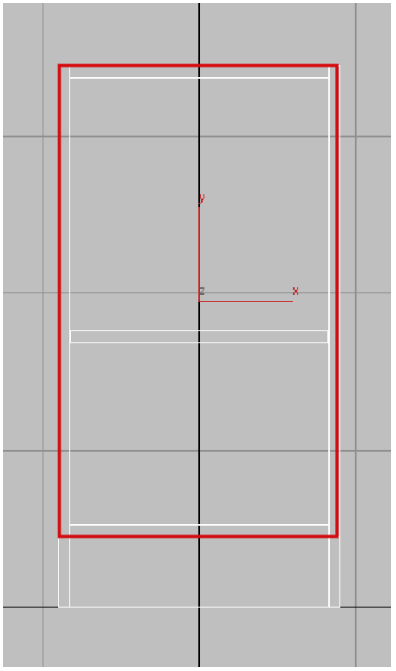
3  Zoom in to the base cabinet and on the main toolbar, click to turn on the 3D Snaps Toggle, then right-click to display the Grid And Snap Settings dialog.

4 Activate the Snaps tab, click Clear All, turn on Vertex, then close the dialog.



5  On the Create panel > Object Type rollout, click Box.

6 In the viewport, drag out a box until it covers the front of the cabinet.



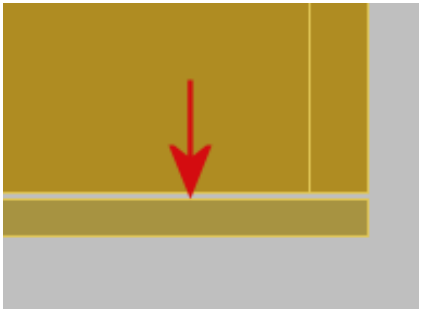
Be sure not to cover the kick plate area as you create the box.

7  Go to the Modify panel, and from the Parameters rollout, set Height to **0.5**.

This is slightly less than the 0.75 inch board thickness we've used elsewhere in the cabinet. The door thickness will be increased later on when you use extrusion to add detail to the door surface.

8  On the main toolbar click the Snaps Toggle again to exit snap mode, then turn on Select And Move.

9 In the viewport, switch to Top view with Smooth and Highlights, and drag the door on its Y axis so that it is slightly separated from the cabinet.



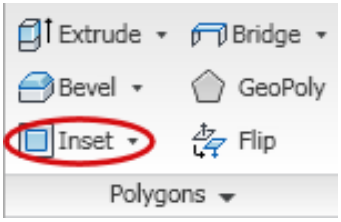
Top view, with door slightly separated from cabinet

Use an extrusion to create a simple inset:

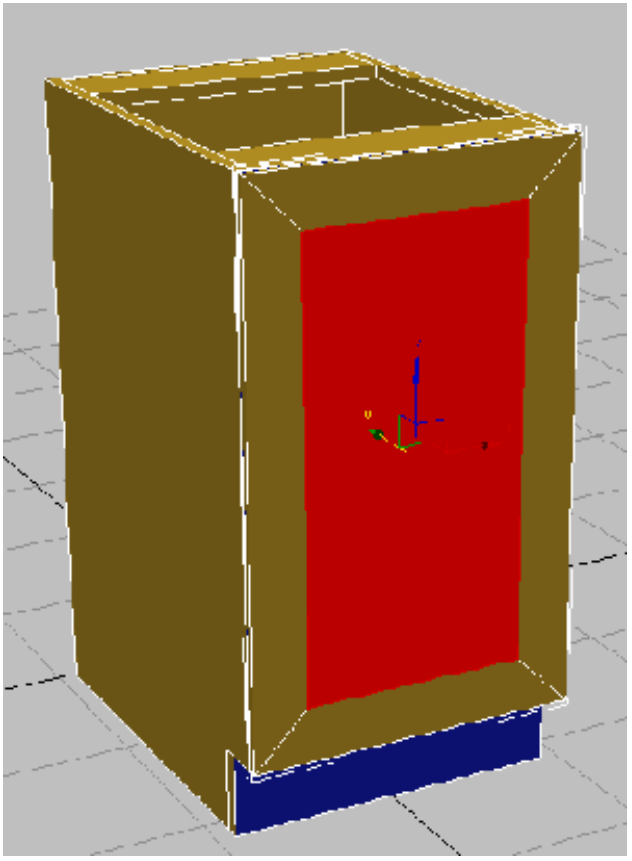
1. Right-click the door and choose Convert To > Convert To Editable Poly.

2.  Use the ViewCube to switch to the Home (Perspective) view, and on the Ribbon > Polygon Modeling panel, activate Polygon selection mode.

3.  In the viewport, select the front face of the door and on the Ribbon > Polygons panel, Shift+click Inset.

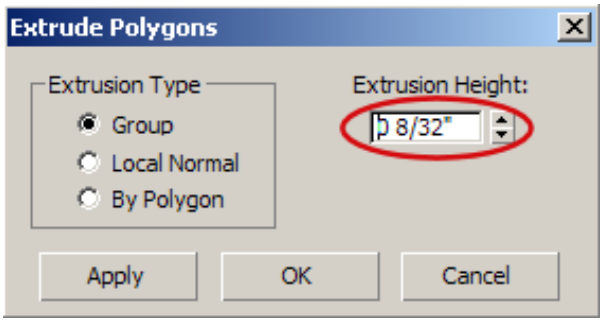


4. On the Inset Polygons dialog, set Inset Amount to **3.0**, then click OK.



This creates a three-inch inset for the selected polygon.

5  Click an empty area of the viewport to deselect all polygons, then click and Ctrl+click the polygons that surround the inset to select them. On the Ribbon > Polygon panel, Shift+click Extrude.



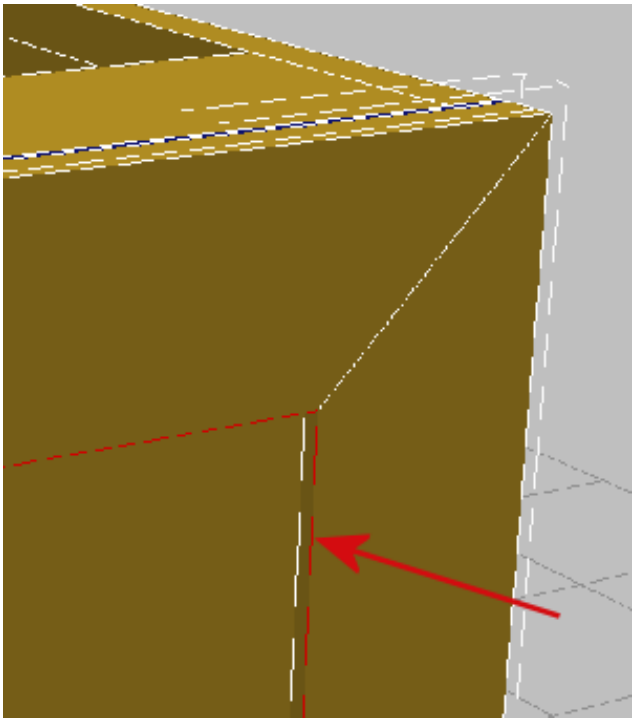
6 On the Extrude Polygons dialog, set Extrusion Height to **0.25**, then click OK.

This creates a simple door with a center panel that is recessed by one quarter inch.

7  On the Ribbon > Polygon Modeling panel, activate Edge selection mode.

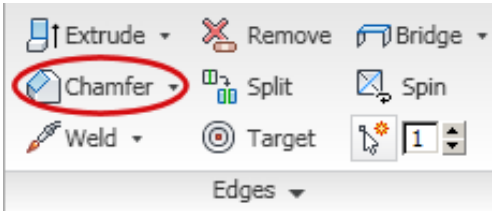
8  On the Modify Selection panel, click the Loop Mode tool.

9 Click a polygon edge as shown in the next illustration.

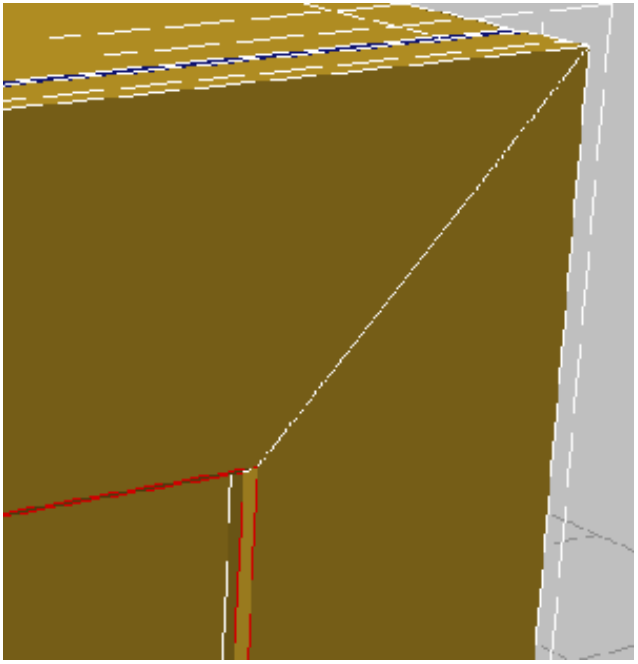


A loop is automatically created around the perimeter of the panel inset.

10 On the Ribbon > Edges panel, Shift+click Chamfer.



11 On the Chamfer Edges dialog, drag the Chamfer Amount spinner down to **0 2/32**, then click OK.



The inside edge of the raised panel now has a slight bevel.

12 Select the outside edge of the door and repeat the previous step to round off the edge of the cabinet door.

A combination of extrusion and chamfering is an effective way to produce a straightforward door. If you prefer to add even more detail, you can do so by means of a beveled profile.

Use bevel profiling to add detail:

In this procedure, you will backtrack and create an entirely new cabinet door using the Bevel Profile modifier and two 2D splines.

1  On the Ribbon > Polygon Modeling panel, click Edge selection to exit sub-object selection mode, then in the viewport, select the cabinet door you created in this lesson and press Delete.

2  Switch to Front view and zoom in on the lower cabinet.

3  On the Create panel > Shapes rollout, click to turn on Rectangle.

4  On the main toolbar, turn on Snaps Toggle.

5 In the viewport, drag out a rectangle so it covers the front of the cabinet, then right-click to end object creation.

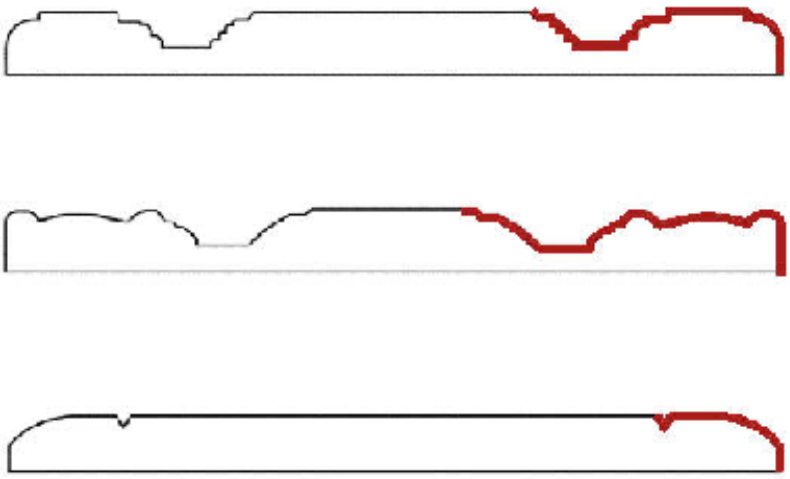
As you draw the rectangle, be sure not to cover the kick plate area.

You will use this rectangle as one of the two splines you'll need to create the bevel profile. This spline will define the bevel area.

6  On the main toolbar, turn off Snaps Toggle, then in the viewport, use the ViewCube to return to the Home (Perspective) view.

7  Go to the Modify panel, and on the Parameters rollout, set Length to **29 7/8** and Width to **17 7/8**.

You now need to add a second spline, one that will define the shape of the bevel itself. You can draw the spline yourself, or use the line tool to trace over images of existing molding profiles, as shown in the next illustration.

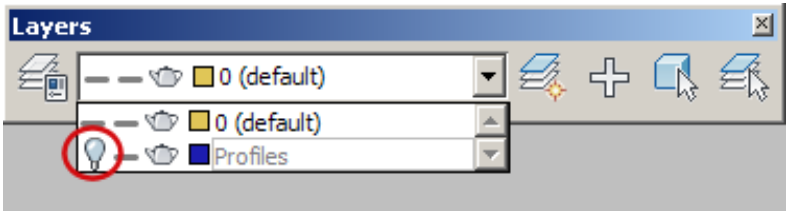


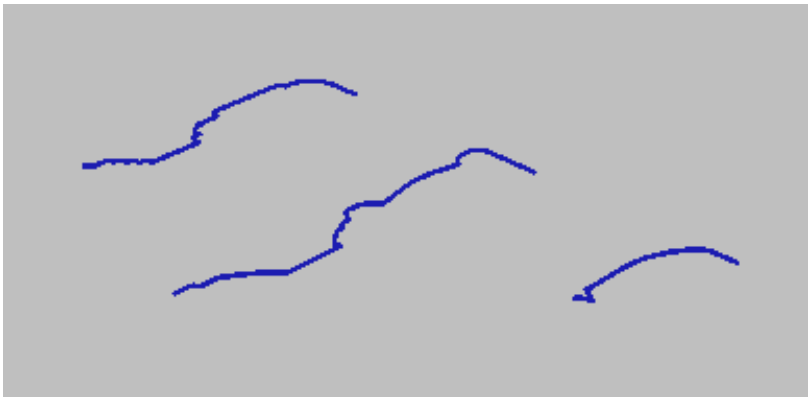
Cross section of sample cabinet door panels, with spline (red) traced over a portion of their profiles

Your *kitcab2.max* scene file already contains three splines, ready for you to use.

8 Right-click an empty area of the main toolbar and choose Layers.

9 On the Layers toolbar, click the Layers list, and from the Profiles option, click the light bulb icon to unhide the profile splines.



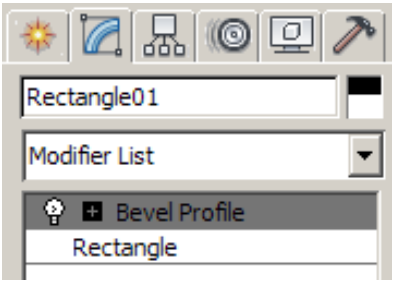


The three splines appear, at floor level off to the right of the cabinets.

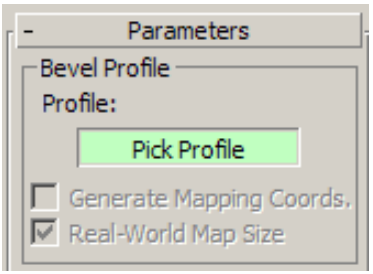
10  If you need to, zoom out until the profile splines are visible.

11 Close the Layers toolbar.

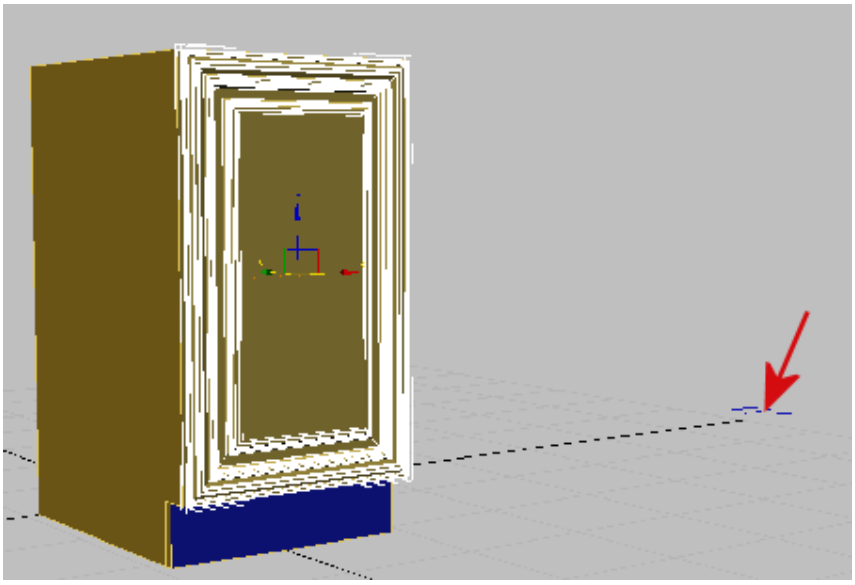
12  In the viewport, make sure the rectangle you created earlier is still selected, and from the Modify panel > Modifier List, choose Bevel Profile.



13 On the parameters rollout, click Pick Profile.



14 Click a profile spline and view the result on the cabinet door.



Cabinet (left) with spline profiles (right)

15 Continue to click Pick Profile and select different splines to see their effect on the door. Stop at Profile B.

Create a bevelled door for the upper cabinet:

1  Switch to Front view and zoom in on the upper cabinet.

2  On the Create panel > Shapes rollout, click Rectangle.

3  On the main toolbar, turn on the 3D Snaps Toggle.

4 In the viewport, drag out a rectangle so it covers the front of the upper cabinet.

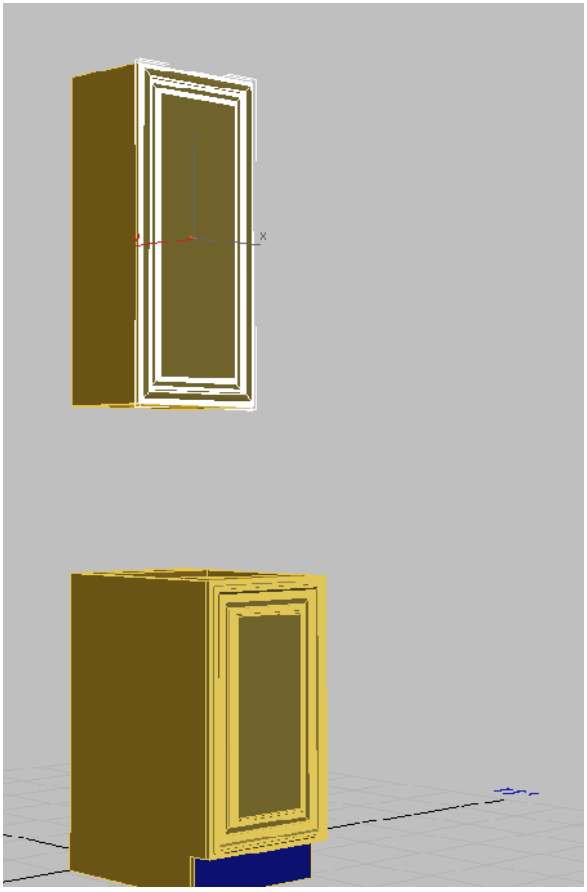
5  On the main toolbar, turn off the 3D Snaps Toggle

6  In the viewport, use the ViewCube to return to the Home (Perspective) view, then pan down so you can see all of the upper cabinet.

7  Go to the Modify panel. On the Parameters rollout, set Length to **38 7/8** and Width to **17 7/8**.

8 From the Modifier List, choose Bevel Profile.

9 On the parameters rollout, turn Pick Profile, and in the viewport, click Profile B.

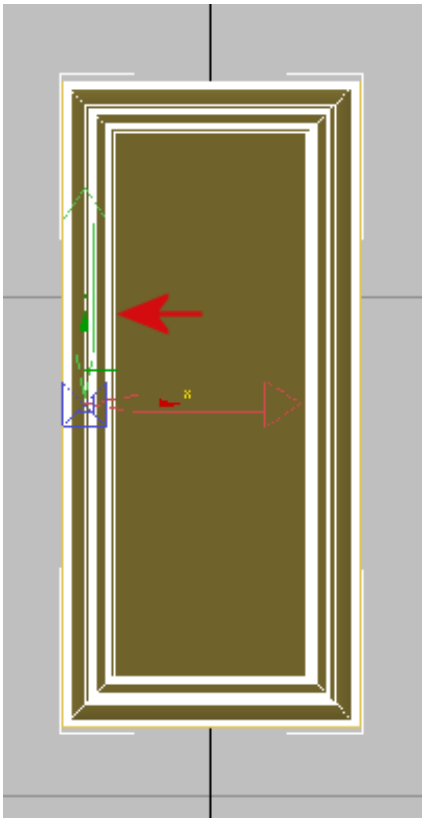


Cabinets with spline profile B applied to their doors

Next, you will adjust the pivot points so you will be able to open the doors properly.

Adjust door pivot point and check material ID settings:

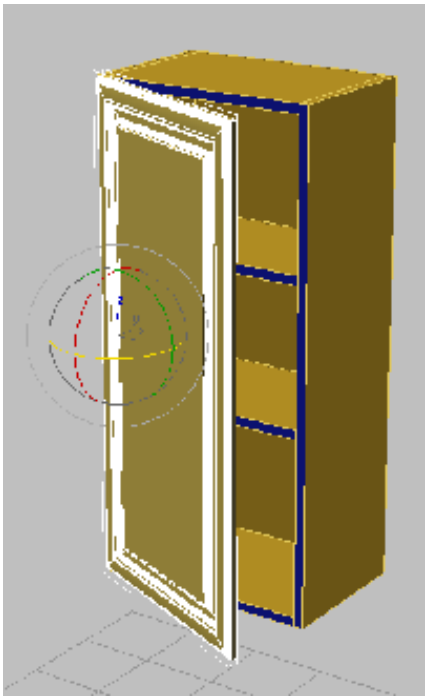
1.  Switch to Front view, go to the Hierarchy panel, and in the Adjust Pivot rollout > Move/Rotate/Scale group, turn on Affect Pivot Only.
2. Right-click the upper cabinet door and choose Transform > Move.
3. Drag the pivot on its X axis to the far left side of the door.



Pivot repositioned to the left side of the cabinet door

4 Click Affect Pivot Only again to turn it off, and on the main toolbar, right-click the upper cabinet door again and choose Transform > Rotate.

5 In Perspective view, rotate the door on its Y axis to see the result.



6 Repeat steps 1 to 5 for the lower cabinet door.

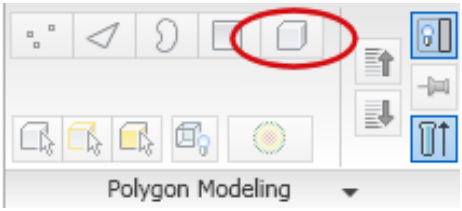
To this point, you have adjusted the pivots so the doors appear to move on hinges. Next, you'll modify the cabinets for situations when you don't need to open the doors.

Make the doors fixed:

1 Right-click the lower cabinet door, then choose Convert To > Convert To Editable Poly.

2 In the viewport, select the lower cabinet and on the Ribbon > Geometry panel, click Attach.

3 On the Ribbon > Polygon Modeling panel, click Element selection mode and select the door.



This selects any polygons that might be detached from any other part of the model.

4  Turn off Element selection.

5 Repeat steps 1 to 4 for the upper cabinet.

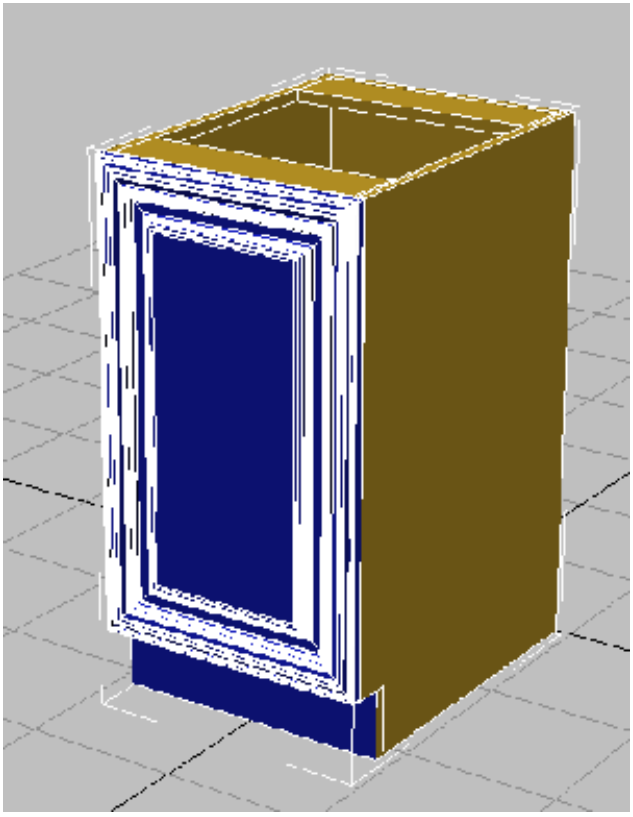
Set the material properties for the doors:

1  Turn on Polygon selection.

2 Region-select all the polygons in the lower door.

(If the region chooses faces not part of the door, use Alt+click to remove those faces from the selection.)

3 On the Properties drop-down panel, click the MatIDs tool, and on the Set ID dialog, change the Set ID field to **2**, the number reserved for a wood texture you will later apply. Press Enter.



4 Repeat steps 1 to 3 for the upper cabinet.

   In the lessons that follow, you will learn how to produce other kitchen cabinets based on these two cabinets, the upper and the lower. The variant cabinets will have different dimensions or symmetry.

Save your work:

- Save your scene as **my_kitcab_3.max**.

Creating Cabinets of Various Sizes

In this lesson, you will use a combination of cloning and vertex editing techniques to quickly create more cabinets of various heights and widths.

Create a 24 inch-wide lower cabinet:

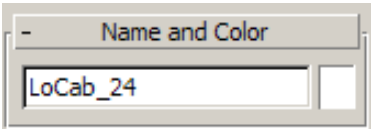
1. Continue working on your scene from the previous tutorial, or open the scene file *kitcab_3.max*.

2.  On the main menu, turn on Select And Move.

3. In Perspective view, select the lower cabinet and Shift+drag the object on its X axis to the left.

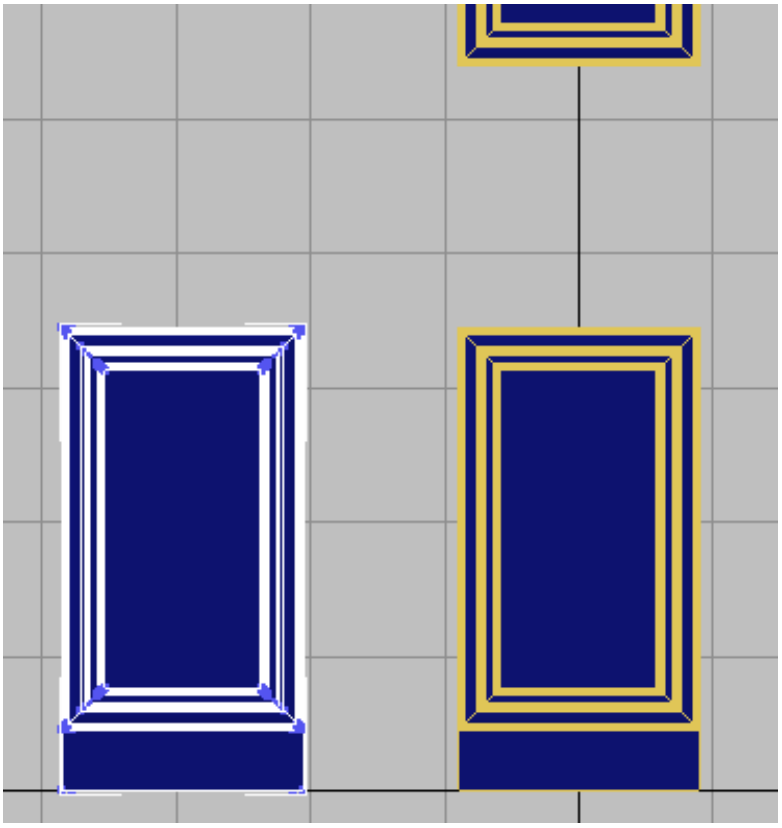
4. In the Clone Options dialog > Object group, make sure Copy is turned on.

5. In the Name field, type **LoCab_24** and click OK.

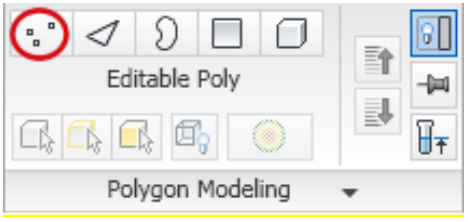


You are specifying the value 24, because the cabinet you are about to create will be 24 inches wide.

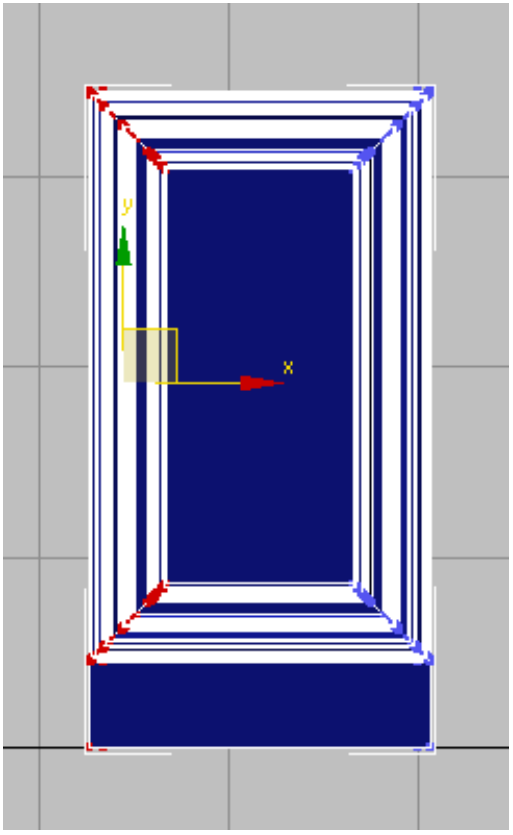
6.  In the viewport, switch to Front view, then zoom in on the lower cabinets.



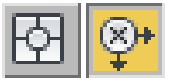
7 On the Ribbon > Polygon Modeling panel, activate Vertex selection mode.



8  Region-select the left side of the new cabinet until all its vertices are selected.



9  On the main menu, turn on Select And Move.

10  On the status bar, switch from Absolute transform mode to Offset transform mode. In the X transform field, enter **–3.0**.

11 Region-select the right side of the cabinet so that all its vertices are selected and in the X transform field, enter **3.0**.

You are enlarging the cabinet equally on either side to ensure the cabinet's pivot point remains in the center of the object.

Create double doors for the new cabinet:

Cabinets that are 24 inches wide generally have double doors rather than a single one.

1.  On the Ribbon > Polygon Modeling panel, activate Element selection mode. In the viewport, select the cabinet door.

2.  Ctrl+click the Polygon Modeling panel > Vertex selection mode to activate vertex selection.

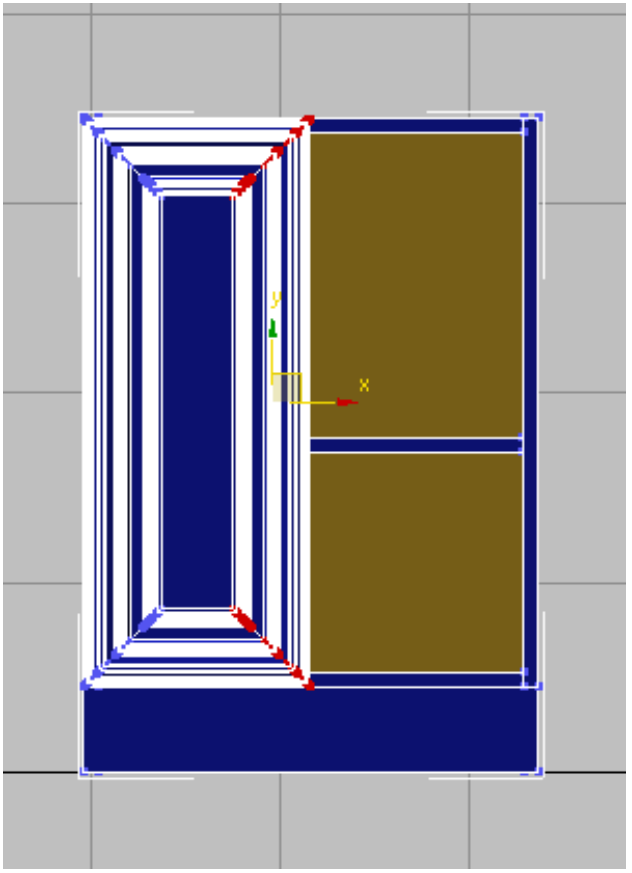
   Holding down Ctrl while you click this button selects all the vertices that were in the previous Element selection.

3. Alt+region-drag around all the vertices on the left side of the door, to remove them from the selection.

4.  On the main menu, turn on Select and Move.

5. Set the X transform field to **–12.0**.

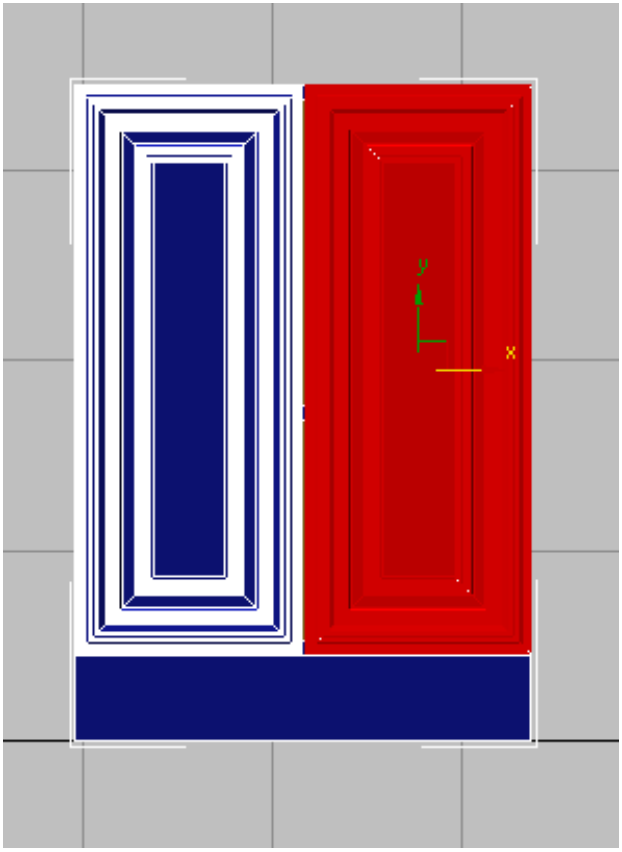
   By moving the remaining selected vertices to the left by 12 inches, you just created a 12 inch door.



6  On the Ribbon > Polygon Modeling panel, turn on Element selection mode.

7 Shift+drag the door to the right until it is in position over the opposite side of the cabinet.

8 On the Clone Part Of Mesh dialog, check that Clone To Element is on, then click OK.



9  Make final adjustments to the door position, as required, then click Element again to exit sub-object selection.

Create a 21 inch-high upper cabinet:

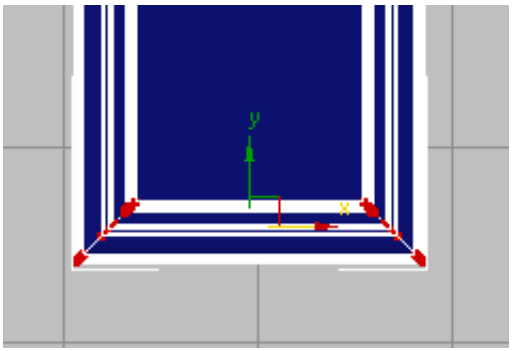
1 Select the upper cabinet and Shift+drag the object on its X axis to the right.

2 In the Clone Options dialog > Object group, turn on Copy, and in the Name field, type **HiCab_18_21**, then click OK.

You are specifying the value 21, because the cabinet you are about to create will be 21 inches high.

3  On the Ribbon > Polygon Modeling panel, activate Vertex selection mode.

4 In the viewport, region-select the bottom of the cabinet so that all its vertices are selected.



5 Set the Y transform box to **18.0**.

This value represents the full height of the 39 inch upper cabinet, less 18 inches, to give you a 21-inch high cabinet.

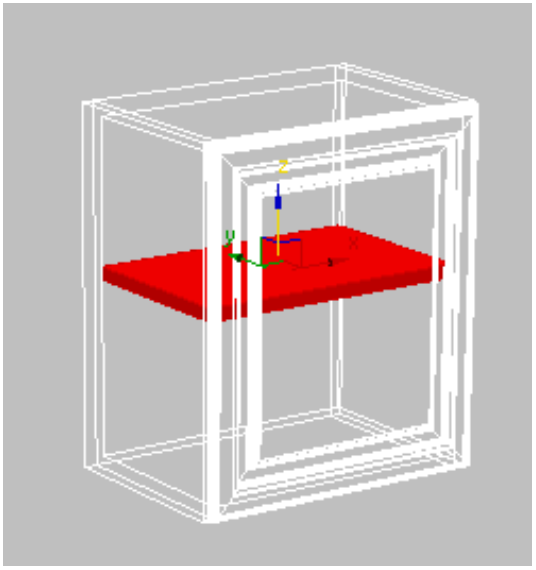
Now that you have resized the cabinet, you will discover that its lower shelf is now exposed.

6  On the Ribbon > Polygon panel, activate Element selection mode.

7  In the viewport, select the exposed shelf, then press Delete.

8  In the Perspective viewport, switch to Wireframe mode. Region-select the remaining shelf, then move it upward on its Z axis.

(It is hard to select the shelf by clicking the cabinet.)



9  On the Ribbon > Polygon panel, click Element to exit sub-object selection mode.

10 Switch to Smooth+Highlights display mode, then save your scene as **my_kitcab_4.max**.

Using Symmetry To Create a Corner Cabinet

In this lesson, you will use the Symmetry modifier to create a corner cabinet.

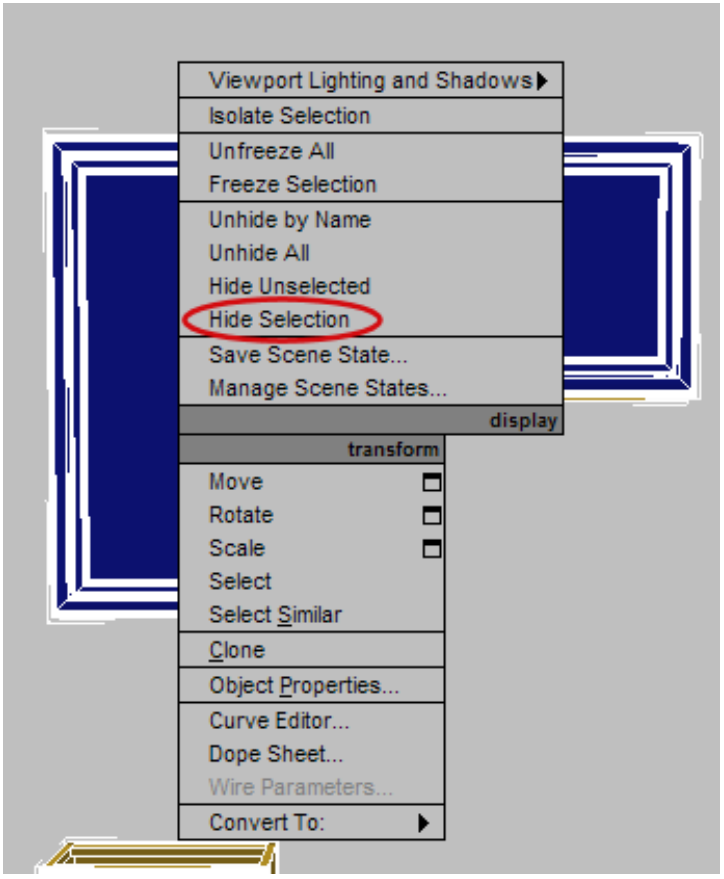
Create a corner cabinet:

1 Continue working on your scene from the previous tutorial, or open the scene file *kitcab_4.max*.

2 In the viewport, make sure you are in Perspective view.

3  Region-select all the cabinets in the scene, except for the 24 inch cabinet with the double doors.

4 Right-click and choose Display > Hide Selection, so only the 24 inch cabinet is visible.

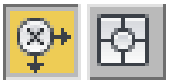


5  Select the cabinet and Shift+drag the object on its X axis to the right.

6 In the Clone Options dialog > Object group, turn on Copy and in the Name field, type **LoCab_Corner**, then click OK.

7  Select, then hide the first 24 inch cabinet as you hid the others in step 4.

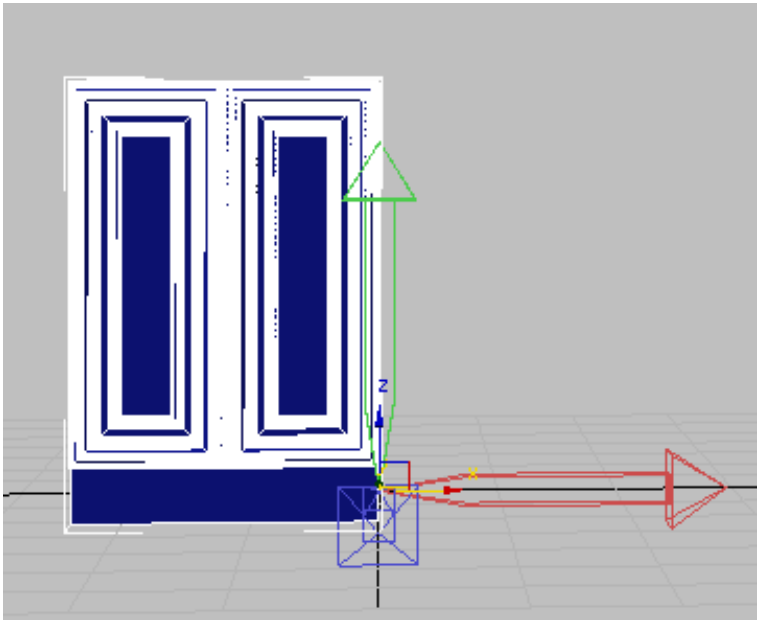
8  Select the cloned cabinet.

9  On the status bar, switch from Offset transform mode to Absolute transform mode. Right-click the X, Y, and Z transform spinner arrows to set them each of these fields to **0**.

10  Go to the Hierarchy panel and in the Adjust Pivot rollout > Move/Rotate/Scale group, click Affect Object Only.

This lets you move the object but not its pivot. In the next step, you will move the object so that its pivot point is at the cabinet's back right corner.

11 In the X transform field, type **–12.0**, then turn off Affect Object Only.



12  On the Ribbon > Polygon Modeling panel, click Modify Mode, then activate Element selection mode.

13 In the viewport, select the right-hand cabinet door, then press Delete.

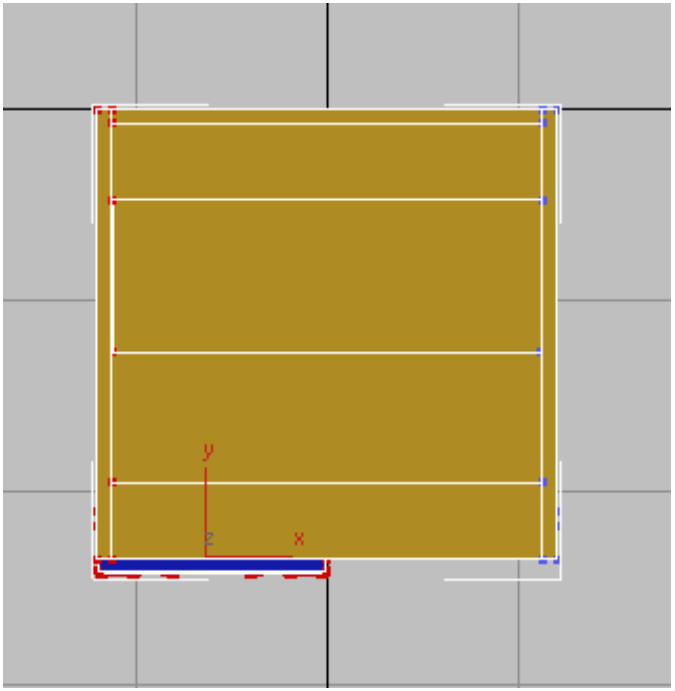
A corner cabinet is typically 36 inches wide, so next you will expand the width of the cabinet.

Widen the cabinet and add the Symmetry modifier:

1  In the viewport, switch to Top view, then zoom in on the cabinet.

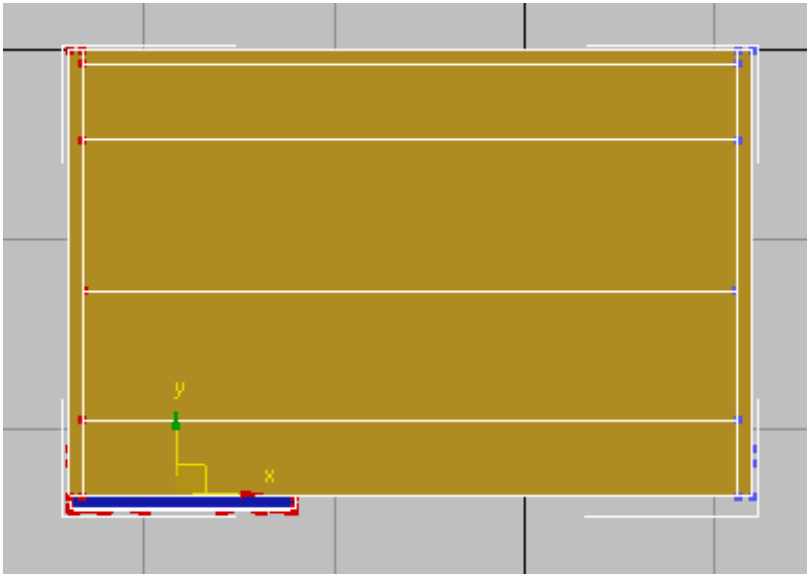
2  On the Ribbon > Polygon Modeling panel, activate Vertex selection mode.

3 Region-select all the vertices on the left side of the cabinet, including the entire door.



Top view of cabinet with all left vertices selected

4  On the main menu, turn on Select And Move. On the status bar, switch to Offset transformation mode, and set the X transform field to **–12.0**.

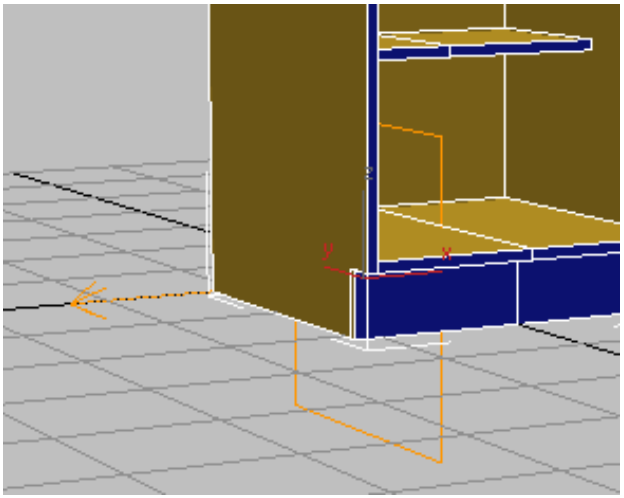


Top view of cabinet after resizing

5  On the Ribbon > Polygon Modeling panel, click Vertex again to exit sub-object selection.

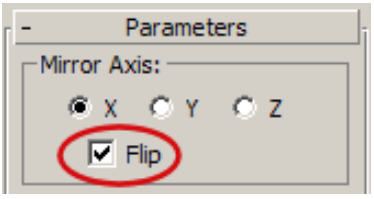
6 Use the ViewCube to return to the Home (Perspective) view.

7  Go to the Modify panel. On the Modifier List, choose Symmetry. The modifier gizmo displays in the viewport, oriented in the direction of the cabinet's pivot point.

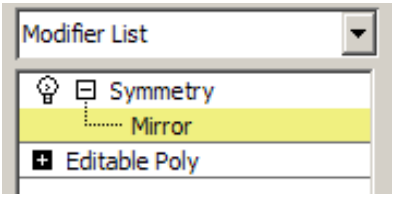


Cabinet with Symmetry gizmo displayed

8 In the Parameters rollout > Mirror Axis group, turn on Flip to see how the Symmetry modifier works.

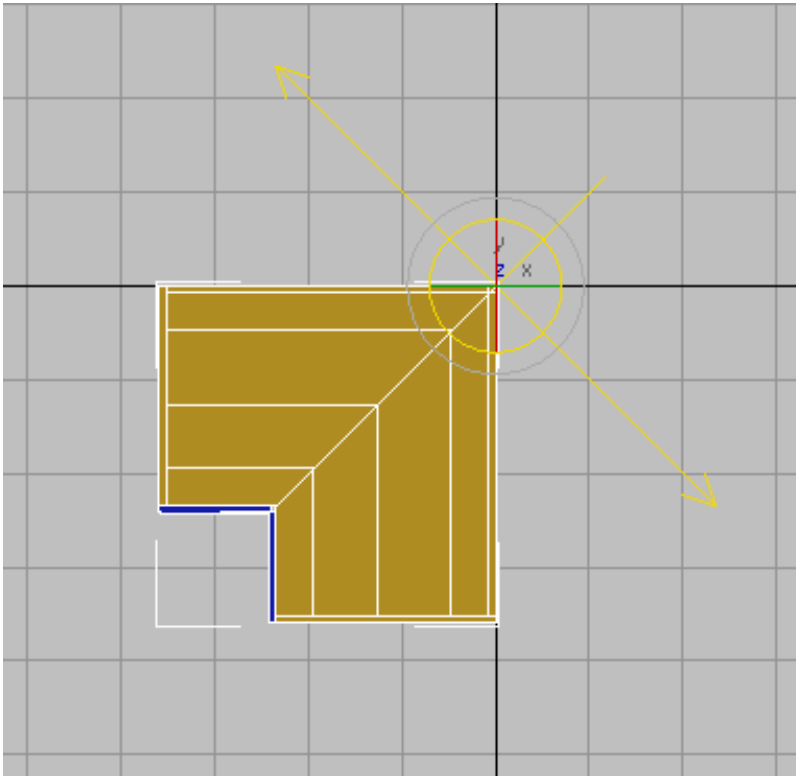


9 Expand the Symmetry modifier in the Modifier stack and highlight Mirror.



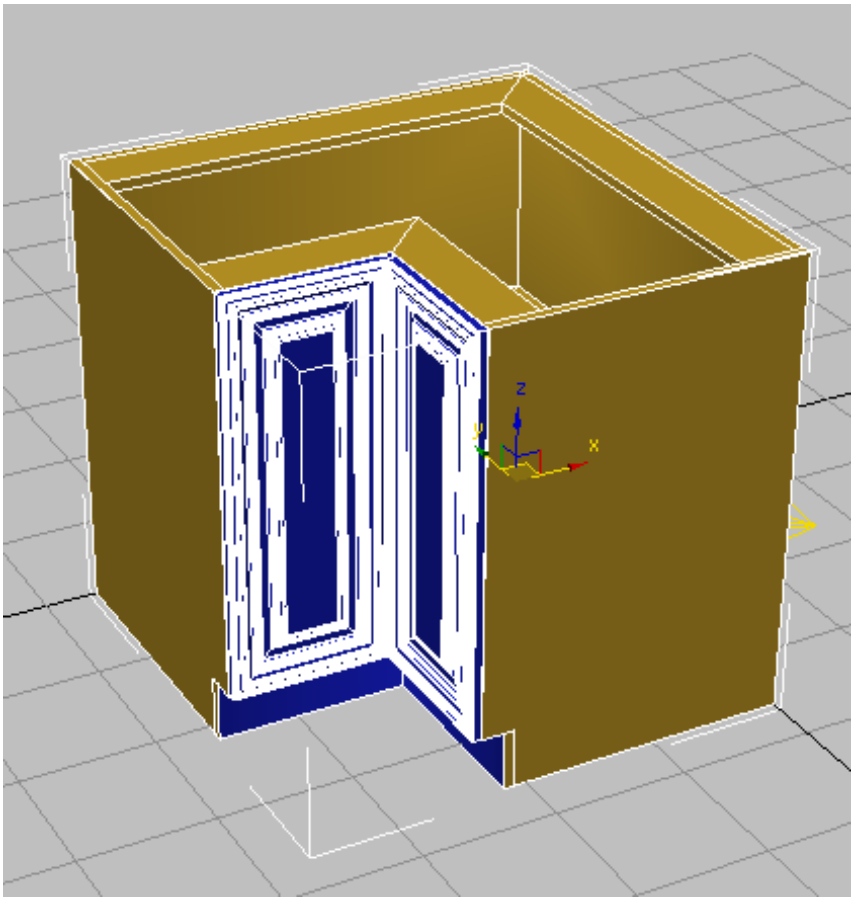
10  On the main toolbar, turn on Angle Snap, then turn on Rotate.

11  Rotate the mirrored portion of the cabinet in its Z axis, and stop when you reach –45 degrees.



Top view of cabinet after 45 degree rotation

12 Switch to Perspective view to see the result.



Save your work:

- Save your scene as **my_kitcab_5.max**.
  To see how cabinets modeled using the Ribbon can look in a completed scene. Open the scene file *kitchen_sample.max*.

Kitchen cabinets in a completed scene, with shading

Summary

Throughout this tutorial, you used a number of modeling tools in the Graphite Modeling Tools Ribbon to create a set of kitchen cabinets. While these tools are also available from the Command panel, the Ribbon gives you faster access, in context, as you need them.

This tutorial only scratched the surface of the many ways in which the Ribbon can be used for editing mesh and polygonal objects. For a full description of the Ribbon tools, consult the 3ds Max Design help.